Script

Subject: Food technology

2. Paper - 00:

3. Paper Code:

4. Topic- Edible mushrooms

PART - 1: MAIN SCRIPT

Edible mushroom and preservation

Dear Students, in to-day's lecture, we will discuss about "Edible mushroom and Preservation.

Introduction:

A mushroom is the soft, spore-bearing fruiting body of a fungus, produced above the ground level or some other food source. Knowledge of "what is edible" and correct identification of mushrooms is very essential and also large extent based on knowledge gathered during centuries from elders. Edible mushrooms are consumed by humans for their nutritional value and they are occasionally consumed for their medicinal value. Mushrooms consumed by those who practicing folk medicine are known as medicinal mushrooms. It is also considered as a complete food and suitable for all age groups. As a food of delicacy of characteristic biting texture and flavor. Fresh mushrooms purchased from a store or harvested from the wild can be used for many months later if stored properly. There are many different kinds of mushrooms and there are different ways to preserve them.

This episode deals with:

- 1. Mushroom and world production
- 2. Classification: A.bisporus and pleurotus flabelatus
- 3. Nutritional value and health benefits.
- 4. Cultivation of mushrooms
- 5. Preservation

1: Mushroom and world production of mushrooms.

It is one of the most suitable fungal organisms for producing protein rich food from various agro-wastes or forest wastes without composting. The global mushroom production as per FAO Statistics was estimated at about 2.18 to 3.42 million tons over period of last ten years (1997-2007). Since there was an increase of 56% of world production in last decades and China is the largest producer and consumer of mushrooms in the world.

World production of mushroom is growing and now exceeds three million tonnes worth a market value of 10 billion US \$. Globally, mushrooms are traded mostly in processed form however; lately fresh mushrooms are being preferred over preserved ones in European Union and American countries. Major exporting countries of fresh mushrooms are Netherlands, Poland, Ireland and Belgium. China is the largest exporter of preserved mushrooms with a market share of 42%. Netherlands (25.11%) and Spain (7.37%) are the other major countries.

Mushroom production in India has been estimated at 48000 tonnes per annum. Punjab alone produces 20-25 % of total produce followed by Himachal Pradesh and Haryana.



2: Classification: A.bisporus and pleurotus flabelatus

Kingdom-----Fungi Phylum --<u>Basidiomycota</u> Family:---- Agaricaceae Genus:--- <u>Agaricus</u> Species:--- A. bisporus

Agaricus bisporus is cultivated in more than seventy countries, and it is one of the most commonly grown and widely consumed mushrooms in the world. It is a temperate verity that grows on performed substrate called compost.



Agaricus bisporus



Pleurotus species

Oyster mushroom (*Pleurotus* sp.) belonging to Class Basidiomycetes and Family Agaricaceae. Grows naturally in the temperate and tropical forests on dead and decaying wooden logs, It may also grow on decaying organic matter. *Pleurotus flabelatus* is white attractive mushroom that grows during rainy season in the southern part of the country.

Oysters are one of the most versatile mushrooms. They are easy to cultivate and common all over the world. They are also very beautiful, coming in a broad spectrum of colors.

The name *oyster mushroom* is also applied to other <u>*Pleurotus*</u> species, *P. ostreatus* is sometimes called as the *Tree Oyster Mushroom* or the *Grey Oyster Mushroom*. Other names may exist:

- Oyster Shelf
- Tree Oyster
- Straw Mushroom¹
- "Flat Mushroom" in Japanese



Mushroom is easily recognized by the way it grows on wood like clusters; its relatively large in size. The oyster mushroom is one of the few known carnivorous mushrooms. Its mycelia can kill and digest nematodes and it is believed that mushroom obtains nitrogen by this way. The oyster mushroom is frequently used in Japanes, Korean and Chines cookery as a delicacy.

<u>3:Health benefits of Mushrooms:</u>

It contains 3 % protein and all the other essential nutrients and minerals. The folic acid present in oyster mushrooms helps to cure anemia. It is suitable for people with hypertension, obesity and diabetes due to its low sodium and potassium ratio, starch, fat and calorific value. High fiber content makes them suitable for consumption for those having hyperacidity and constipation.

