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Mushroom: Beneficial for Health as well as wealth

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Introduction:

A mushroom or toadstool is the fleshy, spore-bearing fruiting body of a fungus, typically produced above ground, on soil, or on its food source. The standard for the name "mushroom" is the cultivated white button mushroom, *Agaricus bisporus*; hence the word "mushroom" is most often applied to those fungi (Basidiomycota, Agaricomycetes) that have a stem (stipe), a cap (pileus), and gills (lamellae, sing. lamella) on the underside of the cap.

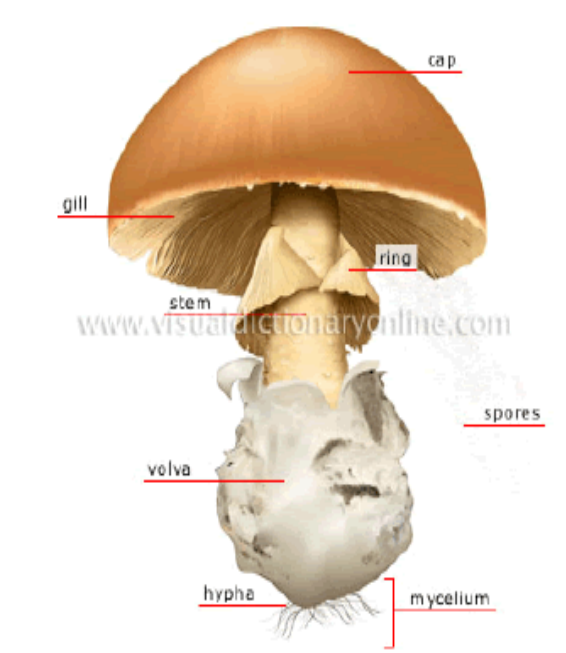

Figure 1: Structure of mushroom.

"Mushroom" also describes a variety of other gilled fungi, with or without stems; therefore the term is used to describe the fleshy fruiting bodies of some Ascomycota. These gills produce microscopic spores that help the fungus spread across the ground or its occupant surface.

1. **Economic Use**: Mushrooms are popular for their delicacy and flavor rather than food. However, it is an established fact that they are excellent sources of vitamins and minerals. In view of their high food value to man and their medicinal properties mushrooms can help in solving the problems of malnutrition and diseases. Besides, the being an important food article, mushroom are variously exploited by man. They are at the same time, also beneficial to forest Writing Materials: Inky cap mushroom *Coprinus comatus* is very deliquescent and soon become black liquid which can be used for writing purposes. Mushroom Used for Flower Pots: Shaped fruit bodies of Polyporus.

