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REVIEW ARTICLE

# Mushrooms Natural Products Cosmetic Weapons as Anti-Hair Loss, Anti-Ageing Skin and Future Prospect

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## Abstract

Throughout old history, mushrooms are considered a rich source of many important phytonutrients such as polysaccharides and other nutrients, in addition to many essential amino acids, which are building blocks of vital proteins. In overall, mushrooms offer a wide range of health benefits with a large spectrum of pharmacological properties, including antidiabetic, antioxidative, antiviral, antibacterial, nephroprotective, hepatoprotective and others. Both wild edible and medicinal mushrooms possess strong therapeutic and biological activities. The multifunctional activities of the mushroom extracts and the targeted potential of each of the compounds in the extracts have a wide-ranging of applications, especially in anti-hair loss and anti-ageing skin. This review aims to provide a clear insight on mushrooms natural bioactive compounds, and their extracts are whichever presently used or original to be used as cosmetics products for their antioxidant, anti-aging, anti-wrinkle, skin whitening, moisturizing effects and anti-Hair loss. Future outlook and prospective challenges.

## Introduction

Mushrooms have been present on earth for ages and are an important, necessary part of global food. Along with this, mushrooms are exploited for their beneficial health properties. Medicinal mushrooms mentioned in many different work such as *Agaricus*, *Amanita*, *Calocybe*, *Cantharellus*, *Cordyceps*, *Coprinus*, *Cortinarius*, *Ganoderma*, *Grifola*, *Huitlacoche*, *Hydnum*, *Lentinus*, *Morchella*, *Pleurotus*, *Rigidoporus*, *Tremella*, *Trametes* sp., etc., which play a vital role in various diseases because of several metabolic components and nutritional values. Medicinal mushrooms can be identified morphologically on the basis of their size, color (white, black, yellow, brown, cream, pink and purple-brown, and others [1]. There are more than 2000 mushroom species worldwide, but just a handful are edible or nutraceutical. *Agaricus bisporus* is the most widely grown mushroom, followed by *Lentinus edodes* and *Flammulina velutipes*. Mushrooms are fungi belonging to the higher phyla Ascomycota and Basidiomycota that have a stem (stipe), a cap (pileus), and gills (lamellae, sing. lamella) on the underside of the cap. Mushrooms have long been appreciated for their

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flavor, texture, and nutrition as culinary mushrooms, but also for pharmaceutical and tonic attributes as medicinal mushroom [2].

Mushrooms contain various metabolites, such as terpenes, steroids, anthraquinone, phenolic acid, and benzoic acid, while primary metabolites contain proteins, oxalic acid, and peptides. Mushrooms have been reported to have an action against both Gram-positive and Gram-negative bacteria [3-11]. Nutritionally, they are rich in protein and amino acids but lack fatty acid content [12-20]. However, they contain a significant amount of vitamins such as B1, B2, B12, C, D, and E [21-28]. Thus, they act as the perfect source of present nutrition and promote the health for synergistic effects of present bioactive compounds. Structurally, mushrooms comprise the pileus, lamella, stipe, mycelium, and roots. The roots are mainly responsible for absorbing and gathering nutrients [29]. Earlier, there was a fallacy regarding the classification of mushrooms as plants. Later, with advancement in science, they were added under the independent kingdom known as Mycota, mainly characterized by chitin inside the cell walls.

Mushrooms have remained an eternal part of traditional cookerries due to their beneficial health potential and have long been recognized as a traditional medicine for their broad spectrum of nutraceuticals, as well as therapeutic and prophylactic uses. Mushrooms currently they have been extensively investigated to explain the chemical nature and mechanisms of action of their biomedicine and nutraceuticals capacity. Mushrooms belong to the amazing dominion of fungi and are known as a macrofungus [29]. Significant health benefits of mushrooms, including antiviral, antibacterial, anti-parasitic, antifungal, wound healing, anticancer, immunomodulating, antioxidant, radical scavenging, detoxification, hepatoprotective cardiovascular, anti-hypercholesterolemia, and anti-diabetic effects, etc., have been reported in many previous studies and have attracted significant interests of its further exploration in commercial sectors (As food and vitamins and others) and in medicinal sectors (Treatment or prevent some penalties of life-threatening diseases) [4-6,27,28]. Mushrooms mainly contained low and high molecular weight polysaccharides, fatty acids, lectins, and glucans responsible for their therapeutic action. Due to the large varieties of mushrooms present, around the world, it becomes interesting to identify chemical components present in them and their beneficial action [29]. The purpose of this review

is to represent the marvelous benefits and varieties of various mushrooms, clarifying their use at a broad scale to be resource-able for future therapeutic usage as hair growth-promoting, skin health as anti-aging and Antiallergic effects.

