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# Anti-inflammatory effects of medicinal mushrooms

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## ABSTRACT

Fungi have been used throughout history as food sources and for their healing properties in various regions around the world. The main factor for this is their nutritional makeup, which offers a rich source of carbs, proteins, amino acids, and minerals. Additionally, mushrooms and truffles contain a large number of bioactive compounds, making them commonly used in traditional medicine in Africa, the Middle East, China, and Japan. The healing properties of mushrooms are said to include anti-inflammatory effects, which are believed to be caused by the various chemical elements found in mushrooms that have anti-inflammatory properties. The substances are made up of polysaccharides, terpenoids, phenolic compounds, and various other small molecules.

**Introduction:**

Mushrooms have long been used in various cultures for both cooking and healing. They consist of many biologically active elements such as proteins, fibers, lectins, polysaccharides, phenolic and polyphenolic compounds, terpenoids, ergosterols and volatile organic compounds. They also contain a wide variety of essential nutrients, including minerals, proteins, vitamins, and amino acids in both small and large amounts. In addition, mushrooms contain valuable components such as beta-glucans, which may have medicinal properties, making them an important source of biologically active substances. In addition, mushrooms also contain substances that may help prevent cancer, including terpenoids, phenolic compounds, peptides, and steroids. Mushrooms are rich in antioxidants that are valuable in protecting human cells from diseases such as cancer and heart disease by fighting free radicals.

Mushrooms are highly regarded as nutritious foods due to their high dietary fiber content and low calorie and fat content. Inflammation is the body's natural defense mechanism against conditions such as heart disease, chronic pain, age-related illnesses, memory loss, and autoimmune disorders. Inflammation plays a crucial role in the advancement of tumors. Multiple types of cancer develop from areas of infection, prolonged irritation, and inflammation. Targeting apoptosis and inflammation in therapy could be very effective in treating cancer. Various forms of inflammation can have lasting impacts, but by following a suitable diet, we can reduce inflammation in the body. Eating foods with added health benefits, like berries and mushrooms. One potential approach to reducing inflammation is to consume vegetables, legumes, and fish that possess anti-inflammatory properties. While the immune-boosting effects of mushrooms have been extensively studied, there has been limited exploration of their possible anti-inflammatory properties [1].

**Inflammation**

Inflammation is the body's way of responding to tissue damage or exposure to external factors such as pathogens, allergens, infections, irritants, and UV light, by the immune system. Prolonged inflammation increases the likelihood of developing cancer. Studying the connection between inflammation and cancer is of utmost importance. Inflammation and cancer are closely connected, and many treatments for inflammation are also used as anti-cancer agents. Inflammation is a complicated biological response that includes cytokines, chemokines, adhesion molecules, and nuclear receptors. Cytokines regulate the inflammatory response. Elevated levels of nitric oxide and pro-inflammatory cytokines such as TNF-α, IFN-γ, IL-6, and IL-1β are associated with impaired macrophage activation and the onset of inflammatory conditions. Inflammation occurs naturally in the body as the immune system's reaction to damage caused by a variety of factors. Acute inflammation usually clears up by itself relatively quickly. In certain instances, inflammation can persist and become chronic. Inadequate levels of antioxidants, vitamins, and anti-inflammatory compounds, along with natural aging processes, can result in poor resolution of inflammation. Persistent inflammation is linked to autoimmune disorders, as well as heart, metabolic, and neurological conditions, and cancer. Edible species provide a valuable source of carbohydrates, particularly chitin that functions as a type of dietary fiber. They offer necessary amino acids and can serve as a substitute for animal-based products. Mushrooms have low calories and fat content, but they are abundant in beneficial polyunsaturated fatty acids. Consumable mushrooms are exceedingly prized for their dietary and therapeutic properties, as they contain various organically dynamic and health-boosting substances. Mushrooms have a run of useful properties such as cancer prevention agents, antibacterial and antiviral impacts [2].