Cancer: Mushrooms contain high antioxidant as capacity as carrots, tomatoes etc and , Selenium is a mineral found in mushrooms. It plays vital role in liver enzyme function and helps detoxify some cancer-causing compounds in the body. Additionally, selenium prevents inflammation and also control tumour growth rate. The vitamin D in mushrooms has also been shown to inhibit the growth of cancer cells from mutations in DNA. **Heart health:** The fiber, potassium and vitamin C content in mushrooms all contribute to cardiovascular health. Potassium and sodium work together in the body to help regulate blood pressure.

Immunity: Selenium has also been found to improve immune response to infection by stimulating production of killer T-cells. The beta-glucan fibers found in the cell walls of mushrooms stimulate the immune system to fight cancer cells.

Weight management: Dietary fiber plays an important role in weight management by functioning as a "bulking agent" in the digestive system. Mushrooms contain two types of dietary fibers in their cell walls: beta-glucans and chitin which reduce appetite, thereby lowering over all calorie intakes.

Nutrients in Button Mushrooms

Amount per 100 g		
1	Polyunsaturated fat	0.2 g
2	Protein	3.1 g
3	Vitamin C	3 %
4	Iron	2 %
5	Vitamin B-6	5 %
6	Magnesium	2 %
7	Sodium-	5 mg
8	Potassium	318 mg
9	Vitamin D	1 %
10	Vitamin C	3 %
11	Iron	2%
12	Magnesium	2%
13	Dietary fiber	1 g
14	Total carbohydrate	3.3 g

Table-1: Nutrition Facts per 100g of Mushroom.

Table-2:Nutrients in Mushrooms

Per 100 g dry weight		
Niacin	Panthothenic Acid	
Riboflavin	Zinc	
Folate	Potassium	

Phosphorus	Copper
Iron	Magnesium
Vitamin B6	Thiamin
Selenium	

All mushrooms are an excellent source of the antioxidant Selenium which works with vitamin E to protect cells from damaging free radicals. Most people think bananas are the high potassium food, but it may surprise, that mushrooms contain more potassium than bananas, potassium helps the body process. So people with hypertension and high risk of stroke can consume mushrooms regularly in their diet.

Beta-glucans, found in numerous mushroom species, contribute to resistance against allergies. The beta-glucans contained in oyster and other gill mushrooms are considered to be the most effective.

4: Cultivation of Mushrooms.

At present three varieties of mushrooms are being cultivated in India. They are white button mushroom (*Agaricus bisporus*), the paddy straw mushroom and the oyster mushroom (*Pleurotus sajor caju*) and *pleurotus flabelatus*, of these *A.bisporus* is the most widely and economically cultivated variety throughout the world. Mushroom cultivation can be done by using agriculture waste from forest and industries. Those are easily available in the villages.

Agaricus species were grown on a fermented substrate called "compost." Composting is defined as incomplete microbial degradation of organic waste. During this process nitrogenous matter like horse gram powder, urea and malt sprouts were added to moist straws.

Pleurotus species are mainly the wood rotting fungi, this can be grown on straw dust ,rice straw, chopped banana waste and newspaper. Fruit bodies in general contain crude fiber and highly perishable at room temperature as compared to *Agaricus* species.

Flow chart

Chopped Paddy straw, (2.5 Kg) fill up in gunny bag soaking in water (for 8-12 hrs) Ţ Drain off excess water 1 Hot water treatment (for 30-60 min) drain off excess water ↓ Moisture up to 70-75 %, Prepared bed layering of spawn 0f 100g Ţ Add 30 g of horse gram powder, mix well in a sterile condition Fill this mixture in to the150 G polyethylene bags with pin holes or perforated trays Mouth of the bags were tied with a piece of thread Hanging of bed watering Pinhead stage, fruiting bodies stated emerging from the polyethylene perforation Ţ Cut open the plastic bags and exposed the straw substrate Ţ Exposed gags were watered heavily and yield noted on third day ↓ Harvest the mature fresh mushrooms containing 89-90% water Ţ Store them in a polyethylene pouch with perforation and at low temperature.

(Spahr, D.L. (2009). Edible and Medicinal Mushrooms of New England and Eastern Canada. North Atlantic Books. <u>ISBN 978-1-55643-795-3</u>)

Grain spawn: Grains are sterilized and inoculated with spores or a sterile mycelium culture. Incubate at room temperature, entire grain covered with full mycelium.

