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Bioactive compounds derived from AGARICUS Species and Bioactivity for type 2 diabetes mellitus

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Abstract:

Mushrooms are obtained from fungi that produce spores. Mushrooms from the Basidiomycota phylum contain almost 33,000 species. Consumption of mushrooms has improved, and the 2016 cultivation rate was about 10,378,163 metric tonnes. All species of mushrooms produce spores for reproduction. The most valuable edible specie is *Agaricus bisporus.* Mushrooms are part of the diet to stimulate the strength of the immune system. Mushrooms function as antidiabetic, anticancer, anti-inflammatory, antimicrobial, as well as Anticholesteremic. *Agaricus bisporus* mainly lowers glucose levels and stimulates production of glycogen in pancreatic cells with the help of glucokinase (GK). The occurrence of diabetes exceeds 592million up to 2035. Mushrooms contain vitamins B and D, phenolic compounds, and bioactive compounds that are non-toxic, so they have positive effects on human consumption. Reactive oxygen species get altered and lead to a risk of type 2 diabetes. B-glucan, polysaccharides, galactose, chitin, non-dietary carbohydrates, hemicellulose, etc. are utilised for the prevention of various diseases and also improve the defensive mechanism of the body. Humans and rats were examined with adipocyte-resultant proteins that regulate the cardiovascular functions. Mushrooms like *A. bisporus, Ganoderma lucidum, Pleurotus ostreatus, Lentinula edodes, Fomes fomentarius* and many others are involved in medications for various life-threatening diseases. Mushrooms are used in the treatment of human immunodeficiency reverse transcriptase type-1, herpes simplex virus type 1, and hepatitis B. Freezing is the most important method for the better preservation of

mushrooms at 12 degrees centigrade. Mushrooms' contents can also be preserved in the microwave rather than by boiling. Mushrooms can be baked, cooked and pickled. So, consumption of mushrooms is beneficial for human health.

Key words: Mushroom, Treatment, Diabetes, Basidiomycota, Human health, Nutritional factor

Introduction:

Mushrooms provide nutritional features to animals and plants equally, they are large filamentous fungi that produce spores so that they often called as fruiting bodies (Feeney, Miller et al. 2014). Mushrooms have not their own groups or subgroups taxonomically (Ganeshpurkar, Rai et al. 2010). They originated from sub-kingdom of moulds like Dikarya and its phylum is Ascomycota which is chief kingdom of fungi and other is Basidiomycota, and almost 33,000 species are found in Ascomycota phylum, all of them produce fruiting bodies except Pezizomycotina, Taphrimomycotina and Saccharomycotina. The second most important phylum which includes 30,000 species is Basidiomycota, that is divided into three sub-phyla Agaricomycotina, Pucciniomycotina and Ustilaginomycotina. Agaricomycotina sub-phyla is known as traditional “mushrooms” because they are responsible for production of spores in different structures of fungi (Carris, Little et al. 2012). Many species of mushroom are produced naturally in woodland, *A. bisporus* is most effective specie due to alimentary factors found in it even though 20 are cultivated at working from 30 species that are cultivated economically. Researchers are working to improve shelf life of edible mushroom (Cardoso, Fernandes et al. 2019). Mushrooms were produced in significant amount in 2014 in various states. Europe formed 19.63% while Asian homelands produce a huge volume of mushrooms 74.64%. World`s total production in industry of mushrooms is about 30,000,000 that depend upon lands and principles (Rosmiza, Davies et al. 2016). Cultivation of both therapeutic and edible mushrooms done in appropriate environments.