Hair loss becomes one of separate big concerns about the artistic appearance, and the markets of cosmetics and pharmaceuticals for the hair re-growth and the protection of hair loss have been markedly growing for a few decades. The causes of hair loss are known to be depression, shame, isolation from the society, stress caused by an increased social activity, air and water pollutions, nutritional unbalance due to a bad dietary life, and others. That is, a cerebral state and a quality of life are closely related to the hair loss. In addition, a genetic inheritance and an aging also have a great effect on abnormal hair loss [30]. There are many things that can improve hair and skin. That includes a good diet, excellent hair washing skills, and proper styling and care. Mushrooms, in some cases, could be one of the best ways to add a bit more health and even reverse some of the damage and hair loss. Mushrooms like *Lentinus edodes* can eliminate or reduce hair loss, grow new hair, maintain hair health, reducing greying of the hair and improve the shine of hair. The *Flammulina velutipes* polysaccharides is composed of a natural structure imitating the "ground" (connected and aligned hollow tubes with porous walls). Temporarily, its biologically active components include polysaccharides and proteins, mimicking the "plant nutrition" in the seedbed. To further optimize the ground and nutrition components, *Flammulina velutipes* Polysaccharides-Derived Supports (FPDSs) were fabricated via the treatment of original *Flammulina velutipes* polysaccharides scaffold (labeled FPS) by NaOH, cysteine. In summary, FPDSs exhibit potential functions as seedbeds to promote the regeneration of the "seed" including hair follicles and injured skin, opening a new avenue for wound healing [31,32].

### Maitake mushroom (*Grifola frondosa*) and anti-hair loss

Maitake mushroom (*Grifola frondosa*) grows near the roots of oak, plum, apricot, and peach trees. Maitake is considered to be one of the best delicious edible mushrooms rich in protein (22%) and selenium and zinc minerals. The health benefits associated with *Grifola frondosa* include immune system support and regulating blood pressure, blood sugar, and cholesterol levels. Maitake mushroom benefits are

believed to be related to a protein-bound  $\beta$ -glucan, which exhibits strong immune support activity. Maitake mushrooms are a good source of protein, vitamins, and minerals essential for healthy hair. They are particularly rich in B vitamins, including niacin, riboflavin, and pantothenic acid, which play a role in maintaining healthy hair growth. Maitake mushrooms are also high in antioxidants, which can help to protect the hair from damage caused by free radicals. *Grifola frondosa* mushrooms are an excellent source of beta-glucans and polysaccharides, both of them can improve scalp health and promote hair regrowth by reducing the damage of free radicals on the scalp and boosting the immune system (Figure 1). The amino acids, zinc, and selenium in the *Grifola frondosa* help refill the micronutrients essential for producing new hair. One potential benefit of Maitake mushrooms for hair health is their potential to stimulate hair growth and prevent hair loss. Additional benefits for hair growth, maitake mushrooms may help treat dandruff and dry scalp. Also anti-inflammatory and antibacterial properties by *Grifola frondosa* mushrooms that may help combat scalp conditions that can lead to these issues. *Grifola frondosa* mushrooms may offer several potential benefits for hair health, including stimulating hair growth and treating dandruff and dry scalp [33].

### Chaga mushrooms (*Inonotus obliquus*) as maintain healthy hair

Sagayama K [34], reported that Chaga mushrooms, the sclerotium of *Inonotus obliquus*, have been used in Mongolia as a traditional hair shampoo to maintain healthy hair. Bioassay-guided fractionations of the extract of Chaga mushrooms using a proliferation

assay on Human Follicle Dermal Papilla Cells (HFDPCs) gave five lanostane-type triterpenes (1–5), whose structures were identified by spectroscopic evidence. Among these, lanosterol (1), inotodiol (3), lanost-8, 24-diene- $3\beta$ ,21-diol (4), and trametenolic acid (5) demonstrated proliferative effects on HFDPCs more potent than minoxidil, an anti-alopecia agent, used as the positive control. The lanostane-type triterpenes (1, 3, 4, and 5) appeared to be potential candidates of new agents possibly used for hair-care with a stimulative effect on hair growth. Triterpenes from Chaga mushrooms could be potential leads of therapeutic agents for promoting hair growth [33].