Preparation of grain spawn

- 1. Select healthy and clean cereal grains
- 2. Boil grains in water for 15-20 mints

- 3. Remove excess water
- 4. Dry grains in a shade for 2-3 hours, add mother spawn
- 5. Mix CaCO₃ (0.5%) and CaSO₄ (2%) on dry wt. basis
- 6. Fill the prepared grains in milk bottles plug with cotton under aseptic conditions
- 7. Incubate at room temperature



spawn



Oyster mushrooms in polyethylene bags

Table-3:Top 10 countries producing mushrooms.

Countries producing mushrooms.		
1	China	
2	United States	
3	Nether lands	
4	Poland	
5	Italy	
6	Spain	
7	France	
8	Iran	

9	Canada
10	UK

Sources: FAOSTAT data 2007- Last Updated, November 22, 2014

List Of Cultivated Edible Mushrooms

- 1. Beach mushroom- Native to East Asia.
- 2. Button mushroom. Native to Europe and North America.
- 3. Cauliflower mushroom- Native of Europe and North America.
- 4. Ear fungus- they are so called "jelly mushrooms". Native of East Asia.
- 5. **Oyster mushroom-** This mushroom found throughout the world and largely cultivated.
- 6. Paddy straw mushroom- It is very common in China and native of East Asia.
- 7. Snow fungus –It is another "jelly mushroom".
- 8. Forest mushroom- One of the more common mushrooms.
- Tuber mushroom- The several hundred species are found all over the world. Cultivation has been in practice since the 19th century, they grow on certain tree roots.
- 10. Winter mushroom-It has been cultivated in Japan for over 300 years.

<u>5: Preservation of Mushrooms:</u>

There are a number of ways to preserve mushrooms which includes drying, freezing, pickling, salting, powdering, and a few more methods are also used. These are the main methods listed are,

- Freezing Raw Mushrooms
- Pickling
- Japanese soy-sauce pickled mushrooms
- Pickled marinated mushrooms
- Packed in Oil
- Salting
- Drying
- Canning

Freezing Raw Mushrooms

Clean the mushrooms, cut them into slices. Spread the mushroom pieces in a single layer on a large plate. Freeze for 2 hours. Transfer the frozen mushrooms to freezer containers. Because they were frozen in a single layer first, the pieces will stay loose and individual in the containers.

Pickling - Mushrooms can be pickled using a standard pickling brine and pickling techniques. It is just like pickle cucumber, same method can be adapted to pickle mushrooms.

Packed in Oil - oil is using for preserving the mushrooms. First, combine one cup of wine vinegar with 2/3 cup of water and put it in a low flame. Add in a few spices like salt, bay leaf, and so forth and then cook for about 15 - 20 minutes. Add in the mushrooms (cleaned and sliced) and simmer for another 10 minutes. Drain the mushrooms well and allow them to dry. Place the mushrooms in a sterilized canning jar and cover with oil. Seal the jar and place in a dark, cool, condition.

Salting - Preserving mushrooms in this way goes back to centuries. Clean the mushrooms thoroughly and slicing them ,using a covered glass jar, pour in a layer of sea salt, add a layer of mushrooms, pour salt over the mushrooms until covered and then add another layer of mushrooms. Continue this process until the jar is full, then cover and store in a cool place. (use a ratio of 3 parts salt and 1 part mushrooms for this process).

Drying: Fresh edible mushrooms have a short shelf life during which they can be consumed. Due to their perishable nature, they quickly deteriorate, so people like to consume mushrooms in fresh form and only a few are preserved after sun-drying, smoke drying or salting.



Removing the moisture will avoid spoilage. Once dried the mushrooms can be placed in airtight containers and store them in a dark place to avoid spoilage and it can be stored in the low temperature for longer period.

Japanese soy-sauce pickled mushrooms: The soy sauce pickle, is nothing but the mushrooms are pickled in soy sauce. Sliced mushrooms are boiled in soy, sugar, vinegar and ginger to add a bit of freshness.

Pickled marinated mushrooms: Use small button mushrooms and bring to a boil in a large saucepan.

