FUNGI USED AS FOOD

History of mushroom use

Mycophagy, the act of consuming mushrooms, dates back to ancient times. Edible mushroom species have been found in association with 13,000-year-old archaeological sites in Chile. The Chinese value mushrooms for supposed medicinal properties as well as for food. Ancient Romans and Greeks, particularly the upper classes, used mushrooms for culinary purposes. Food tasters were employed by Roman emperors to ensure that mushrooms were safe to eat.

Mushroom cultivation has a long history, with over twenty species commercially cultivated. Mushrooms are cultivated in at least 60 countries.
A fraction of the many fungi consumed by humans are currently cultivated and sold commercially.

Agaricus bisporus dominates the edible mushroom market in North America and Europe, in several forms. It is an edible basidiomycete mushroom native to grasslands in Europe and North America. As it ages, this mushroom turns from small, white and smooth to large and light brown. In its youngest form, it is known as the 'common mushroom', 'button mushroom', 'cultivated mushroom', and 'champignon mushroom'. Its fully mature form is known as 'portobello'. Its semi-mature form is known variously as 'cremini', 'baby-bella', 'Swiss brown' mushroom, 'Roman brown' mushroom, 'Italian brown' mushroom, or 'chestnut' mushroom.

Pleurotus ostreatus & *Pleurotus sajar-caju*, the "Oyster mushrooms", are among the most common in the Asian market.
Lentinula edodes, the Shiitake mushroom, also common in the Asian market.

Auricularia auricula-judae, the Jew's ear, wood ear or jelly ear mushroom

Tremella fuciformis, the snow fungus, snow ear, silver ear fungus and white jelly mushroom

Volvariella volvacea, the paddy straw mushroom or straw mushroom
Common in West Bengal

Hypsizygus tessellatus, aka Hypsizygus marmoreus, the beech mushroom, also known in its white and brown varieties as Bunapi-shimeji and Buna-shimeji, respectively

Flammulina velutipes, the enoki mushroom, golden needle mushroom, seafood mushroom, lily mushroom, winter mushroom, velvet foot, velvet shank or velvet stem.

Stropharia rugosoannulata, the wine cap mushroom, burgundy mushroom, garden giant mushroom or king stropharia
Hericium erinaceus, the lion's mane, monkey head, bearded tooth, satyr's beard, bearded hedgehog, or pom pom mushroom.

Cyclocybe aegerita, the pioppino, velvet pioppini, poplar or black poplar mushroom

Some species are difficult to cultivate; others (particularly mycorrhizal species) have not yet been successfully cultivated. Some of these species are harvested from the wild, and can be found in markets. When in season they can be purchased fresh, and many species are sold dried as well. The following species are commonly harvested from the wild:

Boletus edulis or edible Boletus, native to Europe, known in Italian as *fungo porcino* (plural 'porcini') (pig mushroom), in German as *Steinpilz* (stone mushroom), in Russian as Russian *Bely grib* (white mushroom), in Albanian as (wolf mushroom), in French as the *cèpe* and in the UK as the penny bun. It also known as the king bolete, and is renowned for its delicious flavor. It is sought after worldwide, and can be found in a variety of culinary dishes.
Cantharellus cibarius (the chanterelle), The yellow chanterelle is one of the best and most easily recognizable mushrooms, and can be found in Asia, Europe, North America and Australia. There are poisonous mushrooms which resemble it, though these can be confidently distinguished if one is familiar with the chanterelle's identifying features.

Cantharellus tubaeformis, the tube chanterelle or yellow-leg.
Clitocybe nuda, blewit (or blewitt)
Cortinarius caperatus, the Gypsy mushroom (recently moved from genus *Rozites*)
Craterellus cornucopioides, Trompette de la mort (trumpet of death) or horn of plenty
Grifola frondosa, known in Japan as *maitake* (also "hen of the woods" or "sheep's head"), a large, hearty mushroom commonly found on or near stumps and bases of oak trees, and believed to have *Macrolepiota procera* properties.
Gyromitra esculenta, this "false morel" is prized by the Finns. This mushroom is deadly poisonous if eaten raw, but highly regarded when parboiled
Hericium erinaceus, a tooth fungus; also called "lion's mane mushroom"
Hydnum repandum, sweet tooth fungus, hedgehog mushroom or hedgehog fungus, urchin of the woods
Lactarius deliciosus, saffron milk cap, consumed around the world and prized in Russia
Morchella species, (morel family) morels belong to the ascomycete grouping of fungi. They are usually found in open scrub, woodland or open ground in late spring. When collecting this fungus, care must be taken to distinguish it from the poisonous false morels, including *Gyromitra esculenta*. The morel must be cooked before eating.
Morchella conica var. deliciosa
Morchella esculenta var. rotunda
Pleurotus ostreatus, oyster mushroom
Tricholoma matsutake, the *matsutake*, a mushroom highly prized in Japanese cuisine.
Tuber, species, (the truffle), Truffles have long eluded the modern techniques of domestication known as *trufficulture*. Although the field of trufficulture has greatly expanded since its inception in 1808, several species still remain uncultivated. Domesticated truffles include
Tuber aestivum, black summer truffle
Tuber borchii
Tuber brumale
Tuber indicum, Chinese black truffle
Tuber macrosporum, smooth black truffle
Tuber mesentericum, the Bagnoli truffle