### Reishi mushroom (*Ganoderma lucidum*) and anti-hair loss

Reishi mushroom (*Ganoderma lucidum*) has long been used in Eastern medicine to boost the immune system, increase stamina, lower cholesterol, and treat urinary disorders. Now, this kidney-shaped fungus is becoming a popular Western nutritional supplement – with the additional claim that it also help in hair grow. Reishi mushrooms belong to a group of natural ingredients called adaptogens. These adaptogens are believed to have a wide array of beneficial effects on human bodies. The health benefits of adaptogens: Reduce the effects of free radicals on cell membranes. Help with protein production. Help re-build damaged muscle tissue. Help increase muscle endurance. Reduction of stress. Improve sleep at night Improve mental alertness throughout the day (Figure 2). Reishi mushrooms have antioxidant effects that can protect our scalp from environmental toxins and free radical damage. Reduced free radical damage provides a healthier scalp and a better environment



**Figure 1** Medicinally important mushrooms. Maitake mushroom (*Grifola frondosa*), (Photographs were taken by Dr. Elkhateeb WA, Location: Kuwabara, Nishi-Ku, Fukuoka City, Japan).





**Figure 2** Different *Ganoderma* species. (A). *Ganoderma applanatum* (B). *Ganoderma lucidum*, medicinally important mushrooms. Reishi mushroom; (A). Photographs were taken by Dr. Elkhateeb WA. Location: Kuwabara, Nishi-Ku, Fukuoka City, Japan). (B). Locality: National Research Centre, Cairo, Egypt).

for hair follicles to regrow stronger, thicker hair. *Ganoderma lucidum* can act as an inhibitor of DHT (Dihydrotestosterone which is the main cause for hair loss). DHT (Dihydrotestosterone) is a sex hormone that is a byproduct of testosterone when converted by the enzyme called 5 $\alpha$ -Reductase. When the hair follicles are more sensitive to DHT, the DHT binds to receptors in the hair follicles, causing them to shrink, leading to androgenetic alopecia. Many studies indicated that *Ganoderma lucidum* can help lower levels of dihydrotestosterone, a hormone that contributes to male pattern hair loss. Research on reishi mushroom use in humans is still in its early stages, and there are many questions to be answered about their efficacy [34–36].

### Improving human skin health

**Skin and ageing:** The skin is the largest organ of the human body and is also the first line of defense from the external environment [37]. Due to its wide area, it is easily exposed to and even damaged by a range of external factors such as ultraviolet radiation, which may lead to wounds, dehydration, skin aging, melanin deposition, microbial invasion, and skin barrier abnormalities. Hence, different strategies to treat skin problems or promote skin health have been used, such as the use of skin care products [38]. Among various treatments, natural skin care compounds are considered more skin-friendly from the perspective of consumers. Over the years, researchers have explored several natural compounds that can protect skin from damage, most of which are organically sourced macromolecules, including groups of proteins, lipids, polyesters, polysaccharides, and polyphenols [39].

Aging is a complex process (Biological process influenced by different factors) that involves the time-dependent accumulation of varied harmful changes in cells, tissues, organs, or systems that increase susceptibility to chronic illness and death. Aging is a progressive physiological change in an organism that lead to a decline of biological functions of the organism's ability to adapt to metabolic stress. Aging takes place in a cell, an organ, or the total organism with the passage of time. As much as this is change is natural, it can be hurried by both the biotic and abiotic factors and the organism's characteristic factors. Lately, it has been discovered that reactive oxygen species can accelerate the aging process, leading to an increased occurrence of age-related diseases that are characteristic of aging. Mushrooms contain various bioactive compounds, including carbohydrates, bioactive proteins, fungal lipids, and phenolic compounds, these compounds have shown promising effectiveness in fighting skin aging and age-related diseases. Many In vitro and in vivo studies have demonstrated that treatments with mushrooms or their extracts can significantly extend lifespan and improve health span. Furthermore, studies have aimed to elucidate the precise cellular and molecular mechanisms of action and the structure–activity relationship of mushroom bioactive compounds [40]. Improving human skin health there's a lots of evidence that indicate mushrooms helping to promote healthy skin. There are many ways this can happen. Mushrooms contain hyaluronic acid in them. Hyaluronic acid helps to support the proper hydration of cells throughout the body. It can help to make human skin look naturally lithe and soft. Also, the kojic acid found in mushrooms can help

