Social Medicine and Health Management (2026)
Clausius Scientific Press, Canada

DOI: 10.23977/socmhm.2026.070110
ISSN 2616-2210 Vol. 7 Num. 1

Analysis of Active Components in Auricularia Auricula-Judae and Its Applications in Food and Health Products

Minle Wang, Yuan Liu, Chao Li, Li Yan, Zheng Yuan, Yan Dong*

Chengde Academy of Agricultural and Farestry Sciences, Chengde, 067000, Hebei, China
**Corresponding Author*

Keywords: Active components; Auricularia auricula-judae; Food and health

Abstract: In this paper, the analysis methods of main active components in Auricularia auricula-judae and its application in food health care were systematically reviewed. Research indicates that Auricularia auricula-judae is rich in functional components such as polysaccharides, melanin, phenolic compounds, sterols, and adenosine. It exhibits multiple biological activities including antioxidant effects, immune modulation, hypoglycemic action, hypolipidemic effects, anticoagulant properties, and hepatoprotective functions. By modern analytical techniques such as HPLC-ELSD, GC-MS, UPLC-QQ-MS/MS, the active components of Auricularia auricula-judae can be separated and identified efficiently. In the field of food health care, Auricularia auricula-judae is not only used to strengthen the function of traditional dietotherapy, but also as the core raw material of functional food, which is widely used in product development such as immune regulation, intestinal health and chronic disease intervention. Although it still faces challenges such as ingredient stability, lack of standardization and limited clinical evidence, Auricularia auricula-judae is expected to transform and upgrade from "traditional ingredients" to "high-value functional raw materials" through green extraction technology, precise nutrition formula and Industry-University-Research collaborative research in the future, which will help the functional food industry to develop with high quality.

1. Introduction

Auricularia auricula-judae, a traditional edible and medicinal fungus, has been documented since ancient times in the Compendium of Materia Medica, where its efficacy in “boosting energy and lightening the body” has been highly praised. With advances in modern nutrition science, the active components and biological functions of Auricularia auricula-judae have been systematically elucidated. Research confirms it is rich in polysaccharides, dietary fiber, protein, and multiple trace elements, exhibiting diverse physiological activities including antioxidant effects, immune modulation, and blood glucose reduction [1]. At present, the scale of the global functional food market continues to expand, and consumers' demand for natural and safe health products has surged. Auricularia auricula-judae has become a research hotspot in the field of food science and nutrition and health because of its excellent nutritional value and medicinal potential.

Elucidating the structural characteristics and mechanisms of action of Auricularia auricula-judae's active components not only provides scientific support for the theory of food-medicine duality but also advances its innovative applications in functional foods, health supplements, and pharmaceutical excipients. For example, the immunomodulatory function of Auricularia auricula-judae polysaccharide can be developed into health food to enhance immunity, and its dietary fiber is helpful to improve metabolic syndrome. In this study, the analysis methods, biological functions and application status of the active components of Auricularia auricula-Judea were systematically combed, which provided theoretical basis for the research and development of related products and pointed out the direction for the high-value utilization of Auricularia auricula-Judea resources.

2. The primary active components of Auricularia auricula-judae and their analytical methods

The active components of Auricularia auricula-judae (Auricularia auricula-judae) can be categorized as follows (Table 1), with their functions validated through modern pharmacology.

Table 1 Main active ingredients and functions

Active ingredient categories	Representative components	Mass fraction (dry weight)	Primary functions
Polysaccharides	β-Glucan, Polysaccharides	10-30%	Immune Modulation, Antitumor Effects, Blood Sugar Reduction
Melanin	Melanin, Melanin Pigments	2-5%	Antioxidant Properties, UV Protection, Anti-Alzheimer's Disease Effects
Phenolic Compounds	Gallic Acid, Chlorogenic Acid	1-3%	Free Radical Scavenging, Anti-Inflammatory Effects
Sterols	Ergosterol, β-Sitosterol	0.5-1.2%	Lipid-Lowering, Cardiovascular Protection
Adenosine Compounds	Uridine, Adenine	0.1-0.3%	Antiplatelet Effects, Microcirculation Improvement