A partial list of common **foods** made with **fungi** includes: cheese, bread, chocolate, coffee, tea, pickles, olives, salami, soy sauce, tempeh, miso and others. (Alcoholic drinks are produced with the aid of **fungal** yeasts. Some – such as sake – use filamentous **fungi** to convert starches to sugars prior to adding yeast.)
Pioneers in Exotic Mushroom Cultivation Since 1977

Edible mushrooms are the fleshy and edible fruit bodies of several species of macrofungi (fungi which bear fruiting structures that are large enough to be seen with the naked eye). They can appear either below ground (hypogeous) or above ground (epigeous) where they may be picked by hand. Edibility may be defined by criteria that include absence of poisonous effects on humans and desirable taste and aroma.

Edible mushrooms are consumed for their nutritional value and for their culinary value. Mushrooms, especially dried shiitake, are sources of umami flavor from guanylate. Mushrooms consumed by those practicing folk medicine are known as medicinal mushrooms. While psychedelic mushrooms are occasionally consumed for recreational or entheogenic purposes, they can produce psychological effects, and are therefore not commonly used as food. There is no evidence from high-quality clinical research that 'medicinal' mushrooms have any effect on human diseases.

Edible mushrooms include many fungal species that are either harvested wild or cultivated. Easily cultivated and common wild mushrooms are often available in markets, and those that are more difficult to obtain (such as the

prized truffle, matsutake and morel) may be collected on a smaller scale by private gatherers. Some preparations may render certain poisonous mushrooms fit for consumption.

Before assuming that any wild mushroom is edible, it should be identified. Accurate determination and proper identification of a species is the only safe way to ensure edibility, and the only safeguard against possible accident. Some mushrooms that are edible for most people can cause allergic reactions in some individuals, and old or improperly stored specimens can cause food poisoning. Great care should therefore be taken when eating any fungus for the first time, and only small quantities should be consumed in case of individual allergies. Deadly poisonous mushrooms that are frequently confused with edible mushrooms and responsible for many fatal poisonings include several species of the genus *Amanita*, in particular, *Amanita phalloides*, the *death cap*. It is therefore better to eat only a few, easily recognizable species, than to experiment indiscriminately. Moreover, even normally edible species of mushrooms may be dangerous, as mushrooms growing in polluted locations can accumulate pollutants such as heavy metals.

Other edible wild species

Many wild species are consumed around the world. The species which can be identified "in the field" (without use of special chemistry or a microscope) and therefore safely eaten vary widely from country to country, even from region to region. This list is a sampling of lesser-known species that are reported as edible.