Some of them absorbs nutrients from dead materials and breed there. Some most important species which are produce in clean and fresh environment like *Flammulina, Agrocybe, Lentinus, Ganoderma, Pleurotus* and *Auricularia* species and some others are *Volvariella* and Coprinus species formed from lignocellulose substances. *Morchella* and *Lepista* species raised in humus condition in soil while few mushroom`s growth take place in animal dung and other materials. Some types need specific environmental conditions like hot, dry or wet atmosphere and few of all grow on coppices or grass specific species. Some mushrooms are cultivated naturally, and a few are commercially in all overworld. Mushrooms are mycorrhizal part of *Morchella*, Tuber and *Cantharellus* produced with semi cultivated methods. When mushroom moves towards vegetative stage, they need specific condition to grow like low temperature, use of light and fresh air, in these condition growth of fruiting bodies is stimulated. Mushroom can be cultivated through various practices. Techniques used for cultivation modify materials like mushroom that is used and climatic condition. *P. ostreatus* and *L. edodes* produce *A. bisporus* that is most broadly cultivated throughout world.

Structure of mushroom:

Mushrooms consist of cap (pileus) and lamella or gills and stem. Cap is present on the upper side of mushrooms and inner side contain different lines that are used to shelter the internal structure from contamination. When mushroom become mature lamella operated as to distribute the reproductive structure. Further the stem of mushrooms connected with upper part through a ring called annulus and cup like structure. So, between cap and stem fibre like formations are present know as mycelial filaments. Nutritional factors are transported from one part to other with help of mycelia and annulus. They are used for chemical transformation and also predicts the possibilities of reproductive factors present in lamella. The cap of *A. bisporus* is crescent structure of pale-grey chocolate or coffee shade with diameter of 5-10cm. The cap of this contains scales on its external

part that disappears when mushroom is developed. At start of production of mushroom lamella is pink colour and when it has established colour changes to dusky coffee colour. Two types of spores are produced by *A. bisporus* whereas other classes of *Agaricus* form four spores sustained as in diameter 2um. Upper side of annulus marked as 3cm wide and 8cm lengthy with narrow appearance (Buruleanu, Radulescu et al. 2018).Mushrooms play key role as supplementary food in human diet all over the biosphere, in some culture's mushrooms are considered as nutritional components in diet. The most important genus of mushrooms is *Agaricus* that contain almost 300 species with nourishing factors (Vieira, Fernandes et al. 2016). Mushroom are used to enhance antitumor and human immune system for better health and also their extracts are used because of their nutritional aspects (Popovic, Zivkovic et al. 2013). We observed that polyphenols, lectins, alkaloids, proteins, polysaccharides, peptides and fibres in mushroom extracts which enhance their organic activities. Hypertensive characteristics and inhibitory effects for angiotensin 1 converting enzymes exhibited by peptides isolated from *Agaricus bisporus* (Lau, Abdullah et al. 2014). Mushrooms are considered to show numerous pharmacological roles like antioxidant, antimicrobial, Anticholesteremic, antiplatelet-aggregating, immunomodulatory, antihypertensive, antitumor, anti-inflammatory, antigenotoxic and countless supplementary properties (Gargano, van Griensven et al. 2017). Mushrooms are found with such characteristics that can prevent life-threating disorders, because they embrace dietetic supplementary functions. Ingesting equilibrated diet with mushrooms can hold nutritional benefits for mushrooms and shows biological applications (Vieira, Fernandes et al. 2016). The complex fungi contain fruiting bodies like mushrooms and named as palatable bodies.

Due to cooking qualities and sensory appearances mushrooms are edible and consumed from eras by various nations. *Pleurotus* and *edodes* specie produce *A. bisporus* mostly consumed by people throughout world, containing culinary characteristics furthermore nourishing values (Yahaya, Rahman et al. 2014). Nutritional components found in *A. bisporus* are linolenic acid, dietary

