Mini Review

Mushrooms as natural antiviral sources and supplements foods against coronavirus (COVID-19)

Abstract

Coronavirus (COVID-19) is a disease that has caused a lot of casualties worldwide. After the pandemic announcement, it infected quite a lot of people and had serious mortality in many countries. The prevalence of the disease, especially in people with weak immune systems and individuals with chronic diseases, has brought to the fore different protection methods and supplements that strengthen the immune system. In this context, it is important to evaluate mushrooms, which are important supplements. Mushrooms are natural products with many biological activities. In this research we have done, the antiviral activity of fungi has been emphasized. In addition, it is recommended that mushrooms should be evaluated as both supplements and natural antiviral drugs against COVID-19.

Keywords: coronavirus, mushrooms, antiviral sources, pneumonia, COVID-19

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Introduction

The new type of coronavirus, the infectious pneumonia epidemic that started in the central China's Wuhan province in December 2019, was named Coronavirus (COVID-19) by the WHO, SARS-CoV-2 by the International Virus Taxonomy Committee. After the World Health Organization announced the global pandemic as of March 28, 2020, the new type of coronavirus, which was transmitted to 162,773.940 people in the world as of May 17, 2021, died 3,375.573 people worldwide (Figure 1).[1] Approximately 2-14 days after the virus infection, high fever, chills, dry cough, dyspnea, weakness, joint, muscle, head and throat pains, loss of taste and smell, nasal congestion and runny, nausea and vomiting, diarrhea are observed. There have been many similar epidemics in the historical process. Diseases such as Black Plague, Cholera, Flu, Typhoid, Swine Flu have been declared as pandemics.[2,3] COVID-19 attacks the lower airways, causing viral pneumonia. In addition, it may affect the gastrointestinal system, heart, kidney, liver, and central nervous system, leading to multi-organ failure.[4,5] Many different drugs are used in the treatment of COVID-19. In addition, supplementary foods that support the immune system are recommended. In this study, mushrooms, which are natural products that support the immune system, are focused on.

