

Nutritional and medicinal properties of edible mushrooms: A review

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Abstract

Wild edible mushrooms provide a significant source of nutritional as well as medicinal compounds and used for the development of drugs. Also, their unique taste and flavour make them a demanding functional food for every man's plate. Nowadays mushroom have drawn the attention of chemists and immunobiologists due to their immunomodulatory, antimicrobial, antidiabetic, antitumor, anticancer, and antioxidant activities. This review focuses on the health implications, nutritional and medicinal importance of various edible mushroom species.

Keywords: Edible Mushrooms, Nutrients, Medicine, Properties

1. Introduction

Mushrooms are the fruiting bodies of higher fungi and worldwide distributed. Approximately, 140,000 types of mushrooms are present on the earth, out of which only around 10% are known. Meanwhile, about 50% of those ~14,000 species have varying degrees of edibility, more than 2,000 are safe, and about 700 species are known to possess significant pharmacological properties (Chang, 1999; Reshetnikov, Wasser, & Tan, 2001). Edible mushrooms were called the "food of the gods" and the good sources of dietary protein, carbohydrate, fats, vitamins, fibre and minerals (Mattila et al., 1994). From the ancient times mushroom are being used extensively as a functional food in many countries due to their good flavour, taste, high nutritive values and potential beneficial effects on human health (Cheung, 2008; Wang et al., 2014). Hence, food industry is especially interested in both cultivated and wild edible mushrooms. They have recently become attractive for the development of several drugs (Moradali, Mostafavi, Ghods, & Hedjaroude, 2007; Wasser & Weis, 1999a). PSK from *Coriolus* (*Trametes*) *versicolor*, lentinan from *Lentinus edodes* and sonifilan (SPG) from *Schizophyllum commune* have been recognized as anticancer drugs throughout the world (Cui & Chisti, 2003; Fujimoto et al., 1983; Taguchi et al., 1983). Mushrooms have been found effective against diabetes, heart diseases, hypertension, cerebral stroke, asthma, allergies and cancer (Das, 2010; Mizuno, 1999; Tzianabos, 2000; Wasser & Weis, 1999a; Wasser, 2002). Mushrooms are also known to exhibit antifungal, anti-inflammatory, antitumor, antiviral, antibacterial, hepatoprotective, anti-diabetic, hypolipidemic, antithrombotic and hypotensive activities (Moradali, Mostafavi, Ghods, & Hedjaroude, 2007; Wasser & Weis, 1999b). The objective of this review is to compile existing information about the nutritional composition and medicinal significance of edible mushrooms.

2. Chemical composition and nutritional value

The nutritional value of the mushroom originates from its chemical composition. The nutritional compositions of mushrooms as attractive, being good sources of dietary protein, carbohydrate, fats, vitamins, fibre and minerals (Ghorai et al., 2009; Sands, 2013). Mushrooms possess ~ 90% water by weight. The remaining 10% consists of 10-40% protein, 2-8% fat, 3-28% carbohydrate, 3-32% fiber and 8-10% ash (Breene, 1990; Demirba, 2001; Gupta & Singh, 1991; Longvah & Deosthale, 1998; Manzi, Aguzzi, & Pizzoferrato, 2001; Manzi et al., 1999; Manzi et al., 2004; Murugkar & Subbulakshmi, 2005; Sanme et al., 2003; Wang et al., 2014). Presence of high content of protein in mushrooms it is popularly called as "poor man's protein" (Pandey, 2004). Mushroom proteins contain all the essential amino acids, especially rich in lysine and leucine (Mattaila et al., 2001) and considered as a good source of digestible proteins with protein content above most vegetables and somewhat less than most meats and milk (Fitzpatrick, Esselen, & Weir, 1946; Lintzel, 1941). These are the good source of several vitamins such as A, B1, B2, B3, B12, C and D (Breene, 1990; Mattila et al., 1994), and mineral elements such as potassium, calcium, phosphorous, magnesium, iron, zinc and copper (Horowitz, Schock, & Horowitz-Kisimova, 1994; Kalac, & Svoboda, 2000; Latiff, Mohd Daran, & Mohamed, 1996; Murugkar & Subbulakshmi, 2005; Stijve & Besson, 1976). The wild edible mushrooms contain higher quantities of mineral elements than cultivated ones (Aletor, 1995; Mattaila et al., 2000). Besides actual nutrients, mushrooms contain a wide variety of bioactive molecules including terpenoids, steroids, phenols, nucleotides, glycoproteins and polysaccharides. Thus mushrooms are good sources of dietary supplements, functional foods, phyto-chemicals, and nutraceuticals (Chang and Buswell, 1996; Zeisel, 1999). These dietary supplements are used for the

enhancement of health, fitness, and prevention of various human diseases.