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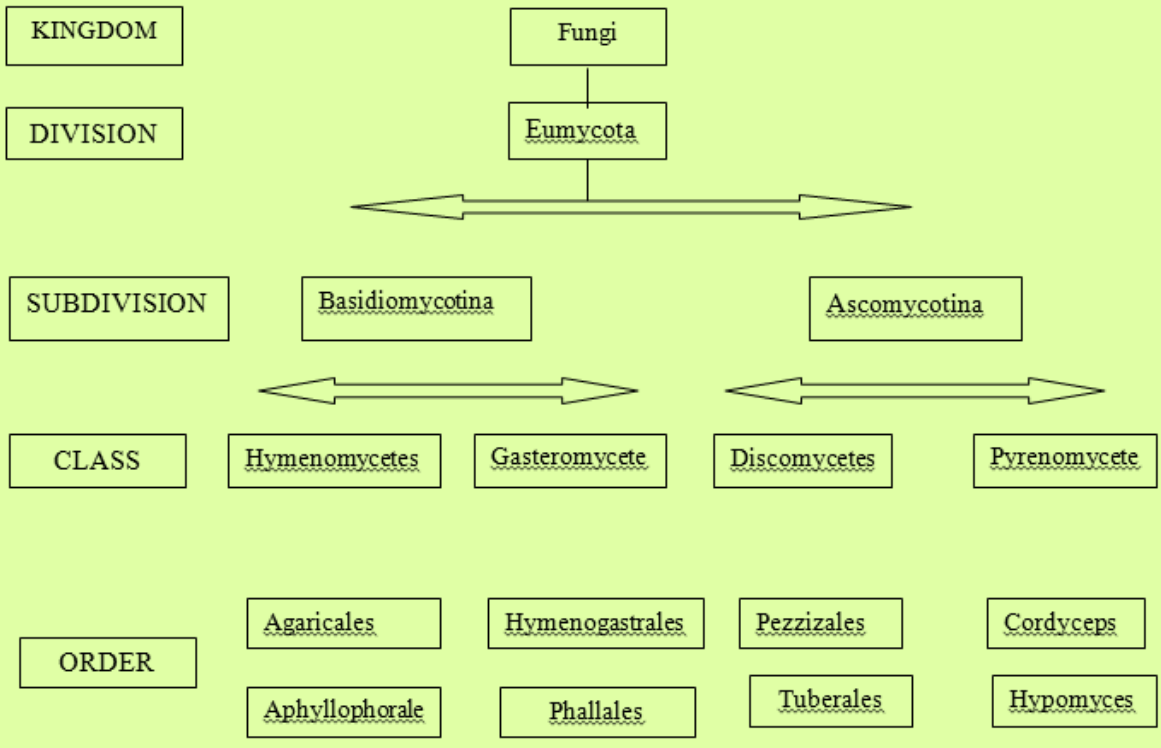
Nutritive values of different mushrooms (dry weight basis g/100g)

Mushroom	Carbohydrate	Fibre	Protein	Fat	Ash	Energy (kcal)
Agaricus bisporous	46.17	20.90	33.48	3.10	5.70	499
Pleurotus sajor-caju	63.40	48.60	19.23	2.70	6.32	412
Lentinula edodes	47.60	28.80	32.93	3.73	5.20	387
Pleurotus ostreatus	57.60	8.70	30.40	2.20	9.80	265
Vovarella volvaceae	54.80	5.50	37.50	2.60	1.10	305
Calocybe indica	64.26	3.40	17.69	4.10	7.43	391
Auricularia auricular	82.80	19.80	4.20	8.30	4.70	351

2. Classification of Mushroom

1. **Taxonomic Position**
2. **Natural habit**
3. **Human Consumption**

1. Taxonomic Position



2. Mushrooms are classified on the basis of natural habitat as precised here:

A. Humicolous or Folicolous(Humus inhabiting)

1. Saprophytic : *Lepista nuda, Volverialla Sp., Marasmium spp*
2. Symbiotic : Bilelus ,Lacterius, Tricholoma, Tuber and Morchella

B. Lignicolous- Wood in habiting

1. Saprophytic *:Agrocybe, Pleurotus, Auricularia spp, Lentinus edodes*

2. Parasitic *: Armillariamellea, Cyttaria*

C. Coprophilus (Dung Inhabiting)-*Agaricus spp*.and *Coprinus spp.*

3. Human Consumption

1. Edible Mushroom

Ediblitiy may be defined by criteria that include absence of poisonous effect on human and desirable taste and aroma. It is reported that there are about 50,000 known species of fungi and about 10,000 are considered as edible ones. Of which, about one hundred and eighty mushrooms can be tried for artificial cultivation and seventy are widely accepted as food. Mushrooms are delicious to eat. It can be added in soups, stews, vegetables and can be topped on your favorite pizza. Generally, all edible mushrooms are:

- Low in sodium, calories and fat
- High in protein and fiber
- Rich in potassium, minerals, copper, selenium, zinc, and magnesium.
- Rich in B-complex vitamins, niacin, riboflavin, and pantothenic acid.
- Rich in cancer-fighting nutrients like polysaccharides and linoleic acid.
- Free of cholesterol etc

The Edible Mushroom are:

1. Paddy straw mushroom - *Volvariella spp.*
2. Oyster mushroom - *Pleurotus spp.*
3. Button mushroom - *Agaricus spp.*
4. Milky mushroom - *Calocybe spp.*
5. Shiitake mushroom - *Lentinulla spp.*
6. Jew's ear mushroom - Auricularia sp.

