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Mushroom-A Nutritious and Environment Friendly Crop: A Review

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ABSTRACT

Mushroom is very nutritious and environment friendly crop additionally to numerous medicinal values. Mushroom contain low protein amount than the animals but way more in case of plants. Except iron it contain higher amount of fiber, essential amino acids and minerals. It is not only a vegetable of full of nutrients as Vitamin D but also it has a property that can prevent cancer, HIV-1 AIDS (a serious disease in human being) and others diseases. It is a crop which requires minimum resources and space to cultivate, which is grown in all over the world and with minimum cost throughout the year. It has a marvelous prospective and petition for growing a nutritious food item with superb taste from agricultural waste substrates that are rich and low expensive for growing, mushroom is a very environmentally friendly crop; lignocellulosic waste material can be also converted into food, feed and fertilizers by its cultivation. However, the consumption and production of mushrooms is much lower than other crops, so the investment in the mushroom industry is not very large.

Key words: Edible mushrooms, Food industry, Medicinal properties, Nutritive value.

Mushrooms is cultivated since earlier period due to his nutritional value and flavour especially in the eastern countries. The edible mushrooms cultivation carries of great relevance in today's world within the situation of a growing human population and extreme pressure on the atmosphere. Therefore, this study summarized the important species of mushroom cultivated in India, nutritional and meditational values and the way mushroom production is environment friendly.

Cultivated mushrooms are a highly nutritious food which will be grown on biological wastes, agricultural wastes or agro-industrial wastes (Sánchez, 2010 and Atila, 2017). Researchers have reported variations within the nutritional content of mushrooms cultivated on different substrates. When comparing the consequences of various agro-wastes on the nutritional composition of oyster mushrooms and *Pleurotus cystidiosus*, formulas with 100% sugar bagasse and 100% corncob showed higher values of protein, fiber, ash and mineral content (Ca, K and Mg) than 100% sawdust Hoa *et al.* (2015). Moreover, supplementation of mushroom substrates in *Agaricus bisporus* with trace elements has been described as reliable for the formation of fruiting bodies enriched with selenium, copper, zinc and micronutrients that regularly are deficient within the human diet Bird *et al.* (2017); Rzymski *et al*. (2017), Werner and Beelman 2002). Several products also made from mushroom for nutrition. Anti-viral, anti-cancerous and anti oxidant properties also found in mushroom so people focused on its processing and cultivation. In case of Edible Mushroom, due to its richness in protein, vitamin, mineral, fibres, microelements and minute calories level used extensively (Naeem *et al*., 2020).

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Universal cultivated mushrooms

In mushrooms there are only some species of fungi which are commercially cultivated Among the 300 genera of mushroom and allied fleshy basidiomycetes, the reason for that, the absence of the host many of them not sporulate due to its mycorhizal condition. But many saprophytic species are agreeable to cultivation. Some common cultivated species of mushroom are shown in Table 1.

Nutritional value of mushroom

Edible mushrooms are source of food and they form easily digestible and very nourishing meals. Mushrooms are intake for their values like nutrition, flavor and taste. On the basis of fresh weight mushrooms contain higher protein content (Aremu *et al.,* 2009) to any or all fruits and vegetables and in meat and dairy products protein content is high than the mushroom source (Table 2). On the basis

of dry-weight, mushrooms are alike to dried-yeast and greater to dried beans and peas.

The nutritional content differs from different species and substrates use for their growth requirement. Mushrooms are recommended to heart patients because it contains high protein and low caloric diet and also all the essential amino-acids required to an adult (Koyyalamudi *et al.,* 2009). Tryptophan and lysine are also present in high concentrations as compare to cystein and methionine. Edible mushrooms contain low amount of carbohydrate and fat. It makes supreme food for diabetic patients and for those persons who wants to shed excess fat due to the lack of starch in mushrooms. Edible mushroom also known as vegetable meat (Haas and James, 2009). can be arranged into different delicious dishes and flavour for other dishes. Some people those are vegetarian use mushroom in their diet on the supplementary of meat (Abulude, 2005).

