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A Review on the Benefits of Oyster Mushroom (*Pleurotus* spp.)

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Oyster mushrooms (*Pleurotus* spp.) rank among the most extensively cultivated edible fungi worldwide, owing to their exceptional nutritional profile, therapeutic properties, economic viability, and ecological contributions. These mushrooms are characterised by high concentrations of protein, vitamins, minerals, dietary fibre, and antioxidants, combined with low fat and caloric content, rendering them a valuable dietary component across all demographic groups. Medicinally, oyster mushrooms demonstrate significant cholesterol-lowering, Hypoglycaemic, Immunomodulatory, antimicrobial, and antiproliferative activities. From an agricultural perspective, they can be cultivated on lignocellulosic agro-industrial residues such as paddy straw and sawdust, thereby facilitating waste valorisation and reducing environmental burden. Their cultivation demands minimal capital investment and technical expertise, creating viable livelihood opportunities for smallholder farmers, rural youth, and micro-entrepreneurs. The appealing organoleptic properties and broad culinary applications of oyster mushrooms further drive consumer demand. Collectively, these attributes position oyster mushrooms as a functionally important food crop with substantial contributions to nutrition, public health, sustainable agriculture, and rural economic development.

Keywords: *Pleurotus* sp., oyster mushroom, nutritional composition, medicinal properties; antioxidant activity.



Introduction

The genus *Pleurotus*, encompasses a diverse group of edible basidiomycete fungi, commonly referred to as oyster, abalone, or tree mushrooms, and represents one of the most commercially significant mushroom genera globally. Taxonomically, *Pleurotus* belongs to the kingdom Fungi, division Basidiomycota, class Agaricomycetes, order Agaricales, and family Pleurotaceae. Among its numerous species, *Pleurotus ostreatus* is the most widely cultivated and studied.

The taxonomic classification of *Pleurotus* species remains challenging due to considerable phenotypic plasticity across broad geographical distributions, interspecific overlap, and ongoing evolutionary diversification. Early taxonomists placed these fungi within the broadly defined genus *Agaricus*, describing the species as *Agaricus ostreatus*. The genus *Pleurotus* was formally circumscribed by Paul Kummer in 1871, and subsequent phylogenetic revisions have resulted in reclassification of several species into related genera, including *Hohenbuehelia*, *Lentinus*, *Omphalotus*, *Panellus*, and *Resupinatus*, among others. The new taxonomic classification is Kingdom: Fungi, Division: Basidiomycota, Class: Agaricomycetes, Order: Agaricales, Family: Pleurotaceae, Genus: *Pleurotus*.

The oyster mushroom is an edible mushroom, which contains more than 40 recorded species, While the number of species varies by source, with some identifying over 200 known types, approximately 25 of these are commercially cultivated worldwide. Oyster mushrooms (genus *Pleurotus*) are diverse, edible fungi known for their shell-like shape, ranging from common Pearl and Blue varieties to vibrant Pink and Golden types. They are cultivated worldwide for their mild, nutty, or savory flavors and fast-growing nature, with popular types including King, Phoenix, and Elm oysters.

Morphologically, *Pleurotus* species typically exhibit laterally attached caps lacking a central stipe; when a stipe is present, it is generally eccentric with decurrent gills, a growth form described by the term pleurotoid. The Basidiospores are smooth, cylindrically elongated, and hyaline. Hyphal junctions are characterised by the presence of clamp connections. Most species are monomitic, possessing a soft, pliant context; however, *P. dryinus* is a notable exception in occasionally exhibiting a dimitic hyphal system incorporating skeletal hyphae, conferring greater tissue rigidity analogous to bracket fungi.

Nutritional Composition and Benefits

Oyster mushrooms are widely regarded as a nutritionally superior edible fungus, distinguished by a favourable macronutrient profile, diverse micronutrient content, and low energy density. Their protein content is notable both in quantity and quality: oyster mushrooms contain all essential amino acids necessary for human physiological functioning, including tissue synthesis, metabolic regulation, and growth - making them a particularly valuable protein source for vegetarian and vegan populations. The carbohydrate fraction provides readily available energy, while fat content remains low and is predominantly composed of health-promoting unsaturated fatty acids, particularly linoleic acid, which supports cardiovascular function and lipid homeostasis. Dietary fibre content is substantial and contributes to gastrointestinal motility, prevention of constipation, modulation of the gut microbiome, and satiety-mediated weight regulation.