- 6 tablespoons bottled lemon juice, 2 parts water (or to cover completely), and then simmer 5 minutes.
- Drain and discard cooking water from mushrooms.
- Add 1¹/₂ cups olive oil, 2 cups white vinegar, 6 tablespoons finely chopped onions, 3 tablespoons red bell peppers, and 2 teaspoons each, basil, and pickling salt. Bring to a boil, turn off heat, and cool to room temperature.
- Add several black peppercorns and garlic cloves to a sterilized jar; fill with mushrooms, cool, cover, and refrigerate up to 1 month.

Canned cultivated button mushrooms: Use standard methods



Source:Internet.

Select brightly colored small to medium sized domestic button mushrooms. Use any standard method for canning.

- Soak in cold water for 10 minutes to remove dirt. Wash in clean water.
- Cook for 5 minutes.
- Cover with water in a saucepan and boil 5 minutes. Fill the jars
- Fill the jars with hot mushrooms, leaving 1-inch headspace.
- Add salt and Vitamin C
- Add 1/2 teaspoon of salt per pint to the jar. For better color, add 1/8 teaspoon of ascorbic acid powder, or a 500-milligram tablet of vitamin C.
- Top with hot water to 1 inch of headspace
- Add fresh hot water, if needed, being sure to leave 1-inch of headspace.
- Seal the jars and process in the pressure canner

Market Opportunities

- Direct Marketing
- Fine restaurants (Continental, French or Asian Cuisine)
- Organic or health food stores
- National chains (internet or mail orders, especially for dried mushroom)
- Grower to wholesaler markets directly under controlled environmental conditions (consistent year round supply)
- Processed mushrooms
- Dried mushroom
- Dried soups
- Sauces
- Dip mixes and teas

Advantages

- Very less money is involved
- Use of many agriculture waste material as substrate
- It is biodegradable hence it is environmental friendly
- Cultivated thought the year, it is not seasonal

• Increasing tendency for demand of mushroom,

Conclusion;

Traditionally, fleshy fungi were being collected for home consumption and also commercialized at the local market. During the monsoon season wild edible fleshy fungi are usually available in the village shops or town markets for sale.Most of the edible species are sold in fresh form as well as dried form.

The economic importance of the mushroom lies primarily in its use as food for human consumption. It is rich in Vitamin C and B complex , including riboflavin, niacin, and pantothenic acid, which help to provide energy by breaking down proteins, fats and carbohydrates. B vitamins also play an important role in the nervous system and the protein content up to 3.5-4 percent. It has most of the mineral salts required by the human body. The niacin content is about ten times higher than any other vegetables.

Mushrooms are rich in protein, dietary fiber, vitamins and minerals. The digestible carbohydrate profile of mushroom includes starches, pentoses, hexoses, di-saccharides, amino sugars, sugar alcohols and sugar acids. The total carbohydrate content in mushroom varied from 26-82% on dry weight basis in different mushrooms. The crude fibre composition of the mushroom consists of partially digestible polysaccharides and chitin.

Riboflavin helps maintain healthy red blood cells. Niacin promotes healthy skin and makes sure the digestive and nervous systems function properly. *Pleurotus* species have high medicinal value. Compounds extracted from these mushrooms exhibit activity against various chronic diseases including hypertension, hyper cholesterolemia.

The spent straw can be re-cycled for growing oyster mushroom after supplementing with wheat or rice bran and also for preparing compost of white button mushroom after suitable supplementation with nitrogen rich dried manure. The spent straw can be used as cattle feed and also for bio-gas production, the slurry can be used as manure for garden. Indian medicinal mushrooms are potential sources of antioxidant and anticancer compounds.

Mushroom cultivation provides employment generation, dried and fresh mushrooms can sold in the market, apart from pickling and mushroom soup powder.

Most suitable for rural areas and can create self employment. . Easy post harvest processing particularly dehydration/sun drying. Faster growth rate and low cost of production.

References:

Chang, S.T., Miles, P.G. (2004). Mushrooms- cultivation, nutritional value, medicinal effect and environmental impact. CRC Press, Washington, D.C. pp. 451.

FAO. (2004). Non wood forest products, wild edible fungi: A global overview of their use and importance. (ed. Boa, E). FAO Publication, Rome, pp. 17-147.

Pandey, G., Singh, B.K. (1978). