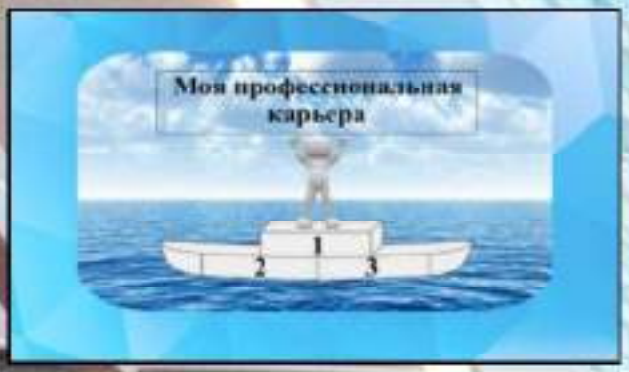

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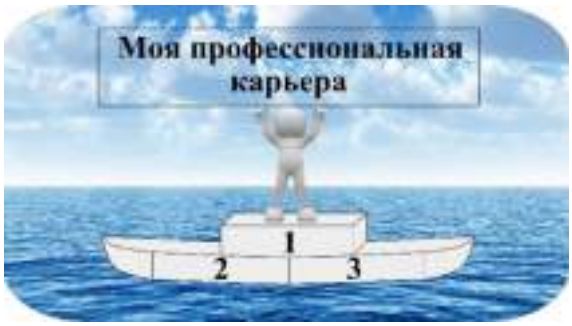

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Содержит научные статьи отечественных и зарубежных авторов по экономическим, техническим, философским, юридическим и другим наукам.

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Целевая аудитория журнала охватывает работников сферы науки и образования (педагоги, учителя, ученые, преподаватели, научные сотрудники, бакалавры, магистранты, аспиранты.

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Abstract

The study explored the prebiotic and antioxidant potential of Agaricus bisporus mushroom extract, emphasizing its role in promoting gut health and combating oxidative stress. Agaricus bisporus, commonly known as the white button mushroom, has been traditionally consumed as food but has recently gained attention for its bioactive properties. The research investigated the extract's influence on beneficial gut microbiota and its free radical scavenging capacity through in vitro assays. Both methanolic and aqueous extracts were analyzed for their phenolic, flavonoid, and polysaccharide contents. Results demonstrated significant antioxidant activity comparable to ascorbic acid and notable stimulation of probiotic bacteria growth, indicating strong prebiotic potential. These findings highlight the dual functionality of Agaricus bisporus as a natural source of dietary antioxidants and a potential prebiotic supplement, providing new insights into its application in nutraceuticals and functional foods designed for improving human health and preventing oxidative-related diseases.

Methods and Methodology

The research was conducted using a systematic experimental approach designed to analyze the bioactive composition, antioxidant potential, and prebiotic activity of Agaricus bisporus extracts. Fresh fruiting bodies of Agaricus bisporus were procured from a local farm and authenticated by a mycology expert. The mushrooms were washed, sliced, and dried in an air oven at 45°C until a constant weight was achieved.

The dried samples were ground into a fine powder using a laboratory mill and stored in airtight containers under desiccated conditions until extraction.

The extraction process employed both aqueous and methanolic solvents to obtain a broad range of polar and non-polar bioactive compounds. Approximately 10 grams of powdered mushroom material was soaked in 100 mL of each solvent for 48 hours with constant shaking at 150 rpm. The extracts were filtered through Whatman No. 1 filter paper, and the filtrates were concentrated under reduced pressure using a rotary evaporator at 40°C. The concentrated extracts were then lyophilized to yield dry extracts for subsequent analyses.

Phytochemical screening was carried out to determine the presence of phenolic compounds, flavonoids, saponins, tannins, and polysaccharides. The total phenolic content was quantified using the Folin–Ciocalteu reagent method, while total flavonoid content was determined using the aluminum chloride colorimetric assay. The antioxidant potential was assessed using DPPH radical scavenging, ABTS assay, and ferric reducing antioxidant power (FRAP) test. The prebiotic activity was evaluated by culturing probiotic strains of Lactobacillus acidophilus and Bifidobacterium bifidum in media supplemented with varying concentrations of the mushroom extract, followed by measuring optical density and colony-forming units over a 48-hour incubation period.

All experiments were conducted in triplicates to ensure reproducibility. Data were analyzed using ANOVA and presented as mean ± standard deviation. Statistical significance was determined at $p < 0.05$. The methodology provided a comprehensive framework to correlate the chemical composition of the extracts with their biological effects, facilitating an integrated interpretation of the results.

Phytochemical Composition of Agaricus bisporus Extracts

The extracts of Agaricus bisporus contained a rich mixture of bioactive compounds that contributed to their functional properties. The methanolic extract yielded a higher concentration of phenolics and flavonoids than the aqueous extract, indicating the efficiency of organic solvents in extracting non-polar antioxidants. The total phenolic content averaged 21.3 mg GAE/g in the methanolic extract and 14.8 mg

GAE/g in the aqueous extract. The total flavonoid content reached 9.4 mg QE/g for the methanolic extract, whereas it was 6.1 mg QE/g in the aqueous extract. The high content of these compounds correlated positively with antioxidant activities measured in subsequent analyses.

The phytochemical screening revealed that Agaricus bisporus possessed a wide variety of secondary metabolites, including phenolic acids such as gallic acid, caffeic acid, and ferulic acid, as confirmed by high-performance liquid chromatography (HPLC) analysis. The polysaccharide fraction, obtained through aqueous extraction, demonstrated significant carbohydrate content, which was believed to influence prebiotic activity. Saponins and tannins were present in trace amounts but still contributed to the extract's overall biological profile. These findings suggested that the mushroom's bioactivity was not due to a single compound but to a synergistic effect of its multiple components.