fibres, vitamin B12, C, D2 and antioxidants. Mushroom interacts with infrared radiations and produce vitamin D. Naturally ergosterol is present in mushroom abundantly that is pro-vitamin formula of vit. D found in plasma sheath of moulds (Feeney, Miller et al. 2014). The most consumable mushroom of *Agaricus* specie for human`s nourishment. Vegetable dried powder rich in fibres combined with residue of mushroom lowers triglycerides and cholesterol level in body when it was experimented on rats (Gonaus, Kittl et al. 2016). They can cultivate easily and rich in anti-inflammatory and antioxidant bioactive composites. Terpenoids, antibiotics, lactones, alkaloids and lectins are the metabolites of mushrooms which display therapeutic aptitudes (Wasser et al. 2010). Oxidative stress that changed and can cause several problems in body is prohibited with help of primary metabolites like peroxidase, enzymes-glucose oxidase, laccases and superoxide dismutase (Chang and Wasser 2012). Several diseases are treated or prevented through advantageous actions of primary and tributary metabolites, diseases such as bacteriological disorders, cancer, circulatory complications, immunity problems, hyperlipidaemia and liver diseases are handled through mushrooms. *A. bisporus* is considered as model creature found in humid-rich atmosphere, mess humiliating basidiomycete frequently used in food industry, so these are cultured at wide range. Its biological function is to reduces and cleanse flora waste by productizing enzymes in environment (Jeong, Jeong et al. 2010). The growth of mushrooms in suitable farmhouses are rich in nutrients, and their formation had improved histrionically in late 1990`s throughout the world. The normal development of mushroom`s consumption was momentous per-capita and in 2016 it was upgraded about 10,378,163 metric tons (Ramos, Burgos et al. 2019). The world`s total farming of comestible mushroom is approximately 85% and it contains 5 types of genus of mushrooms such as *Agaricus, Pleurotus, Flammulina, Auricularia* and *Lentinus edodes* that are cultivated mostly all over world especially and China is at top from first-rate administrators of mushroom production (Royse, Baars et al. 2017). According to creation of mushrooms *A. bisporus* covers 15% from all and take place in

food square as edible mushroom throughout world. For the recovery of hypercholesterolemia, diabetes mellitus and hypertension used as obsolete medication. Many of medicines are obtained from *A. bisporus* because of homoeopathic features contain ergosterol, beta-glucan, lectins, sodium pyroglutamate and laccases used for treatment of different diseases. Cytotoxicity along with antioxidant characteristics are conferred in several experimentations with mushrooms. Endothelial melanoma is treated with lectins present in *A. bisporus* that have antiproliferative properties deprived of presenting cytotoxicity (Jagadish, Krishnan et al. 2009).

Bioactive compound of mushroom and Extraction of Vitamin D from Lentinula edodes:

Mushrooms comprises nutritional fibres, ergothioneine (ERGO) (Cheung et al. 2013) and beta glucans folate are bioactive composites, along with micronutrients like niacin, selenium, ergocalciferol (D2), copper, pantothenic acid and riboflavin (Zhu, Du et al. 2015), infrared radiations or through sunlight vit. D2 obtained, selenium and copper found in soil, and beta-glucan are used to alter bioactive stuff. *A. bisporus* specie covers diversity of brown portobello and white button mushroom that is almost 90% used up by US (Stojković, Reis et al. 2014). Still scientists don't have any strong information regarding defensive properties of mushroom shown by solo or multiple bioactive complexes advantageous for fitness of humans (Lau, Abdullah et al. 2014, Smolskaitė, Venskutonis et al. 2015). Through single electron transmission mushroom demonstrate scavenging impact due to the presence of free radicals in polyphenols derived from edible mushrooms which are considered as worthy source of antioxidants. It has experimented through frequent studies that polyphenols showed antioxidant properties present in different type of digestible mushrooms which includes *Agaricus arvensis, Leucopaxillus geganteus and Lentinula edodes* (Barros, Ferreira et al. 2007, Morales, Piris et al. 2018). The excellent source of phenolic compounds, selenium, polysaccharides and ergothioneine are white button mushroom

(WBM) known as *Agaricus bisporus* specie that bears diversity of edible mushroom economically (Tian, Zeng et al. 2021). It is confirmed from scientists that *A. bisporus* also possess immunity modifying and antitumor activities Mushrooms are finest basis for extraction of polysaccharides and antioxidants substances (Jeong, Jeong et al. 2021). Mushrooms consumption is healthier diet for veggies because with antioxidants, they also hold vitamin D and ergosterol. After experiments ergosterol is converted into lumisterol's, vit. D2 and tach sterols by means of electromagnetic radiations (Wittig, Krings et al. 2017).