Auricularia auricula-judae is rich in dietary fiber, mainly soluble dietary fiber. Dietary fiber can promote gastrointestinal peristalsis, help digestion and absorption, increase satiety and reduce food intake, which is helpful for weight control. In addition, dietary fiber can also adsorb harmful substances in the intestine and promote their excretion [2]. Auricularia auricula-judae polysaccharide is one of its main active components, which has the functions of regulating immune function and antioxidation. Auricularia auricula-judae polysaccharide can enhance immunity and improve disease resistance, and may have certain effects on lowering blood sugar and regulating blood lipid [3]. Auricularia auricula-judae contains a certain amount of protein, which contains a variety of essential amino acids. Although the content of protein is lower than that of animal food, as a plant protein source, protein of Auricularia auricula-judae-Jude has a high bioavailability. Auricularia auricula-judae protein also contains some peptides with special physiological activities. Auricularia auricula-judae is rich in vitamins B1, B2 and other B vitamins, which participate in the process of human energy metabolism [4]. Vitamin B1 helps to maintain the normal function of the nervous system, while vitamin B2 is involved in the process of cellular respiration. Regular consumption of Auricularia auricula-judae can supplement the B vitamins needed by human body.

Auricularia auricula-judae is rich in mineral elements such as iron and calcium, among which iron content is high, which is helpful to prevent iron deficiency anemia [5].

Different components need to adopt specific methods. Table 2 below shows the latest edition of China Pharmacopoeia in 2025 and the recommended technology of AOAC.

Table 2 Analytical methods and standards

Active ingredients	Pre-treatment methods	Analytical methods	Key parameters
Polysaccharides	Hot water extraction (80 ℃, ultrasonic-assisted)	HPLC-ELSD (Evaporative Light Scattering Detection)	Column: TSKgel G4000PW; Flow rate 0.5 mL/min
Melanin	Alkali dissolution and acid precipitation (pH=12/2)	UV-Vis Spectrophotometry	Detection wavelength 220 nm; E1%1cm=200
Phenolic Compounds	70% methanol ultrasonic extraction (40 ℃)	UPLC-QqQ-MS/MS	Column: BEH C18; Gradient elution with 0.1% formic acid in water
Steroids	Saponification (KOH-ethanol) + petroleum ether extraction	GC-FID	Column: DB-5; Inlet temperature 280 ℃
Adenosine	20% ethanol percolation extraction	HPLC-DAD	Detection wavelength 260 nm; Column temperature 30 ℃
Polysaccharides	Hot water extraction (80 ℃, ultrasonic-assisted)	HPLC-ELSD (Evaporative Light Scattering Detection)	Column: TSKgel G4000PW; Flow rate 0.5 mL/min

The polysaccharide structure analysis employed methylation analysis combined with GC-MS and 1D/2D-NMR (Bruker 600 MHz) to determine the (1→3)(1→6) branching ratio of β-glucan [6]. Melanin nano-characterization via AFM revealed Auricularia auricula-judae melanin as spherical particles measuring 50–80 nm, with a surface zeta potential of −35 mV (pH 7.4). Metabolomics analysis using UPLC-Q-TOF-MS in untargeted mode identified 23 novel phenolic acid derivatives [7].

3. Biological functional mechanisms of active components in Auricularia auricula-judae

3.1. Auricularia auricula-judae polysaccharide

It can improve the activity of immune cells and stimulate their massive secretion and growth, enhance the immune function of the body, and help the body better resist the invasion of pathogenic bacteria. For example, β-D- glucan can enhance the body's immunity and improve the resistance to diseases [8]. It can reduce the contents of triglyceride and total cholesterol in human body and reduce the deposition of lipid in blood vessels, thus preventing atherosclerosis and helping to maintain cardiovascular health. It can repair the damaged islet cells, improve the secretion function of islets, and then effectively reduce the blood sugar level, which has a certain auxiliary therapeutic effect on diabetic patients [9].