Oyster mushrooms are an especially rich source of B-complex vitamins, including Thiamine (B₁), Riboflavin (B₂), Niacin (B₃), Pyridoxine (B₆), Pantothenic acid (B₅), and Folate (B₉), all of which are integral to energy metabolism, erythropoiesis, and neurological function. Vitamin D precursors are also present and can be converted to active vitamin D₂ (Ergocalciferol) upon ultraviolet light exposure, supporting calcium absorption and bone mineralisation. The mineral composition of oyster mushrooms includes potassium, phosphorus, calcium, iron, magnesium, zinc, copper, and selenium. Potassium plays a key role in blood pressure regulation and cardiac function, while iron is essential for haemoglobin synthesis and the prevention of iron-deficiency anaemia. Calcium and phosphorus are critical for skeletal integrity, and zinc and selenium serve as cofactors in immune defence and antioxidant enzymatic pathways. Importantly, the characteristically low sodium content and

absence of dietary cholesterol make oyster mushrooms particularly suitable for individuals managing hypertension or cardiovascular disease.

Beyond their macronutrient and micronutrient contributions, oyster mushrooms contain a range of bioactive phytochemicals - including polysaccharides, beta-glucans, lectins, phenolic compounds, and flavonoids - that confer additional functional food properties. The soft texture and low lignin content of oyster mushrooms further facilitate efficient digestive breakdown and nutrient bioavailability. These combined attributes support their inclusion in balanced diets aimed at addressing protein-energy malnutrition, particularly in low- and middle-income countries, and reinforce their status as a high-value, cost-effective functional food.

Medicinal Properties

The therapeutic potential of oyster mushrooms is well-documented in the Scientific literature and is attributable to the presence of multiple bioactive constituents, including Polysaccharides, Beta-glucans, Lectins, Phenolics, Flavonoids, Terpenoids, and Antioxidant compounds.

Immunomodulatory Activity

Immunomodulatory activity represents one of the most significant medicinal properties of oyster mushrooms. Beta-glucans, in particular, activate macrophages, natural killer cells, and other components of innate and adaptive immunity, enhancing the host's resistance to bacterial, viral, and fungal pathogens. This immunopotentiating effect has implications for both infection prevention and adjunctive support in chronic disease management.

Antioxidant Activity

Antioxidant activity is another well-established property, whereby phenolic compounds and other free radical scavengers neutralise reactive oxygen species, attenuate oxidative stress, and mitigate cellular damage. This mechanism has been associated with reduced risk of age-related degenerative conditions, including cardiovascular disease, neurodegeneration, and carcinogenesis.

Hypolipidaemic Effects

Hypolipidaemic effects have been attributed to the presence of lovastatin-related compounds (mevinolin) alongside soluble dietary fibre, which collectively suppress hepatic synthesis of low-density lipoprotein (LDL) cholesterol, improve lipid profiles, and reduce risk factors associated with atherosclerosis, hypertension, and ischaemic stroke.

Hypoglycaemic Activity

Hypoglycaemic activity is relevant for the management of type 2 diabetes mellitus. Bioactive compounds and soluble fibre in oyster mushrooms have been shown to attenuate postprandial glucose absorption, enhance insulin sensitivity, and improve overall glycaemic control. Anti-inflammatory constituents may further alleviate chronic low-grade inflammation associated with metabolic syndrome.

Anticancer Potential

Anticancer potential has been demonstrated in preclinical studies, where polysaccharides and antioxidant compounds were found to inhibit tumour cell proliferation, induce apoptosis, and stimulate immune-mediated cytotoxicity against neoplastic cells. Additionally, the protective role of antioxidants in preventing oxidative DNA damage may reduce mutagenic risk.