3. Medicinal properties

However, mushrooms are used as tasty, edible, and dietetic miracle foods worldwide (Lucas et al., 1957). Also, they have been used in folk medicine throughout the world and considered to be one of the most useful antitumor agents for clinical uses (Wasser and weis, 1999b; Brochers et al., 1999; Mizuno, 1999; Mizuno, 1996; Mizuno et al., 1999). For medical purposes, mushrooms have been consumed to prevent cancer and cardiac diseases, to improve blood circulation and to reduce blood cholesterol level (Ooi & Liu, 1999; Ooi & Liu, 2000; Wasser, 2002). Several mushroom polysaccharides are widely used and commercialized worldwide as anti cancer agents for therapeutic purposes. Several mushroom polysaccharides such as Lentinan (from *Lentinus edodes*, Japan), Schizophyllan (from *Schizophyllum commune*), Krestin (from turkey tail mushroom *Trametes versicolor*), Agarican (from *Agaricus blazei*, USA), and Grifon-D (from *Grifola frondosa*, Japan) have been established as pharmaceutical agents and used as anticancer drugs (Chihara et al., 1969; Cui & Chisti, 2003; Fujimoto et al., 1983; Mizuno, 2002; Moradali, Mostafavi, Ghods, & Hedjaroude, 2007; Taguchi et al., 1983; Zhuang et al., 1994). All these polysaccharides exhibit anticancer activity and are used in cosmetics products (Wu et al., 2016). Lentinan was shown to induce apoptosis in gastric cancer cells and could be used for the treatment of gastric cancer (Furue & Kitoh, 1981; Taguchi et al., 1985). Schizophyllan has great importance in the pharmaceutical and food industries (Reyes, Brabl, & Rau, 2009). Moreover, Schizophyllan (SPG) is found to be effective in the therapy of uterine cervix cancers (Okamura et al., 1986; Okamura et al., 1989). PSK has an accepted anti-tumor activity in various types of cancers, including colorectal, gastric, breast, liver, pancreatic, and lung cancer (Iguchi et al., 2001; Rai, Tidke, & Wasser, 2005; Tsang et al., 2003). It is also useful for hepatitis B (Mizuno, 1995) and chronic active hepatitis (Ying et al. 1987). Agarican has been commercialized and used clinically as antitumor agents (Ebina & Fujimiya, 1998; Kawagishi et al., 1989, 1990). It is also used to prevent various diseases including chronic hepatitis, allergies, and asthma (Biedron, Tangen, Maresz, & Hetland, 2012; Grinde, Hetland, & Johnson, 2006). Grifon-D has been shown to have a cytotoxic affect on human prostate cancer cells (PC9) in vitro, possibly acting through oxidative stress, and causing 95% cell death by an apoptosis (Fulleroton & Samadi, 2000; Nishida, Nanba, & Kuroda, 1988). Several α -D-glucans (Miura et al., 1996; Morikawa et al., 1985; Wasser & Weis, 1999b) and α -D-glucans (Whistler et al., 1976) are widely used as antitumor and immunomodulating agents. The important bioactive carbohydrate moiety α -L-fucose is essential for novel treatment approaches in human breast cancer (Jay, Gene, & Catherine, 2011). Different parts of the mushroom are being used for the treatment of blood sugar, high blood pressure, as a preventive of ageing as well as for the beauty treatment (Wasser & Weis, 1999a; Wasser, 2002).

4. Conclusion

Mushrooms are the important natural renewable source of bioactive polysaccharides that exhibit immunostimulating and antitumor properties. Various structures of β -D-glucans show distinct affinities toward receptors to trigger different host responses. So, they are regarded as biological response modifiers, BRM. β -D-glucans are useful to recover the impaired immune systems of humans and particularly against cancer and infectious diseases. The

commercial pharmaceutical products such as schizophyllan, lentinan, grifolan, PSP and PSK have shown potential clinical applications in cancer therapy. Hence, they have a great role for future application as drugs for immune and cancer therapy.

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