Agaricus arvensis (Horse Mushroom)
Agaricus silvaticus (Pinewood Mushroom)
Amanita caesarea (Caesar's Mushroom)
Armillaria mellea
Boletus badius (Bay Bolete)
Calocybe gambosa (St George's mushroom)
Calvatia gigantea (Giant Puffball)
Calvatia utriformis (Lycoperdon caelatum)
Chroogomphus rutilus (pine-spikes or spike-caps)
Clavariaceae species (coral fungus family)
Clavulinaceae species (coral fungus family)
Coprinus comatus, the Shaggy mane, Shaggy Inkcap or Lawyer's Wig. Must be cooked as soon as possible after harvesting or the caps will first turn dark and unappetizing, then deliquesce and turn to ink. Not found in markets for this reason.
Corn smut
Cortinarius variicolor
Cyttaria espinosae
Fistulina hepatica (beefsteak polypore or the ox tongue)
Flammulina velutipes (Velvet Shank or Winter Fungus)
Hygrophorus chrysodon
Kalaharituber pfeilii
Lactarius deterrimus (Orange Milkcap)
Lactarius salmonicolor
Lactarius subdulcis (mild milkcap)
Lactarius volemus
Laetiporus sulphureus (Sulphur shelf). Also known by names such as the "chicken mushroom", "chicken fungus", the sulphur shelf is a distinct bracket fungus popular among mushroom hunters.
Leccinum aurantiacum (Red-capped scaber stalk)
Leccinum scabrum (Birch bolete)
Leccinum versipelle (Orange Birch Bolete / Boletus testaceoscaber)
Macrolepiota procera (Parasol Mushroom); globally, it is widespread in temperate regions
Marasmius oreades (Fairy Ring Champignon)
Polyporus mylittae
Polyporus squamosus (Dryad's saddle and Pheasant's back mushroom)
Ramariaceae species (coral fungus family)
Rhizopogon luteolus
Russula, some members of this genus, such as *R. laeta*, are edible
Sparassis crispa, also known as "cauliflower mushroom"
Suillus bovinus
Suillus granulatus
Suillus luteus
Suillus tomentosus

Tricholoma terreum
Amanita fulva (Tawny Grisette) must be cooked before eating.
Amanita muscaria is edible if parboiled to leach out toxins,[14] fresh mushrooms cause vomiting, twitching, drowsiness, and hallucinations due to the presence of muscimol. Although present in *A. muscaria*, ibotenic acid is not in high enough concentration to produce any physical or psychological effects unless massive amounts are ingested.
Amanita rubescens (The Blusher) must be cooked before eating.
Coprinopsis atramentaria is edible without special preparation, however, consumption with alcohol is toxic due to the presence of coprine. Some other *Coprinus* spp. share this property.
Gyromitra esculenta is eaten by some after it has been parboiled, however, mycologists do not recommend it. Raw *Gyromitra* are toxic due to the presence of gyromitrin, and it is not known whether all of the toxin can be removed by parboiling.
Lactarius spp. Apart from *Lactarius deliciosus*, which is universally considered edible, other *Lactarius spp.* that are considered toxic elsewhere in the world are eaten in some Eastern European countries and Russia after pickling or parboiling.[15]
Lepista nuda (Wood Blewit) must be cooked before eating
Lepista saeva (Field Blewit, Blue Leg, or Tricholoma personatum) must be cooked before eating.
Morchella esculenta (Morel) must be cooked before eating.
Verpa bohemica is considered choice by some—it even can be found for sale as a "morel"—but cases of toxicity have been reported. Verpas contain toxins similar to gyromitrin and similar precautions apply.

Nutrients

White mushrooms, raw	
Nutritional value per 100 g (3.5 oz)	
Energy	93 kJ (22 kcal)
Carbohydrates	3.3 g
Fat	0.3 g
Protein	3.1 g
Vitamins	Quantity%DV†
Vitamin A equiv.	0% 0 µg
Thiamine (B1)	7% 0.08 mg
Riboflavin (B2)	33% 0.4 mg
Niacin (B3)	24% 3.6 mg
Pantothenic acid (B5)	30% 1.5 mg
Vitamin B6	8% 0.1 mg
Folate (B9)	4% 17 µg
Vitamin B12	0% 0 µg
Choline	4% 17.3 mg
Vitamin D	1% 7 IU
Vitamin E	0% 0 mg
Vitamin K	0% 0 µg
Minerals	Quantity%DV†
Calcium	0% 3 mg
Copper	16% 0.32 mg
Iron	4% 0.5 mg
Magnesium	3% 9 mg
Manganese	2% 0.05 mg

Phosphorus	12% 86 mg
Potassium	7% 318 mg
Selenium	13% 9.3 µg
Zinc	5% 0.52 mg
Other constituents	Quantity
Water	92 g