1 . *Volvariella spp*.

The Paddy straw mushroom Mushrooms are white initially, become dark tan in colour as the veil tease and then changes to a pale tan with age. Fruiting bodies are small when young enveloped by a sheath like universal veil, which soon breaks as fruit bodies mature , leaves an irregular cup-like sack at the base of the stem known as volva.

Cap 5-15 cm broad , egg shaped and expands to campanulate or convex with slight umbo . Gills are free, white first and soon pinkish. Spores are pinkish to pinkish brown in mass ,7.5–9 x 4–6 µ in size. Stem 4-20 cm long, solid, smooth and white to yellowish in colour. Stem base is encased in a thick volva .Basidia are tetrapolar , producing four haploid spores , primary homothallic, clamp connections are present, form cheilocystidia, pleurocystidia and chalamydospores.

2. *Pleuotus spp.* - Oyster Mushroom

The Oyster mushroom The cap of oyster mushroom is tongue shaped , maturing to a shell shaped form , 50-150 mm in diameter , whitish to grey to blue grey in colour . Flesh is thin and white , margin is occasionally wavy. Gills are white, decurrent , broadly spaced, stem attached in an off - centred fashion and is short at first and absent in age . Spores are whitish to lilac grey in mass, mycelium whitish , fast growing rhizomorphic to linear . Basidia tetrapoplar , producing 4 haploid spores, heterothallic, clamp connections present . Because of the allergic nature of spores , some sporeless strains have also been developed.

3. Button Mushroom- *Agaricus bisporus*:

The Button Mushroom Cap: 3-16 cm, convex to broadly convex or nearly flat in age; dry; smooth or with pressed-down or small scales; white in some varieties, brown in others. Gills free from the stem; close; pinkish to pinkish brown at first, becoming dark brown to blackish. Stem 2-8 cm long; 1-3 cm. thick; sturdy; more or less equal; smooth or with small scales below the ring; white, often bruising brownish; with a ring that sometimes disappears in maturity. Flesh ¬white and firm; usually bruising and staining brownish (see top illustration). Odour and taste pleasant. Chemical Reactions -cap not yellow with

KOH. Spore print brown. Microscopic Features -spores 5.5-8.5 x 4-6.5 µ; elliptical; smooth. Basidia 2-spored.

4. Milky Mushroom- *Calocybe indica*:

White milky mushroom The milky mushrooms are also known as Swetha mushrooms. They are the only mushroom species that is both native to and cultivated in, the hot moist climate of India. Milky mushrooms are called 'milky' for their white color. Milky mushrooms are rich in nutrient, have a good shelf life and are the only fungus that can be cultivated in the tropics. Milky mushroom (*Calocybe indica*) can be grown on wide range of substrates as in case of oyster mushroom. It can be grown on substrates containing lignin, cellulose and hemicelluloses. Substrate should be fresh and dry. Substrates exposed to rain or harvested premature (green color) are prone to various weed moulds which may result in failure of the crop. It can be grown on straw of paddy, wheat, ragi, maize/bajra/cotton stalks and leaves, sugarcane bagasse, cotton and jute wastes, dehulled maize cobs, tea/coffee waste etc., However cereal straw (paddy/wheat) easily available in abundance, is being widely used.

5. Shiitake mushroom - *Lentinulla spp*.

Also known as: Shitake, black forest, black winter, brown oak, Chinese black, black mushroom, oriental black, forest mushroom, golden oak, Donko. and medicinal wood-dwelling fungus of the family Marasmiaceae (order Agaricales). Native to East Asia, the shiitake is among the most commonly cultivated fungi in the world. Important in a number of Asian and vegetarian dishes, shiitake mushrooms are high in dietary fibre, B vitamins (especially pantothenic acid), copper, selenium, manganese and iron . The fungus has been used extensively in traditional Asian medicine and has a number of biologically active chemicals, such as the polysaccharide lentinan, that some studies suggest may