Researchers Kattawan *et al.* (2011) and Naeem *et al.* (2020) has been proved that mushroom enclose antioxidants. Apart from nutritious importance, mushrooms have prospective medicinal benefits particularly as antitumor. A number of researchers gave details about medicinal importance of *Pleurotus tuber-regium* (Abulude, 2005; Kuforiji and Fasidi, 2008; Kattawan *et al*., 2011). Mushroom also used with medicinal plants for care of many diseases as chest pain, headache, dropsy, fever, smallpox and stomach pains (Change, 2012). Mushrooms convey many nutritional produce, as well as aspect more generally originate in grains, beans or meat. Mushroom has low calories, fat-free, very squat in sodium and cholesterol-free (Patel and Goyal, 2013). Mushroom perform as anti-cancer complex and play fundamental role as immediate anti-mitotic, oxygen species inducer, mitotic kinase inhibitor, topoisomerase inhibitor, angiogenesis inhibitor, leading to apoptosis and eventually inspection cancer dispersal.

Medicinal value

Numerous chemical compounds are found in mushrooms and hypothetical that it has curative uses and benefits. Similarly, the lipid fraction of *Grifola* exhibit antioxidant activity and inhibit enzymes that cause many chronic diseases as well as cancer (Inoue *et al*., 2002). The mushroom constituents not only restrain development of the disease by using direct cytotoxicity against tumour cells but also deplume other non-immune inhibiting mechanisms (Chang, 1996).

The chemicals formed by species of *Ganoderma* have antibacterial property (Smania *et al*., 1999) and have been shown to check the growth of bacteria like *Staphylococcus* (Mothana *et al*., 2000). Steroids isolated from them are active against various microorganisms (Kuznetsov *et al*., 2005). Experimentally based evidence has been growing to support observations over the centuries about the nutritional and medicinal benefit from mushrooms.

Currently the value of mushrooms has been acquired to a wonderful level with medicinal mushroom trials conducted for HIV/AIDS patients in Africa, yielding promising results (Chang, 2006). The mycelial extracts from *Lentinula* generate antiprotozoal actions against *Paramecium* (Badalyan, 2004). Mushrooms have an antiviral properties and various elements isolated from *Ganoderma* are active against HIV-1 (El-Mekkawy *et al*., 1998; Ichimura *et al*., 1998) are also known to possess antiviral property against influenza virus type 1 of the various medicinal use of mushroom.

In medicinal purpose mushroom or mushroom extracts, that are used to treatments for diseases also. *Lentinula edodes* (shiitake), *Grifola frondosa* (maitake) and *Ganoderma lucidum* (reishi), have a history of medicinal use spanning millennia in parts of Asia. Medicinal mushroom researches indicate the properties of antiparasitic, cardiovascular, anticancer, antibacterial, antiviral, anti-inflammatory, antidiabetic and hepatoprotective, activities (Lentinan, 2009). The benefits of mushroom such as the medicinal, nutritional and mythological uses also have been diagnosed (Akpaja, 2005; Smith *et al*., 2002).

It is recognized that the uses of mushroom genetic resources are not only of high attention in agriculture, agronomy, animal feed and human food but also for the production, development and detection of constituents with high added value in industries like pharmaceutical and chemical industries (Labarère and Menini, 2000). Mushrooms materials, including polysaccharide, proteoglycens and glycoprotein modulate immune system responses and block tumor growth. Currently, numerous extracts have wide spread use in China, Japan and Korea as adjuncts to chemotherapy and radiation treatments (Smith *et al.*, 2002; Borchers *et al*., 2008).

Mushrooms that include psychoactive substances have been used as ordinations for therapeutic (Mental and physical) (Huder, 2000). Certain mushrooms, mainly polypores like Reishi were thought to be able to benefits in a various variety of health illne (Sarfaraz *et al*., 2009). A researcher finds out the enhancements of egg laying capacity and disease resistant ability of birds when they use *Ganoderma sp.* (Ogbe *et al*., 2008). Okhuoya *et al.* (2010) have found that Betaglucan based diet originated by *Ganoderma lucidum* (Leyss.) effective in buruli ulcer caused by Mycobacterium in Nigeria.