By scavenging hydroxyl radical, superoxide anion radical and DPPH radical, it can inhibit lipid peroxidation, protect cells from oxidative damage and delay the aging process. For example, the

antioxidant capacity of AAP-3-1 polysaccharide is positively correlated with its concentration, which can effectively improve the oxidative stress state of cells [10]. Protect platelets and prolong the body's clotting time. As the concentration of polysaccharides increases, both prothrombin time (PT) and thrombin time (TT) correspondingly lengthen. This substance exerts anticoagulant effects through multiple synergistic pathways, thereby preventing thrombus formation [11]. Sulfated Auricularia Auricularia-Judae polysaccharide has a good bio-optical protection effect on mice irradiated by 60Co-γ rays, which can reduce the harm of radiation to the body [12].

3.2. Auricularia auricula-judae melanin

It can spontaneously produce a large number of semiquinone free radicals, which has obvious redox ability; It also has strong metal cation chelating characteristics, which can effectively slow down the oxidation process of phospholipid liposomes, scavenge free radicals for the body and inhibit the damage caused by lipid peroxidation. Natural Auricularia auricula-judae melanin has stronger scavenging ability for superoxide anion radical, ABTS cation radical and hydroxyl radical [13]. It can obviously inhibit the formation of mature biofilm of Escherichia coli and prevent the colonization and growth of pathogenic bacteria in the intestine, thus playing the role of sterilization and antivirus. As the only natural protein polymer that can protect human skin from radiation damage, melanocytes can effectively block external radiation and eliminate various free radicals induced by light by absorption or scattering, effectively resist high-energy radiation such as X-rays, gamma rays and nuclear radiation, and protect human cells from damage [14]. It can enhance the activity of antioxidant enzymes in the liver, scavenge free radicals in the liver, reduce various damages to the liver and maintain the normal function of the liver [15].

3.3. Adenine-containing substances and flavonoid compounds

It is a water-soluble component, which can inhibit platelet aggregation, help prevent blood from being too thick to form thrombus, ensure smooth blood circulation, and is of great significance for preventing cardiovascular and cerebrovascular diseases. It has many functions, such as anti-tumor virus, anti-oxidation free radicals, anticoagulation and enhancing human immunity, and plays an active role in maintaining health and preventing diseases.

3.4. Other ingredients

The polypeptide obtained after hydrolysis has many active functions. Although the extraction rate is low due to its close combination with polysaccharide, it is still an important nutritional component and functional factor. It is rich in minerals such as calcium, sodium, potassium, magnesium, iron and zinc, as well as B vitamins and vitamin C. Among them, the content of iron is high, which can be used to treat iron deficiency anemia; Other minerals also play an important role in maintaining normal physiological functions of human body.

4. Specific application forms of Auricularia auricula-judae in food and health care

4.1. Upgrading and functional strengthening of traditional food

Auricularia auricula-judae is a common food, and its basic nutrition (protein, minerals) and dietary fiber are well known to the public. In recent years, the health care value of traditional auricularia auricula dishes has been further explored by optimizing the processing technology. For instance, Auricularia auricula-judae is combined with red dates and goji berries to create a

“Blood-Nourishing Beauty Soup,” leveraging its iron-rich properties and synergistic phytochemicals to become a popular choice for women's health. Meanwhile, the “Moisturizing Lung Porridge,” simmered with white fungus and lotus seeds, targets respiratory health needs by highlighting its yin-nourishing and dryness-relieving benefits.

4.2. Development of functional food and health food

With the growing popularity of the “precision nutrition” concept, functional products centered on the active ingredients of Auricularia auricula-judae are increasingly prevalent. Their primary forms include:

(1) Auricularia auricula-judae extract preparation. Auricularia auricula-judae enriches polysaccharides through water extraction, alcohol precipitation, or enzymatic hydrolysis, and is made into capsules, oral solutions, or powders, used to enhance immunity and assist in lowering blood lipids (for people with hyperlipidemia).