Essential component vitamin D:

Vitamin D is essential component extracted from mushrooms just like polysaccharides, vitamins and antioxidants found in mushroom. Extracted vit. D is valuable for treatment of various diseases. Isolation of this can be done by diverse methods, the most suitable process is supercritical fluid extraction (SFE) with application of ultraviolet radiations. Vit. D is present in food as vit. D2, D4 and D3 (ergocalciferol, 22,23-dihydroergocalciferol and cholecalciferol respectively). Liver blood serum contain vit. D and can produce 25-hydroxycholecalciferol with processing hydroxylation cholecalciferol (Keegan, Lu et al. 2018). Precursor of vit. D is ergosterol that dropped the cholesterol level in the experiment on rats with hypercholesterolemic effects so in patients of high cholesterol level who are taking statin drugs for hypocholesterolaemia, they covert ergosterol to desired form vit. D. So ingestion of vit. D can prevent stroke (Qin, Zhao et al. 2017).

Fruiting bodies of *Lentinula edodes* obtained from Glucan feed S.L. in Spain for extraction of vitamin D. This was taken in powdered form that is stowed in darkness at -20degree centigrade with <5% humidity. Methanol, hexane (95%), absolute ethanol (from sea) and chloroform are used as solvent in this method. Some other solvents can be used for extraction are ascorbic acid, ergosterol (95%), cholecalciferol (vit. D3), potassium hydroxide (KOH), ergocalciferol (vit. D2)

and hexadecane as well as CO_2 used in pure form. Supercritical fluid extraction (CFE)method take place in plants that is supported by with CO_2. This process is used to extract components from a fluid from solvent and Apparatus for removal of vit. D which contains two extractors (S1and S2) of different abilities (0.5L each in size) and container (2L), rotary vacuum. This method doesn't require specific place to operate. Primarily extractors are filled up with 253g of mushrooms and 1100g clean sea sand with 1:1 proportion (García-Risco, Vicente et al. 2011). Pressure and temperature in extractors in sustained 60bar and 40degree centigrade respectively. This method almost takes 3h for completion and in between CO_2 is succeeded about 3.6kg/hr. After completion mixture is extracted out and placed into rotary vacuum for drying after washing with ethanol. Withdrawal yield is controlled and stored at -20degree centigrade. Its yield is articulated in grams by 100g of used material for removal. Ultraviolet radiations are exposed to powder of L. edodes at 245nm then ergosterol that is precursor of vitamin is decreased about 16% which alternatively upgraded production of Vit. D. But its level improved by 6.6 folds when powder is put off in solution of methanol and it reduce the level of ergosterol about 27%. Hence it is demonstrated that when mushroom`s powder is exposed to any medium like methanol it improved the development of vit. D. When fresh mushrooms exposed to UV- radiation for 1h they produce about 0.004mg/g of vit. D at 20degree centigrade with their gills which are exposed to UV- light for 30mint that produce 0.029mg/g, while on other hand powder form of fruiting bodies with UC-radiations produce almost 0.06mg/g (Sławińska, Fornal et al. 2016). Methanol is used as basic solvent with CO_2 in SFE procedure because of two basic purposes such as it is an organic compound that is more valuable for biosynthesis of vit. D rather than other solvents, enhance production of vit. D. Organic solvents can improve solidity of products. In the process of SFE the product is oily that cannot solubilize in aqueous solvents that's why for this procedure organic molecules are more significant. Ergosterol level is reduced when incubated for 2hr that regulate the production of vit. D until 1hr when these molecules are exposed to UV-lamp.