Antimicrobial, Antiviral, and Other Properties

Antimicrobial and antiviral properties have been reported, with bioactive compounds demonstrating inhibitory activity against a range of pathogenic bacteria, fungi, and viruses, supporting broader applications in infectious disease prevention. Oyster mushrooms also offer hepatoprotective effects through detoxification of hepatotoxic compounds and attenuation of oxidative liver injury. Their high fibre content, probiotic-modulating capacity, low caloric density, and satiety-promoting properties further position oyster mushrooms as beneficial in the dietary management of obesity, dyslipidaemia, and gastrointestinal disorders. Furthermore, B-vitamin and mineral content support neurological health, stress

resilience, and mitochondrial energy production, while calcium, phosphorus, and vitamin D contribute to musculoskeletal integrity.

Agricultural, Environmental, and Socioeconomic Benefits

Oyster mushrooms offer substantial benefits that extend beyond their nutritional and medicinal value, encompassing important contributions to sustainable agriculture, environmental management, and rural development.

A defining advantage of oyster mushroom cultivation is the capacity to utilize low-cost lignocellulosic agro-industrial by-products as substrate, including paddy straw, wheat straw, sugarcane bagasse, maize stalks, cotton waste, sawdust, and banana leaves. This capability transforms agricultural residues - which would otherwise be open-field burned or discarded, contributing to greenhouse gas emissions and soil degradation - into a high-value food product, exemplifying the principles of circular bioeconomy and zero-waste agriculture.

The cultivation technology is low-input, space-efficient, and accessible: production can be established in small rooms, sheds, or domestic spaces, without the requirement for large arable land areas. This makes oyster mushroom cultivation particularly appropriate for urban and peri-urban farming. The relatively short fruiting cycle enables rapid returns on investment and year-round production, supporting consistent household income. Accordingly, oyster mushroom enterprises offer meaningful livelihood diversification for smallholder farmers, women's self-help groups, and rural youth, contributing to poverty alleviation and economic empowerment.

Spent mushroom substrate (SMS) - the residual growth medium following harvest - retains considerable biological and chemical value. It may be repurposed as organic fertiliser, vermicomposting feedstock, ruminant feed supplement, or soil amendment, thereby improving soil organic matter content and promoting sustainable nutrient cycling.

From an environmental perspective, *Pleurotus* species possess ligninolytic enzymatic systems, including lignin peroxidases, manganese peroxidases, and laccases, enabling degradation of complex recalcitrant organic compounds. This enzymatic capacity underpins their studied applications in bioremediation of industrial dyes, petroleum hydrocarbons, pesticides, and other environmental pollutants, positioning them as promising agents in mycoremediation strategies.

Culinarily, oyster mushrooms are highly valued for their delicate texture, subtle aroma, and savoury flavour profile, which accommodate diverse preparations including soups, curries, stir-fries, pickles, and meat analogues for vegetarian and vegan diets. Rising consumer awareness of health-oriented and sustainable food systems has amplified market demand, creating entrepreneurial opportunities across the mushroom value chain - from primary production and processing to packaging, value-added product development, and commercial marketing.

Compared to conventional livestock or row-crop agriculture, oyster mushroom cultivation requires significantly less water, land, and energy per unit of protein produced, underscoring its environmental sustainability. Capacity-building programmes in mushroom cultivation further promote technical skill acquisition, self-employment, and community resilience.

Conclusion

Oyster mushrooms (*Pleurotus* spp.) constitute a versatile and high-value agricultural commodity whose significance spans nutritional science, medicine, ecology, and rural development. Their dense nutritional profile - encompassing complete protein, essential micronutrients, dietary fibre, and bioactive compounds - supports multiple dimensions of human health and offers particularly in addressing dietary deficiencies. Medicinal evidence supports their roles in immune enhancement, cardiovascular protection, glycaemic regulation, and cancer chemoprevention, among other therapeutic applications. Concurrently, their agronomic simplicity, compatibility with waste valorisation, and alignment with circular economy principles render oyster mushroom cultivation an environmentally responsible and

economically inclusive enterprise. The convergence of these attributes confirms the status of oyster mushrooms as a functionally important crop with broad potential to advance global food security, public health outcomes, and sustainable agricultural systems.

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