human skin to be bright and beaming. It does this by helping with the exfoliation process, from the inside out. That helps to ensure skin is as beautiful as possible. Mushrooms may also contribute to improving clarity, especially for those who have spots. The Vitamin D present in mushrooms works very effectively at helping to minimize breakouts. That's why we can add a mushroom based topical to skin to see benefits to it. It may also offer some anti-aging benefits, especially due to the presence of Vitamin C, choline, and selenium in the mushrooms. Increase the amount of mushrooms you consume [41]. Fungal polysaccharides can be composed of different monosaccharides, and have a variety of skin health-promoting effects, such as anti-oxidant [42], antiaging [43], and regulating immune function [44]. Moreover, fungal polysaccharides are commonly non-cytotoxic components, especially those derived from edible mushrooms, which further indicates the great potential of fungal polysaccharides for cosmetic and cosmeceutical applications. Oxidative stress can upset the antioxidant balance and cause accelerated aging including neurodegenerative diseases and decline in physiological function. Therefore, an antioxidant-rich diet plays a crucial role in healthy aging [45,46].

Skincare is one of the most profitable product categories today. Consumers' demand for skin-friendly products has stimulated the development of natural-ingredient-based cosmeceutical preparations over synthetic chemicals. Therefore, natural polysaccharides from different sources in general and especially from mushroom like *Lentinula edodes* have gained much attention since the promising potent efficacy in wound healing, moisturizing, antiaging, and whitening [47]. The challenge is to raise consciousness of polysaccharides

with excellent bioactivities from natural sources and consequently incorporate them in novel and safer cosmetics. Among the 14 evaluated mushroom species, *Lentinula edodes*, shiitake mushroom contains the highest ergothioneine content and hence was used for the in-vitro studies (Figure 3). Though, the pretreatment with ethanolic extract of *Lentinula edodes* for 8 h significantly improved the cell viability, reversed the t-BHP-induced cellular senescence in the neuronal cells, and reduced the reactive oxygen species visualized through DCFH-DA staining. These results suggest that ergothioneine-rich mushroom is a potential candidate for anti-aging exploration through the elimination of senescent cells [41].

### Chaga mushrooms (*Inonotus obliquus*) prevent of skin aging

Fungi have a rich history of medicinal use within many cultures. In most cases it is the fruiting body that is harvested and valued. Ancient use of the species *Inonotus obliquus* is different, in that it is a conk-like structure of sterile mycelial mass formed in a pre-sporulation phase that is utilized. The species *Inonotus obliquus*, is a wood-rot fungus of living trees. The fungus enters through wounds within the tree and from there may develop for an estimated 10–80+ years causing decay and forming a sterile mycelial mass [47]. Chaga has been found to contain a host of pharmacologically active compounds that beneficially affect human health [48]. The biological activity of *I. obliquus* is mainly due to the presence of several polysaccharides, constituting the following sugars: rhamnose, arabinose, xylose, mannose, glucose, and galactose. Several studies have reported biological activities of *I. obliquus* such as anticancer, anti-oxidation, anti-inflammatory, antidiabetic and enhancement of immunity [49].



**Figure 3** Medicinally important mushrooms. *Lentinula edodes*, (Shiitake mushroom); (Photographs were taken by Dr. Elkhateeb WA. Location: Kuwabara, Nishi-Ku, Fukuoka City, Japan).



Inotodiol, a lanostane-type triterpenoid, and many phytochemicals from Chaga mushrooms have been investigated by Park J [50], for various allergic diseases. Lanostane triterpenoids-rich concentrate, which contained 10% inotodiol as major (inotodiol concentrate), was prepared from Chaga and compared with pure inotodiol in terms of anti-inflammatory activities on a human keratinocyte cell line, HaCaT cells, under various stimulations such as stimulation with Ultraviolet (UV) B or Tumor Necrosis Factor (TNF)- $\alpha$ . Furthermore, pure inotodiol/inotodiol concentrate could also modulate the synthesis of collagen and hyaluronic acid by controlling COL1A2 and HAS2/3 expression, which implies a crucial role for pure inotodiol/inotodiol concentrate in the prevention of skin aging (Figure 4). These results illuminate the anti-inflammatory and anti-aging effects of pure inotodiol/inotodiol concentrate, and it is highly imaginable that pure inotodiol and inotodiol concentrate could be promising natural bioactive substances to be combined in therapeutic and beautifying applications for human skin [50].