Ergosterol is transformed into vit. D. Infrared radiations (IR) are useful for transformation of ergosterol to vit. D instead of lumisterol's and tach sterols (Wittig, Krings et al. 2013).

Vitamin D2 is broken down into a compound 1,25-hydroxyvitamin D when ultraviolet or electromagnetic radiations are applied to mushrooms. Vitamin D2 is beneficial for many problems like, beta cells present in pancreas secrete insulin to lower down blood sugar level in human body, promote health development and improve reabsorption capacity of bones. It normalizes pressure in blood vessels and helps heart to function effectively. Stimulate fetal and brain growth, Improve immune system (specific and non-specific immunity) (Jovičić, Ignjatović et al. 2012). Oyster mushroom interact with UV rays, gives 204.7ug/g range of vit. D present in them. Natural nutritional diet like oily fish rich in vit. D, they possess different potential by edible mushroom for those who lack with vit. D in their diet especially vegetarians and fruitarians (Huang, Lin et al. 2020).

A.bisporus comprises bioactive composites like dietary fibres, niacin, amino acids, riboflavin, iron proteins, pantothenic acid and carbohydrates and mushrooms are used in field of science in homeopathic medication that are added into human diet (Feeney, Miller et al. 2014, Muszyńska, Kała et al. 2017). Flavonoids, terpenoids, phenolics and alkaloids are abundantly present in mushrooms. Due to existence of these contents in mushrooms express genetic functions such as anti-bacterial, anti-diabetic, anti-inflammatory, antiviral, anti-parasitic and for treatment of cardiovascular problems (Zhang, Li et al. 2019). The bioactive molecules present mushrooms have no toxicity, even they are essential and beneficial for human health. Metabolic syndrome is caused due to physiologic or genetic irregularities in structure of cells that make the organs at risk to develop heart complications and type 2 diabetes mellitus (T2D). The life threating disorders described through various features which are insulin resistance, overweight, cholesterol high density lipoprotein (HDL) absorption and plasma triglycerides level leads to different ailments (Eckel, Alberti et al. 2020). With healthier lifestyle and proper dietary intake scientists thought

that development of type 2 diabetes mellitus can be prohibited and delayed because its incidence is increasing gradually in all age's human. Risk of type 2 diabetes boosted when reactive oxygen species (ROS) present in body injured tissues inside human body, pro-inflammatory and obesity are interrelated aspects that have connected each other also low-grade inflammation are reasons of progressing diabetes (Furukawa, Fujita et al. 2021). Generally oxidative stressed is caused by grilled meat and American affection of fries and with high consumption of oily food and the whole process is called glycation end products (AGEs) while on other hand low ingestion of vegetables and fruits leads to progress T2D (Folchetti, Monfort-Pires et al. 2014, Vlassara and Uribarri 2014).

Bioactivity for type 2 diabetes mellitus:

It has been experimented those dietary antioxidants like folates, vit. B, D and C, polyphenols have potential to cure or protect different factors in T2D as well as oxidative stress etc. In pre-diabetic patients` high intake of dietary fibres fruits and vegetables that are rich in antioxidant properties are used to recover inflammatory indications and oxidative stress when interrelate with antioxidant food. It is observed that through digestion of food that is rich in antioxidants in addition to consumption of low AGEs when person is diagnosed with type 2 diabetes, so expansion of insulin resistance and AGEs serum intake can be rigorous to improve human health (Monfort-Pires, Folchetti et al. 2014). Edible mushrooms have such type of properties which prevent various types of disorders, they improve specific and non-specific immunity against diseases to prevent human`s health. Edible mushrooms are part of food group (Dai, Stanilka et al. 2015). Mushroom are considered as valuable for hyperglycaemic patients that lowers the blood sweetness level in human bodies. They strengthen the production of glycogen which illustrate hypoglycaemic effects reduced the blood sugar. Streptozotocin tempted diabetic rats consumed *A. bisporus* that low blood sugar level. So, *A. bisporus* specie is useful for hyperglycaemic patients (Jeong, Jeong et al. 2010). Liver is only organ that accumulate glycogen and its production is