prove beneficial against cancer and other diseases. Like other members of the genus Lentinula, shiitake mushrooms feed as saprotoph on the deadwood of broad-leaved trees, especially oaks and various other trees in the order Fagales. Commercially grown fungi are usually cultivated on logs, sawdust blocks, or sawdust pellets. The fruiting bodies of these fungi are generally light-coloured to reddish brown, with a convex pileus (cap) supported by a fibrous stipe (stalk). The pileus can be 8–15 cm (3–6 inches) in diameter and features white gills on the underside. The mushrooms characteristically produce white spores.They has a light woody flavor and aroma, while their dried counterparts are more intense. They are savory and meaty and can be used to top meat dishes and to enhance soups and sauces. Shiitake can be found both fresh and dried. Shiitake mushrooms have the potential to fight tumors, as they have high amount of lentinan, which is a natural antitumor compound. These flavourful, meaty mushrooms contains excellent source of vitamin D and helps in fighting infections.

6.Morel Mushroom Also known as: morchella

Out of all the mushroom types, these distinctive fungi have a honeycomb appearance on their cap. Morels are prized by gourmet cooks, particularly in French cuisine, because they are super savory and delicious. Due to difficulties in cultivation, commercial harvesting of wild morels has become a multimillion-dollar industry in the temperate Northern Hemisphere, in particular in North America, Turkey, China, the Himalayas, India, and Pakistan, where these highly prized fungi are found in abundance. One of the best and simplest ways to enjoy morels is by gently sautéeing them in butter, then season them with salt and pepper. They are a little chewy and taste great. Serve them with meat and poultry, or add them to soups, or in pasta fillings.

2. Poisnous Mushroom

Poisonous mushrooms represent less than 1% of the world's known mushrooms hence constitute the dangerous and sometimes fatal species. For this reason, mushrooms must be identified by a competent mycological authority before consumption. Therefore, one must be absolutely sure whether a given mushroom is edible or otherwise before consumption. The toxins contained in various species are very different in chemical

composition, thus the effects of poisoning differ considerably according to the species involved. In any case, suspected mushroom poisoning should never be regarded lightly and medical assistance should be sought at once.

1.***Amanita*-type poisoning**

The *Amanita phalloides* group causes the most dangerous type of mushroom poisoning. The toxins involved belong to the phallotoxin and amatoxin complexes. The phallotoxin phalloidin binds specifically to actin. The phallotoxins are not active following ingestion, but they are potent when injected intravenously and have proved useful in experimental studies. In such studies phalloidin, binding to actin, is coupled with fluorescent groups. By this means actin can be localized in the cells. It is the amatoxin such as amatine that is involved in amanita poisoning. Amatine is a specific inhibitor of RNA polymerase present in all eukaryotes. This blocking of the enzymes associated with the replication of RNA inhibits the formation of new cells. These toxins tend to accumulate in the liver and damage that organ severely. The RNA polymerase of the fungus is not affected. This group has caused the majority of recorded deaths from mushroom poisoning, especially in Europe. Generally the symptoms of this type of poisoning are said to be severe abdominal pains, nausea, violent vomiting, diarrhea, cold sweats, and excessive thirst. These may last for 48 hours, with dehydration, cramps, and anuria.

2.Muscarine-type poisoning

Two toxins, muscarine and ibotenic acid, are involved. They occur in *Amanita muscaria*, *A. pantherina*, and also in a number of *Inocybe* and *Clitocybe* species. Muscarine is known to be responsible for "pupil contraction, blurred vision, lachrymation, salivation, perspiration, reduced heart rate, lowering of blood pressure, and asthmatic-like breathing." Ibotenic acid is responsible for the insecticidal properties of *A. muscaria*, the fly agaric. Both muscarine and ibotenic acids are intoxicants, and there is a long history of different cultures using these compounds from *A. muscaria*for

this purpose and in religious rites. The symptoms usually appear soon after eating the mush- rooms, with vomiting, diarrhea, and salivation. The most characteristic symptoms are nervous excitement, difficulties in breathing, shivering, and a tendency to collapse.