Antioxidant Mechanisms and Free Radical Scavenging Activity

The antioxidant assays demonstrated strong radical scavenging abilities in both extracts. The DPPH radical scavenging activity reached 85% inhibition at 1 mg/mL concentration for the methanolic extract, which was comparable to that of the standard ascorbic acid (92% inhibition). The aqueous extract displayed a slightly lower activity of 71% inhibition at the same concentration. The ABTS assay supported these results, indicating high electron-donating capacities of the mushroom extracts. Furthermore, the FRAP values confirmed their ability to reduce ferric ions to ferrous ions, reflecting the overall reducing power of the bioactive components.

The antioxidant mechanism of Agaricus bisporus was attributed mainly to the phenolic compounds that acted as hydrogen donors and metal chelators, neutralizing reactive oxygen species (ROS). Flavonoids also played a role by stabilizing free radicals through electron delocalization. The synergy among phenolics, flavonoids, and polysaccharides enhanced the total antioxidant response. The extracts exhibited potential to protect biological membranes from lipid peroxidation and prevent oxidative damage to proteins and DNA. These findings suggested that regular consumption of Agaricus bisporus or its extract could contribute to reducing oxidative

stress, which is implicated in chronic diseases such as cardiovascular disorders, diabetes, and cancer.

Prebiotic Properties and Microbial Growth Stimulation

The prebiotic potential of Agaricus bisporus extract was examined by analyzing its ability to support the growth of beneficial probiotic bacteria. In media supplemented with 1% extract concentration, Lactobacillus acidophilus showed a 42% increase in growth compared to control without extract. Similarly, Bifidobacterium bifidum exhibited a 38% increase in colony-forming units, indicating that the mushroom extract served as an efficient carbon source for these bacteria. The enhanced microbial growth was attributed to the polysaccharide and oligosaccharide content of the mushroom extract, which acted as fermentable substrates for probiotics.

The fermentation profile demonstrated the production of short-chain fatty acids (SCFAs) such as acetate, propionate, and butyrate during incubation, which are essential metabolites for maintaining intestinal health. These SCFAs lowered intestinal pH, inhibited pathogenic bacteria, and promoted mucosal integrity. Compared with commercial prebiotics like inulin, Agaricus bisporus extract provided comparable or superior growth enhancement, suggesting its potential as a natural prebiotic alternative.

Correlation Between Antioxidant and Prebiotic Effects

The study revealed a close relationship between the antioxidant and prebiotic properties of Agaricus bisporus extract. The presence of antioxidant phenolic compounds not only contributed to oxidative balance in the host but also indirectly supported microbial health by reducing oxidative stress in the gut environment. Polysaccharides such as β-glucans functioned as prebiotic substrates while also showing antioxidant activity, forming a biochemical link between the two properties.

This correlation indicated that the consumption of Agaricus bisporus could deliver dual benefits: promoting the growth of beneficial gut bacteria and providing systemic antioxidant protection. Such multifunctionality was particularly valuable for designing functional foods and nutraceuticals targeted at holistic well-being. The integration of these biological effects demonstrated how natural foods could influence both microbial ecology and host physiology simultaneously.

Applications in Functional Foods and Nutraceuticals

The dual functionality of Agaricus bisporus extract made it an attractive ingredient for the development of functional foods and nutraceutical formulations. The extract could be incorporated into beverages, dietary supplements, and fermented dairy products to enhance their nutritional and health-promoting qualities. In addition, its mild flavor and solubility allowed it to be easily integrated into common food matrices without affecting sensory properties.

Food industry applications could also include the stabilization of lipid-based products by preventing oxidation. In pharmaceuticals, Agaricus bisporus extract could serve as an adjunct therapy to prevent oxidative damage associated with degenerative diseases. The biotechnological utilization of mushroom waste biomass to produce such extracts would further increase the sustainability of the mushroom cultivation industry. Thus, the valorization of Agaricus bisporus as both a food and a source of bioactive compounds represented a sustainable model for functional food innovation.

Health Implications and Future Prospects

The findings emphasized that Agaricus bisporus extract offered promising potential for improving human health through its antioxidant and prebiotic functions. Its natural composition provided a safe and effective means of enhancing gut microbiota diversity, reducing oxidative stress, and strengthening immune responses. The extract's phenolic and polysaccharide fractions could play preventive roles against metabolic and inflammatory diseases.

Future studies were recommended to further elucidate the molecular mechanisms underlying its dual bioactivity. In vivo trials on human subjects would help validate its efficacy and safety as a functional dietary supplement. Moreover, optimization of extraction methods to maximize bioactive yield and stability could enhance its industrial applicability. As scientific interest in natural prebiotics and antioxidants continues to grow, Agaricus bisporus may emerge as a key component in the next generation of nutraceutical and therapeutic products designed to promote longevity and health resilience.

Conclusion

The comprehensive analysis of Agaricus bisporus extract demonstrated significant prebiotic and antioxidant properties, positioning it as a valuable natural resource for functional food development. The synergistic presence of phenolic compounds, flavonoids, and polysaccharides contributed to its strong radical scavenging activity and capacity to support beneficial microbial growth. By integrating these effects, Agaricus bisporus provided a dual mechanism for maintaining oxidative balance and gut health, making it an important candidate for nutraceutical applications. Continued exploration of its bioactive components could pave the way for innovative health-promoting products derived from natural, sustainable sources.

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