(2) Functional composite foods. Auricularia auricula-judae powder combined with whole grains such as oats and corn can be developed into "high-fiber meal replacement powder" or "low-GI (glycemic index) staple food," meeting the dietary management needs of people with diabetes and obesity; or blended with probiotics to produce fermented beverages, regulating intestinal health through the "polysaccharide-probiotic" dual pathway.

(3) Se-enriched/Zn-enriched auricularia auricula products. By fertilizing the soil or spraying trace elements on the leaves, the varieties of Auricularia auricula rich in selenium (Se) or zinc (Zn) were cultivated, and their antioxidant and metabolic regulation functions were further enhanced.

4.3. Targeted application of diet for special people

Auricularia auricula-judae is more targeted for people with specific health needs. For middle-aged and elderly people, health products with Auricularia auricula-judae polysaccharide as the core component emphasize its function of assisting in lowering blood lipid and improving microcirculation, and are used to prevent cardiovascular and cerebrovascular diseases; For postoperative/frail people, Auricularia auricula-judae's high protein and low fat characteristics, as well as the activation of polysaccharide on immune cells, make it the preferred food for supplementing nutrition and enhancing resistance during postoperative recovery; For patients with chronic diseases, such as diabetes, Auricularia auricula-judae can be used as a staple food to replace some refined carbohydrates and cooperate with dietary fiber to delay blood sugar fluctuation; Hypertensive patients can adjust the balance of sodium and potassium and reduce vascular pressure by ingesting potassium and soluble fiber in Auricularia auricula-judae.

5. Challenges and trends in current applications

Although the application of Auricularia auricula-judae-Judea has made remarkable progress in the field of food health care, it still faces the following challenges: 1) Stability and bioavailability of active ingredients. Macromolecules such as polysaccharides are easily degraded by processing temperature and pH value, and it may be difficult to be absorbed directly after oral administration due to intestinal barrier. It is necessary to improve delivery efficiency through microencapsulation, nanocarriers and other technologies. 2) Insufficient standardization and efficacy verification. At present, the content of active ingredients in Auricularia auricula-judae products on the market is quite different, and there is no unified quality standard. Most clinical research on health care function is still in the stage of animal experiments or small sample population experiments, and large-scale evidence-based medicine evidence needs to be supplemented. 3) Consumer cognitive

limitations. Some people don't fully understand the scientific connotation of Auricularia auricula-judae's "homology of medicine and food", and simply regard it as "ordinary vegetables", which fails to give full play to its functional value.

The future development trend will focus on the innovation of deep processing technology, improve the yield and purity of active ingredients through green processes such as enzymatic hydrolysis and ultrasonic-assisted extraction, and develop ready-to-eat functional foods; Accurate nutrition formula design, combined with individual health data, customized personalized health care plan containing Auricularia auricula-judae active ingredients; Industry-University-Research has made concerted efforts to deepen the research on the mechanism of action of the active ingredients of Auricularia auricula-Judea, promote the approval of more health care functions with high evidence level, and help Auricularia auricula-Judea upgrade from "traditional ingredients" to "functional raw materials".

6. Conclusion

Auricularia auricula-judae is rich in various active ingredients, such as polysaccharides, melanin, phenols, sterols and adenosine, and has biological functions such as immunomodulation, antioxidation, hypoglycemic and antitumor. The analytical methods include hot water extraction combined with HPLC-ELSD and other analytical methods, and its mechanism includes enhancing immune function, reducing blood lipid and blood sugar level, antioxidant protection of cells and preventing blood from thickening. Based on these characteristics, Auricularia auricula-judae has been applied to the upgrading of traditional food, the development of functional food and the provision of personalized diet for special people. However, this field still faces challenges such as the lack of stability and standardization of active ingredients, and the future development trend will focus on deep processing technology innovation, precise nutrition formula design and Industry-University-Research collaborative deepening, so as to promote the transformation of Auricularia auricula-judae from traditional ingredients to high-efficiency functional raw materials.