White mushrooms, cooked, boiled, drained, without salt	
Nutritional value per 100 g (3.5 oz)	
Energy	117 kJ (28 kcal)
Carbohydrates	5.3 g
Fat	0.5 g
Protein	2.2 g
Vitamins	Quantity%DV†
Vitamin A equiv.	0% 0 µg
Thiamine (B1)	9% 0.1 mg
Riboflavin (B2)	25% 0.3 mg
Niacin (B3)	30% 4.5 mg
Pantothenic acid (B5)	44% 2.2 mg
Vitamin B6	8% 0.1 mg
Folate (B9)	5% 18 µg
Vitamin B12	0% 0 µg
Choline	4% 19.9 mg
Vitamin D	4% 21 IU
Vitamin E	0% 0 mg
Vitamin K	0% 0 µg
Minerals	Quantity%DV†
Calcium	1% 6 mg
Copper	25% 0.5 mg
Iron	13% 1.7 mg
Magnesium	3% 12 mg
Manganese	5% 0.1 mg
Phosphorus	12% 87 mg
Potassium	8% 356 mg
Selenium	19% 13.4 µg
Zinc	9% 0.9 mg
Other constituents	Quantity
Water	91.1 g

Units μg = **micrograms** • mg = **milligrams** IU = **International units**

List of Fungus used in food and beverage preparation

Fungus	Food or Beverage
Aspergillus acidus	tea
Aspergillus niger	awamori- alcoholic Beverage
Aspergillus fumigatus	chocolate
Aspergillus oryzae	miso
Aspergillus oryzae	sake
Aspergillus oryzae	soy sauce
Aspergillus sojae	miso
Aspergillus sojae	soy sauce
Candida colliculosa	cheese
Candida colliculosa	kefir
Candida exiguus	sourdough bread
Candida humicola	chocolate
Candida kefyr	surface-ripened cheese
Candida krusei	surface-ripened cheese
Candida milleri	sourdough bread
Candida mycoderma[10]	Limburger cheese
Candida pelliculosa	chocolate
Candida rugosa	chocolate
Candida tropicalis	chocolate
Candida utilis	cheese
Candida valida[10]	sourdough
Candida vini[10]	Reblochon cheese, wine
Candida zeylanoides	Reblochon cheese
Cyberlindnera mrakii	wine
Cystofilobasidium infirmominiatum	cheese
Debaryomyces hansenii	smear-ripened cheese
Debaryomyces hansenii	Reblochon cheese
Debaryomyces kloeckeri	Limburger cheese
Fusarium domesticum	cheese
Geotrichum candidum	cheese
Issatchenkia orientalis	kefir
Kazachstania exigua	kefir
Kazachstania unispora	kefir
Kloeckera africana	chocolate
Kloeckera apis	chocolate
Kloeckera javanica	chocolate
Kluyveromyces lactis	cheese

Fungus	Food or Beverage
Kluyveromyces marxianus	cheese
Kluyveromyces marxianus	chocolate
Mucor hiemalis	soy bean curd
Mucor plumbeus	cheese
Mucor racemosus	cheese
Mucor racemosus	chocolate
Neurospora intermedia	oncom
Penicillium album	farmhouse cheeses
Penicillium camemberti	cheese
Penicillium caseifulvum	cheese
Penicillium chrysogenum	cheese
Penicillium chrysogenum	sausage
Penicillium commune	surface-ripened cheese
Penicillium nalgiovense	cheese
Penicillium nalgiovense	ham
Penicillium nalgiovense	sausage
Penicillium roqueforti	cheese
Penicillium solitum	meat
Pichia fermentans	dairy
Pichia fermentans	kefir
Pichia fermentans	wine
Rhizopus microsporus ssp. *oligosporus*	oncom
Rhizopus microsporus ssp. *oligosporus*	tempeh
Rhodosporidium infirmominiatum	cheese
Rhodotorula glutinis	chocolate
Rhodotorula minuta	smear-ripened cheese
Rhodotorula rubra	chocolate
Saccharomyces bayanus	beer
Saccharomyces bayanus	cider
Saccharomyces bayanus	wine
Saccharomyces carlsbergensis	lager beer
Saccharomyces cerevisiae	ale beer
Saccharomyces cerevisiae	bread
Saccharomyces cerevisiae	cider
Saccharomyces cerevisiae	cheese
Saccharomyces cerevisiae	chocolate
Saccharomyces cerevisiae	wine
Saccharomyces pastorianus	lager beer
Saccharomyces rouzii	miso
Saccharomyces uvarum	lager beer

Fungus	Food or Beverage
Torulaspora delbrueckii	smear-ripened cheese
Torulopsis versatilis	miso
Thrichosporon beigelii	smear-ripened cheese
Verticillium lecanii	Tomme cheese
Yarrowia lipolytica	Raclette cheese
Yarrowia lipolytica	smear-ripened cheese
Yarrowia lipolytica	dairy
Zygotorulaspora florentina	kefir