### ***Tremella mushrooms (Tremella fuciformis) improve skin appearance***

*Tremella* species are mainly parasitic on wood-rotting fungi *Tremella* species occur worldwide as a group. Over 100 species of *Tremella* are currently recognized worldwide. Two species, *Tremella fuciformis*, and *Tremella aurantialba* are commercially cultivated for food and medicinal activities [51].

*Tremella fuciformis*, an edible medicinal mushroom, is commonly known as snow fungus, snow ear, silver ear fungus, and white jelly mushroom (Figure 5). *Tremella fuciformis* belonging to the order Tremellales and the family of Tremellaceae, which has been traditionally used for health promotion in China and other East Asian countries for many years [15]. Plenty of bioactive substances are discovered in *Tremella fuciformis*, including fatty acids, proteins, enzymes, polysaccharides, phenols, flavonoids, dietary fiber, and trace elements. *Tremella fuciformis* polysaccharide shows multiple physiological, and healthy promoting effects, such as enhancing immune function, antitumor, anti-oxidation, anti-aging, hypoglycemic, hypolipidemic, neuroprotection, and other effects [52]. *Tremella fuciformis* polysaccharide has been identified as a major bioactive component. The monosaccharides detected in polysaccharide were mannose, xylose, glucuronic acid, glucose, and galactose. *Tremella fuciformis* polysaccharides shows multiple physiological and healthy promoting effects including immunomodulation, antitumor, anti-oxidation, anti-aging, hypoglycemic, hypolipidemic, neuroprotection, and other effects [53].

*Tremella* mushrooms (*Tremella fuciformis*) are edible mushrooms that grow in tropical and subtropical regions around the world. These mushrooms are also known as white fungus or snow ear [54]. *Tremella* mushrooms have been used for thousands of years in Traditional Chinese Medicine (TCM) to prevent disease, support immunity, and



**Figure 4** Chaga (*Inonotus obliquus*) (photographs taken by Thomas PW, Near Pitlochry, Scotland). Products containing Chaga (*Inonotus obliquus*) supplement capsules and extract.



**Figure 5** Different *Tremella* species, Collected by Gena Bentall, Locality: United States, California, McGuffie Rd, Salinas.

improve skin appearance. Most of the health benefits of *Tremella* mushrooms are related to their high polysaccharide content. This type of carbohydrate may have anti-inflammatory and antioxidant properties. The *Tremella* mushroom is still used for medicinal purposes, but there's a lack of research to support its use [52-55].

### ***Agaricus bisporus* curing skin aging**

Mushrooms have been mainly investigated for their medicinal and nutritional values [56]. However, little work has been done in exploring the biotechnological potential of mushroom extract for the formulation of plenty of cosmetic products (Figure 6). It has been found that skin whitening could be achieved by inhibiting the tyrosinase enzyme activity [57]. The cosmetic industry has been working continuously to isolate some important ingredients from mushrooms especially from *Agaricus bisporus* and confirm their aesthetic values and their succeeding use in cosmetic products such as lotions and creams [58].

Ethanol extract from *Agaricus bisporus* exhibits strong antioxidant properties, thereby playing an important role in curing skin aging. The base

cosmetic cream prepared from mushroom extracts (Especially from *Agaricus bisporus*) displayed anti-inflammatory and antioxidant potential against the production of nitric oxide and melanin by suppressing the tyrosinase activity [59]. Cosmetic formulations including mushroom extracts suppress the growth of bacterial strains, which cause damage to the skin. Certain bioactive compounds in the base cream extracted from mushrooms enhance beauty and play an important role against inflammation, skin aging, and hyper-pigmentation [60].

### **Mushroom cosmetics: The present and future prospect**

Many studies have been done to find out more about the different components in mushrooms that are beneficial to human bodies instead of other synthetic drugs having side effects. For centuries peoples were using wild mushrooms for food and medicine and cosmetics, as well as for other economic and cultural purposes. Nowadays several types of mushrooms are combined in topical creams, lotions, ointments, serums, and facial preparations as cosmetic ingredients. These mushrooms include Shiitake (*Lentinula edodes*), Maitake (*Grifola*



**Figure 6** *Agaricus bisporus*.





*frondosa*), Reishi or Lingzhi (*Ganoderma lucidum*) and other different mushrooms. Cosmetics category can be classified into two categories of cosmeceuticals for topical application and nutricosmetics for oral one. Cosmeceuticals applies only to products applied topically, such as creams, lotions, and ointments, while nutricosmetics are known with similar apparent benefits but that are ingested orally, so-called inner beauty. Mushrooms have been appreciated as a traditional source of natural bioactive compounds for eras and have recently been subjugated for potential components in the cosmetics industry. Numerous mushrooms and their components have been known to be valuable to the skin, hair and others [56].