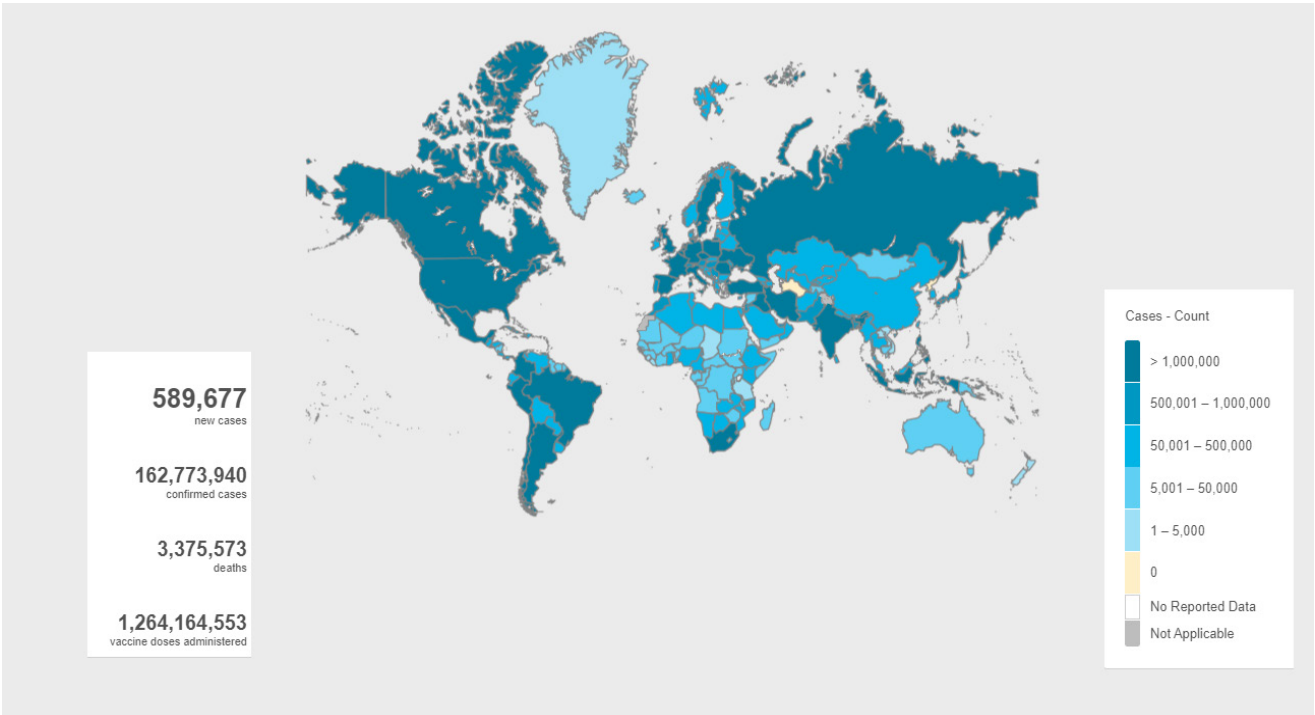

Figure 1 Countries, territories or areas with reported confirmed cases of COVID-19, 17 May 2021.

Mushrooms have been used by people for different purposes since ancient times.[6,7] They have been used in different communities as food, medicine, religious rituals, and poison. We can group mushrooms as poisonous, edible and inedible.[8,9] In this context, when poisonous mushrooms are consumed, they can show lethal effects as well as gastrointestinal disorders.[10,11] Edible mushrooms, on the other hand, are food products with very good nutritional properties.[12,13] It is especially low in fat content, rich in protein, chitin, vitamins and minerals, and is an essential element of low calorie diets.[14,15] Inedible mushrooms are hard and tasteless mushrooms that do not have toxic or nutritious properties. Inedible mushrooms are distinguished by their medicinal properties.[16,17] In recent years, the medicinal properties of mushrooms as well as their nutritional properties have been reported by many researchers. In this context, the interest of researchers in the research of the pharmaceutical potential of mushrooms is increasing.[18–21] Many studies have shown the existence of biologically active molecules produced within the body of fungi.[22] Fruit bodies and cultured myceliums have been reported to contain polysaccharides, proteins, oils, minerals, glycosides, alkaloids, essential oils, terpenoids, tocopherols, phenolics, flavonoids, carotenoids, folates, lectins, enzymes, ascorbic and organic acids.[23–26] Especially polysaccharide groups and β-glucans are versatile metabolites with a wide spectrum of biological activity.[26–28] In many studies conducted in this context, it has been reported that mushrooms have different biological effects such as antioxidant, antiproliferative, antiallergic, immunomodulatory, antiviral, antibacterial, antiparasitic, antifungal, anticholesterolemic, hepatoprotective, DNA preservative, anticancer, and anti-inflammatory.[29–41] In addition to these biological effects, antiviral effects of fungi against COVID-19 can be used. Many studies have shown that different types of fungi have anti-viral effects (Table 1).[42–55] As stated in the literature, it is seen that many different mushroom extracts or compounds isolated from fungi have antiviral effects (Table 1). It is thought to be a type of mushroom that has not been researched but has medicinal properties. In this context, mushrooms, which are indispensable elements of natural ecosystems, can be used to combat COVID-19 and many different viral diseases.