Table 1: Various species of edible mushrooms grown in India.

Common variety of edible mushrooms	Scientific name
Button, European/Temperate	*Agaricus isporus*
Button/Edulis/Hot weather mushroom	*A. bitorqius*
Oyster mushroom	*Pleurotus species*
Paddy straw/Chinese/ Tropical mushroom diplosia	*Valvariella volvacea, V.*
Black ear mushroom	*Auricularia polytricha*
White milky mushroom	*Colocybe indica*
Brown cap/Giant mushroom annulata	*Stropharia ruguso*
Shiitake mushroom	*Lentinus edodes*

Table 2: Cultivated mushroom and some common vegetables composition per 100 g of produce.

Name	Calories	Moisture, %	Fat, %	Carbohydrate, %	(Dry wt basis) Protein (%)
Mushrooms	16	91.1	0.3	4.4	36.9
Beet root	42	87.6	0.1	9.6	12.9
Brinjal	24	92.7	0.2	5.5	15.1
Cabbage	24	92.4	0.2	5.3	18.4
Cauliflower	25	91.7	0.2	4.9	28.8
Celery	18	93.4	0.2	3.7	20.6
Green peas	98	74.3	0.4	17.7	26.1
Green beans	35	88.9	0.2	7.7	21.6

Other uses of mushroom

Mushroom is use for dyeing wood and other natural fibers. The chromosphores of mushroom dyes are organic material and produce a vivid and solid colors and all variety of colors can have attained with mushroom dyes Wikipedia (Accessed, 2011). Dyes from them have been the resource of various dyes before the artificial dyes (Mussak and Bechtold, 2009).

In developed countries, mushroom has been used as fire starter. They also have been applied by Evocative devise LLC to make biodegradable packaging. Currently, they play a vital role in the improvement of new biological filtration technologies and remediation techniques. Wikipedia (Accessed, 2011). Mushrooms are also use as gun powder (Akpaja *et al*., 2005).

Environment friendly crop

Use of expensive substrate for growing oyster mushroom increases their cost of production. So there was need to search for definite substitute materials which should be existing in sufficient amount at relatively low price (Arya and Arya, 2003). *Pleurotus* has been reported to grow readily on a number of non-conventional substrate (Das *et al.*, 2000; Mukherjee and Nandi, 2002; Nageswaran *et al.*, 2003). In West Bengal, India water hyacinth (*Eicchornia crassipes* Solms.), a low-cost supplement for oyster mushroom (*Pleurotus florida*) cultivation. Bandopadhyay *et al.* (2009). In India *Pleurotus sajor-caju* has been successfully cultivated on banana pseudo-stem and paddy straw (Jandaik, 1974; Jandaik and Kapoor, 1975). Rice straw, wheat straw, ragi straw, hulled maize cab, waste paper were tried in different studies (Jandaik and Kapoor, 1975). All these unutilized wastes together with other trash materials which pollute the environment may well be utilized for cultivation of protein-rich mushrooms. (Medda, 2001). With the help of biotechnological process, the huge organic wastes can be re-cycled through mushroom cultivation for the production of food, fuel and fertilizers. Spent residues after the cultivation of edible mushroom could be better source of biologically pre-treated substrates for biogas production. Recycling of agro wastes is done through mushroom cultivation (Madan, 1994).

CONCLUSION

The population of the world continues to rise and quantity of food and medical care availability to each individual, especially those live in less developed countries, decreases day by day. Mushrooms, with their abundant variety of species, are very effective for nutrition and medicinal purpose and constitute a cost-effective with environment friendly. Mushroom can be produce on different waste material from agriculture and other industries like waste paper, saw dust, card board and wood *etc*. After harvesting mushroom substrates are used in agriculture crop production like compost. At last we can say that mushroom cultivation is cost effective in nutritional, medicinal and environmental, recycling of waste products and environment friendly crop.

Conflict of Interest

There is no conflict of interest.

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