stimulated through Glucokinase (GK) by intaking mutually islet and hepatic glucose. Hepatic glucose is used with GK and if level of GK becomes low cause high risk to produce diabetes (Pal et al. 2009). Glucokinase show valuable characteristics for depressing sugar level and glucose level after having meal can be stopped by Gk activators (Buruleanu, Radulescu et al. 2018).Diabetes is life threating disease and increasing day by day, it is anticipated that diabetes incidence will be at high rate in coming years. After cardiovascular diseases and cancer, it is most enduring disease that can also cause death. Occurrence of diabetes in 2035 the expected cases of diabetes mellitus will be about 592million (Guariguata, Whiting et al. 2014). Reactive oxygen species (ROS) are stimulated by attack of high sugar level in human body, through this chronic attack insulin production is damaged and body cannot produce enough insulin for breakdown of glucose molecules and irritation inside the mitochondria is caused and all functions are distressed (Marcovecchio, Lucantoni et al. 2011). The outer membrane of red blood cells with its functions and structure damaged due to hyperglycaemia, this condition also reduced the distorting and improve accumulation of cells. Many functions are performed by disturbance in oxidative stress that altered that assembly of heart by destructing the working inside the cells, it also source of countless difficulties in diabetes mellitus like to damage the cells and leads to severe hyperglycaemia (Psallas and Manes 2012). After having meal glucose increased in blood, with use of binary-acting component capable to impair antioxidants and to condense oxidative stress, these constituents can switch hyperglycaemia. Antioxidants present inside of cell make a defence system in diabetic patients to fight for hyperglycaemia. Fruiting bodies contain dietary fibres, polysaccharides and proteins show such properties that low blood glucose level in diabetic persons (Wahab, Abdullah et al. 2014). *Agaricus* specie has different types of mushrooms with positive effects on human health. From all *A. bisporus* and its powder form can beneficial to low triglycerides and cholesterol level (Jeong, Jeong et al. 2019).

There is another mushroom that is used in human diet for nourishment is *P. ostreatus* with antitumor, anti-inflammatory, antidiabetic effects. It also used to breakdown fatty acids. *P. ostreatus* holds beta-glucan and phenolic compounds. The supplementary factors dietary fibres, chitin and Beta-glucan of *A. bisporus* condense phospholipids and blood glucose in hypercholesterolemic mice. *A. bisporus* have antidiabetic and many other properties, also regulate the removal of adiponectin and adipokine that are anti-inflammatory factors (Sánchez, Quiñones et al. 2018). Adiponectin are proteins that lowers the oxidative stress disturbance and also reduce risk of developing of type 2 diabetes (T2D). They are adipocyte-resultant proteins that improve circulating level in rats and human`s model. Risk of chronic diseases like blood pressure and diabetes mellitus is reduced due to low level of adiponectin in serum. high level of AGE serum inside cell and more intake of dietary fibre stimulates oxidative stress. Due to high level of oxidative stress deplete the internal resistance process against diseases (Esfahani, Movahedian et al. 2018). Mushrooms contains various types of valuable characteristics like antioxidants, their presence make them interesting as in human diet. More consumption of mushrooms protects humans from chronic disorders like diabetes (Kozarski, Klaus et al. 2021).