Table 1 Antiviral activities of some mushrooms

Mushroom name	Virus	Compounds	Literature
Rhodotus palmatus (Bull.) Maire	Hepatitis C	Meroterpenoid and Sesquiterpenoids	42
Boletus edulis Bull., *Fomes fomentarius* (L.) Fr., *Laetiporus sulphureus* (Bull.) Murrill, *Lentinus edodes* (Current name: *Lentinula edodes* (Berk.) Pegler), *Morchella conica* (Current name: *Morchella esculenta* (L.) Pers.), *Morchella esculenta*, *Phellinus igniarius* (L.) Quél., *Phellinus pini* (Current name: *Porodaedalea pini* (Brot.) Murrill), *Pleurotus ostreatus* (Jacq.) P. Kumm., *Porodaedalea pini* (Brot.) Murrill, *Pyrofomes demidoffii* (Lév.) Kotl. & Pouzar, *Rozites caperata* (Current name: *Cortinarius caperatus* (Pers.) Fr.), *Terfezia boudieri* Chatin, *Tricholoma anatolicum* H.H. Doğan & Intini	Herpes simplex virus types 1 (HSV-1)	RC-183, Methanol and aqueous extracts, polysaccharide	43–46
Daedaleopsis confragosa (Bolton) J. Schröt., *Datronia mollis* (Current name: *Cerioporus mollis* (Sommerf.) Zmitr. & Kovalenko), *Ischnoderma benzoinum* (Wahlenb.) P. Karst., *Laricifomes officinalis* (Current name: *Fomitopsis officinalis* (Vill.) Bondartsev & Singer), *Lenzites betulina* (L.) Fr., *Trametes gibbosa* (Pers.) Fr., *Trametes versicolor* (L.) Lloyd	Type A influenza virus of birds (H5N1) and humans A (H3N2)	Aqueous extracts	47
Ganoderma lucidum (Curtis) P. Karst., *Hericium erinaceus* (Bull.) Pers., *Lignosus rhinocerotis* (Cooke) Ryvarden, *Pleurotus giganteus* (Berk.) Karun. & K.D. Hyde, *Schizophyllum commune* Fr.,	Dengue Virus 2	Hot aqueous, ethanol, hexane, ethyl acetate and aqueous extracts	48
Agaricus brasiliensis Fr., *Cordyceps sinensis* (Current name: *Ophiocordyceps sinensis* (Berk.) G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora), *Ganoderma lucidum*(Curtis) P. Karst., *Grifola frondosa* (Dicks.) Gray, *Lentinus edodes* (Current name: *Lentinula edodes* (Berk.) Pegler), *Trametes versicolor* (L.) Lloyd,	Human immunodeficiency virüs (HIV)	Polysaccharide	49
Cantharellus isabellinus Heinem., *Cantharellus platyphyllus* (Current name: *Afrocantharellus platyphyllus* (Heinem.) Tibuhwa), *Pleurotus citrinopileatus* Singer, *Pleurotus djamor* (Rumph. ex Fr.) Boedijn, *Pleurotus sajor-caju* (Current name: *Lentinus sajor-caju* (Fr.) Fr.)	Infectious bursal disease virüs, Poxviridae	Methanol extract	50
Hypoxylon fuscum (Pers.) Fr.	Echoviruses (E7, E13, and E19)	Methanol extract	51
Auriporia aurea (Peck) Ryvarden, *Flammulina velutipes* (Curtis) Singer, *Fomes fomentarius* (L.) Fr., *Ganoderma lucidum*(Curtis) P. Karst., *Lentinus edodes* (Current name: *Lentinula edodes* (Berk.) Pegler), *Lyophyllum shimeji* (Kawam.) Hongo, *Pleurotus eryngii* (DC.) Quél., *Pleurotus ostreatus* (Jacq.) P. Kumm., *Schizophyllum commune* Fr., *Trametes versicolor* (L.) Lloyd	H1N1 (influenza A virus subtype), HSV-2 (Herpes simplex virus types 2)	Mycelial extracts	52

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Table Continued...

Mushroom name	Virus	Compounds	Literature
Agaricus brasiliensis Fr.	Poliovirus type 1	Polysaccharide	53
Phellinus linteus (Current name: *Tropicoporus linteus* (Berk. & M.A. Curtis) L.W. Zhou & Y.C. Dai),	Newcastle disease virus (NDV)	Crude extract	54
Lentinus squarrosulus Mont., *Pleurotus ostreatus* (Jacq.) P. Kumm.	Human Cytomegalovirus (HCMV)	Methanol extract	55

Conclusion

Proper and balanced nutrition plays an important role in preventing diseases. In this context, adding mushrooms, which have important biological activities, to the diet list is important in the prevention of diseases as well as their nutritious properties. Today, due to the high antiviral effects of many fungal species, its use before, in the treatment and after the covid 19 can benefit human health. In this context, especially medicinal mushrooms can be used in the fight against COVID-19.

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None.

Conflicts of interest

The author declares that they have no potential conflict of interests.

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