**Polysaccharides**

The presence of parasitic polysaccharides encompasses an advantageous effect on human well-being. A consider on subarachnoid hemorrhage found that trehalose can restrain pro-inflammatory proteins and anticipate the breakdown of IκB-α, advertising defensive impacts. Trehalose helps in lessening the hurt caused by responsive oxygen species by bringing down lipid peroxidation and defending arachidonic acid within cell layers. The basic components found within the hyphae of mushrooms, such as glucans, chitin, and chitosans, play a pivotal part in upgrading the safe framework and ensuring people from potential dangers. These components act as a source of dietary fiber and contribute to ensuring the mucous layers of the digestion tracts. Probiotic microbes are presently progressively recognized for their capacity to upgrade the resistant framework [3].

**Proteins**

The anti-inflammatory properties of Pleurotus ostreatus are thought to be credited to the nearness of amino acids such as leucine, isoleucine, tyrosine, and phenylalanine. It is critical to concentrate on arginine since it can obstruct the development of cancer cells and lower the probability of cancer spreading to other parts of the body. The consideration of arginine within the treatment of cancer patients leads to changes in their safe framework, expanded weight, and amplified survival time.

**Ergothioneine**

A vital amino corrosive display in mushrooms acts as an antioxidant and is basic for human well-being. It is ingested from nourishment and plays a vital part in securing defenseless tissues from oxidative harm, counting ruddy blood cells, the eye focal point, sperm, and skin. A makes a difference ensure against oxidative harm. Bisporus is associated to the nearness of this particular histidine subsidiary. In addition, ergothioneine shows characteristics that can defend against hereditary changes and offer security from chemotherapy and radiation [4].

**Fatty acids**

The huge sum of unsaturated greasy acids found in mushrooms makes a difference to bolster the body's anti-inflammatory forms. PUFAs are fundamental for the generation of eicosanoids, which are critical in directing cellular capacities in muscles, blood vessels, nerve cells, and the resistant framework. Eicosanoids play a role in balancing inflammation and anti-inflammation within the body. PUFA is composed of omega-3, omega-6, and omega-9 fatty acids. ALA is essential for basic nutrition and overall health, and it serves as a precursor for long-chain n-3 PUFAs. It also has strong anti-inflammatory characteristics. PPARγ agonists not only provide relief for insulin resistance, making them valuable for diabetes, but also show promise for treating inflammation and specific tumor types. Mushrooms contain high levels of palmitic, linoleic, and α-linolenic acids. Bisporus may have a potential protective effect against hormone-sensitive breast cancer [5].

**Terpenoids**

Terpenoids are a diverse group of fungal compounds with anti-inflammatory properties. Many research studies have been carried out to isolate new, powerful terpene compounds from various sources, such as inedible mushrooms. Researchers discovered new terpene compounds in nineteen different species of Japanese mushrooms. Over 100 different triterpenes have been discovered in G. lucidum, exhibiting 50 unique characteristics specific



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to this species. These compounds are mainly composed of acids, such as ganodermic and lucidenic, alongside ganoderols and ganoderiols. The triterpene extracts in G have been demonstrated to possess anti-inflammatory properties. The extract led to a notable reduction in the expression of COX-2 and stopped the production of prostaglandin E2 in RAW 264. The activity of iNOS decreased, leading to a reduction in NO production and a decrease in the secretion of TNF-α and IL-6 in the cells. The examined extracts function by blocking the NF-κB and AP-1 signaling pathways, thus decreasing inflammation. Lucidum exhibits antibacterial and antiviral properties, specifically targeting Epstein-Barr virus and HIV-1. Tree-dwelling mushrooms were discovered to contain terpenoids that possess anti-inflammatory, anti-proliferation, and anticancer properties. Poria cocos is a type of mushroom that is classified within the Polyporaceae family and is commonly referred to as poroid mushrooms. Components from this species have demonstrated anti-inflammatory properties in a laboratory model using RAW 264. 7 macrophages [6].