Experiment of antidiabetic properties of mushroom:

Researchers worked on properties of white button mushrooms, they observed that adiponectin level was increased in body when treated with mushrooms for 14-weeks with changings in environments and insulin resistance. So, mushrooms especially *A. bisporus* was considered as excellent diet for type 2 diabetic patients due to valuable health benefits (Hsu, Liao et al. 2019). Oxidative stress was improved when diabetic patient consumed 100g of white button mushroom up to 112 days (4-weeks). Researchers observed momentous changes in serum level. After 0ne month in 16-weeks the person was examined and at the same time a person was also under observation who was not nit consuming mushrooms. So that we can easily identify the difference

between changing in both serum level with or without mushrooms intake. Mushrooms contain bioactive compounds like phenolic compounds, chitin, polysaccharides and beta-glucan and ergothioneine level was given about 3.2mg/100g to diabetic patient. These are biomarkers to improve inflammation in cell that is basic symbol of T2D. Researchers observed that the person who consumed mushrooms show positive result rather than another person. So, mushrooms have antidiabetic characteristics and used in medication of diabetes. Antidiabetic properties of mushrooms stimulated due to presence of proteins containing selenium and phenolic compounds in them. Synthesis of reactive oxygen species (ROS) is influenced by high reactivity of polyphenols as electron or hydrogen contributor who has ability of stabilization of transition metals and radicals (Mishra and Mishra 2017). Reactive oxygen species are congested by flavonoids as well as phenolic composites. Fresh mushrooms and their extracts expressed immunomodulatory, antidiabetic immunomodulatory and antitumor properties. *F. fomentarius* is non-edible mushroom *P. ostreatus* and *A. bisporus* are eatable used to make powder form that show antioxidant effects. *A. bisporus* used in human diet for nourishment because they are rich in folate, antioxidants, vitamins, dietary fibres and many other valuable compounds. Anticancer, antioxidant, antibacterial and anti-inflammatory are found in *F. fomentarius* used in Chinese traditional medicine like oriental therapy (Kim, Jakhar et al. 2015). High glucose level of diabetes is caused due to change in oxidative stress. Its level is reduced by ingesting mushroom, they also important for lowering glucose level in serum after consumption of food (Jayasuriya, Wanigatunge et al. 2015).

Conclusion:

Mushrooms that are also called toadstool belongs to kingdom fungi. They are of great economic importance due to countless properties present in it. They are not only source of nutrition for flora and fauna but also express anti-cancer, anti-allergic, antibiotic, antidiabetic and antioxidants that make them more beneficial for human beings. Mushrooms are used in dietary food as

nutraceuticals because of high contents on nutrients. They are rich in fatty acids and carbohydrates. Mushrooms serves as antioxidants and used in medicinal and cosmetics field. Mushrooms are better source of antibiotics instead of using artificial drugs. Antioxidants like folate, vit. D and B, polyphenols, ergothioneine treat many disorders like cancer, diabetes mellitus, inflammation. *Agaricus bisporus* specie considered as excellent source in treatment of type 2 diabetes. This specie contains bioactive molecules that can fight for contamination caused by different microbes. Significantly antimicrobial characteristics for gram positive and negative bacteria shown by extraction of L. edodes specie, such as lentinan which is utilized in treatment of cancer especially gastric cancer. Mushrooms also work as antihypertensive enzymes and compounds extracted from mushrooms like *A. bisporus, H. marmoreus, P. ostreatus, H. erinaceus* and *G. frondosa* through hot extraction process. Some chronic problems are treated by Basidiomycete's species because of antioxidant properties. Basidiomycetes also involve in treatment of hepatitis, cancer and HIV and many more. *A. blazei* and *H. erinaceus* are used for repairing of intracellular tissues of body. *Schizophyllan* covers polysaccharides best source of treatment of S-180 cancer. At the stage of virus replication mushrooms inhibit their specie to regrow so, ach as antivirals. Human immune system is regulated by proteins, peptides and polysaccharides present in mushrooms. They can also treat infection of microorganism and work like anti-allergens. Mushrooms prevent liver from any damage like hepatoprotectives. Mushrooms possess positive effects on human body and can be preserved with freezing method, they have better taste and used as supplementary food to improve nutritional factors.

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