3.Psychotropic or hallucinogenic poisoning

Several different toxins are involved, including psilocin and psilocybin, which are found in species of *Psilocybe*, *Conocybe*, and *Stropharia*. These compounds are similar in their reaction to d-lysergic acid diethylamide. They act on the central nervous system, producing distortions in vision and of tactile sensations as well as mixed emotional feelings of happiness or depression. Other symptoms are varied, including vomiting, increased rate of heartbeat, and hallucinations, which may last for various lengths of time.

Psilocybe ***Conocybe*** ***Stropharia***

2. *Coprinus* poisoning

Several *Coprinus* species, such as *C. micaceus* and *C. atramentarius*, when consumed with an alcoholic drink, produce unpleasant but not dangerous symptoms. The symptoms include reddening of the face, increased rate of heartbeat, and, in some cases, vomiting and diarrhea. The mode of action of the chemical in *C. atramentarius* mushrooms is similar to Antabuse, which is a drug used to induce nausea and vomiting in individuals who are trying to overcome an addiction to alcohol.

C. micaceus ***C. atramentarius***

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3. Poisoning from external sources

The poisoning is not caused by mushrooms themselves but by toxic substances that have accumulated in the mushrooms. The principal causes are (1) heavy metals due to polluting environmental conditions where the mushrooms are harvested that are far in excess of permissible levels, and (2) radioactive contaminants due to the pollution by contaminating radioactive materials in mushroom hunting areas and subsequent consumption of the collected mushrooms.

Toxicity of Mushroom

Toadstool is a name commonly given to poisonous mushrooms. Mushroom poisoning is caused by the consumption of raw or cooked fruiting bodies (mushrooms, toadstools) of a number of species of higher fungi. This poisoning occurs when individuals who are not experts in mushroom identification prepare any type of mushroom for consumption. Mushrooms are generally not easily recognizable between poisonous and non poisonous species. The toxins involved in mushroom poisoning are metabolites produced naturally by the fungi themselves which differ from one species to the other. Individual specimen of a toxic species is considered equally poisonous though the potency of their poisons varies according to species and location of growth. Unfortunately, toxicity of poisonous mushrooms cannot be made nontoxic by any form of processing hence the consumption of the toxic species must be avoided. Mushroom poisonings are generally severe after the incubation period and manifested by a variety of symptoms and prognoses, depending on the amount and species consumed. There is paucity of information on the chemistry of many of the wild mushroom toxins and this makes positive identification of the mushrooms based on physiological effects often difficult.

- Four categories of mushroom toxins which are recognized are

(1) protoplasmic poisons which are poison that result in generalized destruction of cells, followed by organ failure.

(2) Neurotoxins which are compounds that cause neurological symptoms such as profuse sweating, coma, convulsions, hallucinations, excitement, depression, spastic colon.

(3) Gastrointestinal irritants - compounds that produce rapid, transient nausea, vomiting, abdominal cramping and diarrhea.

(4) Disulfiram-like toxins - Mushrooms in this last category are generally non toxic and

produce no symptoms unless alcohol is consumed within 72 hours after eating them, in which case a short lived acute toxic syndrome is produced.

- Seven of the world's most poisonous mushrooms are:
  1. Death cap (*Amanita phalloides*),
  2. Conocy bettilaris,
  3. web caps (*Cortinarius* species),
  4. Autumn skullcap (*Calerina marginata*),
  5. destroyin angels (*Amanita* species),
  6. Podostron a cornu-damae and
  7. deadly dapperliry (*Lepiota brunneoincarnata*).

Differences between Poisonous mushrooms and edible mushrooms

Poisonous mushrooms	Edible mushrooms
When you cut the mushroom it turns either green or purple	When you cut the mushroom it does not stain green or purple.
When you taste a piece of the mushroom, it burns or stings the tongue	When you taste a piece of the mushroom, it does not burn or sting the tongue.
Poisonous mushrooms have bad odour.	Edible mushrooms have pleasant odour.
It tastes bitter.	It has sweet taste.
There is no presence of worms.	There is presence of worms.
There is presence of scales on the cap	There is no scale on the cap.