**Bioelements**

Mushrooms are a rich source of bioelements as they have the ability to readily absorb them from the surrounding soil. Mushrooms gather essential bioelements such as zinc, copper, iron, and selenium, all of which possess antioxidant and anti-inflammatory qualities. A Please rephrase this text skillfully. The edible mushroom, C. bisporus Cibarius and myself. Badlands are abundant in these elements. Mushrooms have anti-inflammatory properties due to their zinc content. Mushrooms have a concentration of 150-200 milligrams per kilogram of dry weight. The text is about the benefits of zinc. Studies demonstrate a substantial increase in the presence of zinc (II) ions in mushroom cultures that have been fortified with the element. Mushrooms have anti-inflammatory properties due to their zinc content. The fruiting bodies of different types of mushrooms have a concentration of 150-200 mg/kg of dry weight. Research has indicated a notable rise in the accumulation of zinc(II) ions in the biomass of in vitro cultures grown in media enriched with the element. Zinc is crucial for antioxidant function as it regulates superoxide dismutase and gene expression, including metallothioneins. Zinc plays a crucial role in the proper functioning of immune cells, affecting their behavior and overall performance. It assists in maintaining a balance between Th1 and Th2 lymphocyte activities by controlling the release of cytokines in the immune system. Zinc's ability to reduce inflammation is due to its activation of zinc-dependent transcription factors and its inhibition of NF-κB activation, resulting in decreased production of pro-inflammatory cytokines. Disorders in maintaining zinc levels in the body and long-term inadequate zinc intake can compromise the immune system, elevate inflammation, and result in long-lasting inflammation. Zinc-enriched cultures of cibarius biomass. Zinc helps to release repressed COX-2 and cPGES in LPS-activated A549 pulmonary epithelial cells, thereby decreasing the production of pro-inflammatory proteins. Additional research has demonstrated the anti-inflammatory and antioxidant properties of I extracts [7].

**Anti-inflammatory properties of mushrooms**

Several studies conducted in a laboratory setting have investigated the potential of various mushroom types to prevent cancer and reduce inflammation. The ethyl acetate extracts from mushrooms demonstrated greater inhibition of COX-1 and COX-2 enzymes compared to the 70% ethanolic extracts. The extracts of Ethyl acetate from Ganoderma applanata, Naematoloma sublateritium, and Pleurotus eryngii. A compound derived from G and containing triterpenes. Lucidum also decreased the LPS-induced production of iNOS and COX-2 in RAW264. 7 cells Macrophages exposed to varying concentrations of hot extract effectively reduced the LPS-induced generation and release of NO, TNF-α, and IL-6 in a manner dependent on the dosage. The mushroom extracts have shown anti-inflammatory effects in macrophages when they are activated. The methanolic extracts displayed significant anti-inflammatory properties by reducing the production of NO and the expression of iNOS, IL-1β, and IL6 mRNA when exposed to LPS. The study stated that extracts from Russula virescens have demonstrated anti-inflammatory properties in RAW 264. 7 cell lines The findings indicated that R. At a concentration of 1–5 mg/mL, it decreased the production of NO induced by LPS. The extract groups are becoming green. The level of TNF-α mRNA expression in the RAW 264. 7 cell was reduced when treated with 5 mg/mL R. Sample treated with ethanol extract showing signs of growth. Treated sample with Virescens extract. Mycelia extracts from Taiwanofungus salmoneus were examined for their ability to reduce inflammation in laboratory tests using RAW 264. 7 cells The IC50 values for the hot-water and ethanolic extracts were 18. 2 and 142 µg/mL, respectively the hot-water and ethanolic extracts of Trametes versicolor showed anti-inflammatory activity with 50% inhibitory concentration values of 4. 99 and 713 µg/mL for TNF-α production. The research discovered that the acetone fraction showed a 15-LOX inhibitory activity that increased with dosage [8].

**Conclusion**

This review discusses how mushrooms can act as biological factories for generating a wide range of natural anti-inflammatory molecules. These compounds display biological effects by reducing the expression of different inflammatory mediators. The use of anti-inflammatory compounds from mushrooms can be incorporated into medical and cosmeceutical products with no adverse reactions. The potential future medical application of anti-inflammatory compounds derived from mushrooms encounters five primary challenges. The bioactive components differ significantly in various samples due to factors such as the time and method of collection, as well as the season and environment. Validated standard testing protocols for pharmaceutical uses of mushroom products are lacking.

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