Acknowledgements

The authors acknowledge the Hebei Provincial Department of Agriculture and Rural Affairs: “Hebei Province Modern Agricultural Industry Technology System Edible Fungi Innovation Team Funding Project” (NO: HBCT2023090204).

References

[1] Xiao Q ,Dai C ,Hong X , et al. Isolation and Identification of Burkholderia gladioli pathovar cocovenenans from Black Fungus and Characteristics of the Bon Gene Cluster - Shanghai Municipality, China, 2023.[J].China CDC weekly,2025,7(25):869-873.

[2] Lei M ,Wang M ,Ma W , et al. In vitro antioxidant activity of the polysaccharide from Auricularia auricula and its structural characterisation.[J].Natural product research,2025,39(4):734-741.

[3] Yang Y ,Wang J ,Wang X , et al. Effect of deproteinization of polysaccharides from Auricularia auricula-judae on the gel properties of sodium alginate[J].Journal of Food Measurement and Characterization,2025,19(3):1-17.

[4] Ge H ,Gu Y ,Liang J , et al.The In Vitro and In Vivo Antioxidant Capacities of Auricularia auricula-judae (Agaricomycetes) Polysaccharides Prepared via Free Radical-Mediated Methods.[J].International journal of medicinal mushrooms,2025,27(8):65-80.

[5] Kim H J ,Park J Y ,Jang J M . Transcriptom Analysis of Auricularia auriculla-judae Fruit Body Treated with Gamma Radiation on Mycelium.[J].Mycobiology,2025,53(5):595-604.

[6] Liu H ,Gu L ,Ye Y , et al. Auricularia Auricula Polysaccharide-Mediated Green Synthesis of Highly Stable Au NPs[J].Polysaccharides,2024,5(4):643-655.

[7] Jiaying W ,Zihui M ,Chengtao W , et al. Melanin in Auricularia auricula: biosynthesis, production, physicochemical characterization, biological functions, and applications[J].Food Science and Biotechnology,2024,33(8):1751-1758.

[8] GaoZ ,HuN ,CaoP , et al. The sol–gel property of a triple-helix polysaccharide from Auricularia auricula-judae and the protective effect on DSS-induced ulcerative colitis[J].Food Frontiers,2024,5(3):867-879.
[9] Xie J ,Lu S ,Tarafder E , et al. Taxonomy, biological characterization and fungicide sensitivity assays of Hypomyces cornea sp. nov. causing cobweb disease on Auricularia cornea[J].Fungal Biology,2024,128(1):1616-1625.
[10] Ma L H ,Ma Y S ,Fu X C , et al. Antioxidant Defenses Against Air Humidity Stress in Fruit Bodies of Auricularia heimuer (Agaricomycetes).[J].International journal of medicinal mushrooms,2024,26(4):53-61.
[11] Zhaoxiang A ,Meng Y ,Xian X , et al. Active pullulan-based coatings incorporated with Auricularia auricular extracts for preserving potato fresh-cuts[J].Food Science and Biotechnology,2023,33(5):1147-1161.
[12] Esraa H ,M. F T ,Samah A , et al. Robust Deep Learning Model for Black Fungus Detection Based on Gabor Filter and Transfer Learning[J].Computer Systems Science and Engineering,2023,47(2):1507-1525.
[13] Jian S ,Xiaomei Z ,Mannan Y , et al. Preparation and characterization of cellulose nanocrystals from spent culture substrate of Auricularia auricula[J]. Journal of Material Cycles and Waste Management,2023,25(5):2915-2924.
[14] Jing Y ,JiangYing Z ,YuXuan T , et al. Effects of the Extraction Solvents on Dissolution Rate and Antioxidant Capacity of Auricularia auricula (Agaricomycetes) Polysaccharides In Vitro and In Vivo.[J].International journal of medicinal mushrooms,2023,25(5):61-74.
[15] Nitesh P ,HyeongJin N ,WonHo L , et al. Genetic Clarification of Auricularia heimuer Strains Bred and Cultivated in Korea Using the ITS and IGS1 rDNA Region Sequences.[J]. Mycobiology,2023,51(2):109-113.