The most important mushroom ingredients are phenolics, polyphenolics (Compounds are aromatic hydroxylated compounds, possessing one or more aromatic rings with one or more hydroxyl groups, being commonly found in numerous mushrooms, these compounds exhibit a wide range of biological effects due to free radical scavenging and antioxidant activity) [61], terpenoids (Large and expanded group of organic compounds similar to terpenes, derived from five-carbon isoprene units, most known terpenoids in mushrooms were found in *Ganoderma* spp. especially *Ganoderma lucidum*, containing a wide range of terpenes and terpene derivatives, such as ganodermic and ganoderic acids) [62], selenium (Ultra-trace essential element for mammals and essential in different selenoproteins and/or selenoenzymes present in *Agaricus bisporus* and *Lentinus edodes* are edible mushrooms that accumulate selenium in their bodies) [63], polysaccharides (Most of mushroom polysaccharides are homoglycans or heteroglycans, depending on types of monosaccharide molecules in polysaccharides), vitamins, volatile organic compounds and others. These compounds show excellent antioxidant, anti-aging, anti-wrinkle, skin whitening, and moisturizing effects, anti-hair loss and others which make them ideal applicants for cosmetics products.

It is important to identify the chemical structure of these compounds to gain insight into how they interact with cells and develop more effective anti-aging and anti-hair loss strategies. Skincare and anti-hair loss were the most important products categories today. Consumers' demand for skin-friendly products has stimulated the development of natural-ingredient-based cosmeceutical preparations over synthetic chemicals. Thus, natural polysaccharides have gained much attention since the promising potent

efficacy in wound healing, moisturizing, antiaging, whitening and Anti-hair loss. The challenge is to raise consciousness of polysaccharides with excellent bioactivities from natural sources and so join them in novel, safer and harmless cosmetics.

Now percentage of mushrooms currently identified and utilized is small. More mushroom species will be discovered, verified, and cultivated in the future, boosting the development of relevant industry especially in cosmetic fields. Combining with progress in genomics, proteomics, metabolomics, and systems pharmacology, mushrooms can find their way into cosmetics with multiple approaches. From different traditional sources of natural bioactive compounds, mushrooms are now being exploited for effective ingredients in the cosmetics industry. Several mushrooms and their extracts are whichever presently used or patented to be used as cosmetics products for their antioxidant, anti-aging, anti-wrinkle, skin whitening, moisturizing effects, anti-Hair loss and others.

## Conclusion

As the population ages, there is an increasing demand for strategies to promote healthy aging. Nutritional interferences and nutrient supplementation have been identified as effective ways to extend both health span and lifespan among the elderly. Among various food sources, mushrooms have demonstrated promising anti-aging potential due to the presence of bioactive compounds such as polysaccharides, proteins and peptides, lipids, phenolic compounds and others, which have been shown different effects such as anti-inflammatory, anti-oxidant, anti-hair loss, immunomodulatory, neuroprotective, anti-diabetic, and cardiovascular disease-ameliorating properties. Mushrooms natural bioactive compounds, are now being exploited for potential components in the cosmetics industry. Several mushrooms (Such as *Agaricus*, *Amanita*, *Calocybe*, *Cantharellus*, *Cordyceps*, *Coprinus*, *Cortinarius*, *Ganoderma*, *Grifola*, *Flammulina*, *Lentinus*, *Inonotus*, *Huitlacoche*, *Hydnum*, *Lentinus*, *Morchella*, *Pleurotus*, *Rigidoporus*, *Tremella*, *Trametes* sp. and others) and their extracts are whichever presently used or original to be used as cosmetics products for their antioxidant, anti-aging, anti-wrinkle, skin whitening, and moisturizing effects, anti-Hair loss. Moreover, safety, dosage, and effectiveness of the bioactive compounds should be verified. Further research, particularly clinical or nutritional trials, will be highly required.



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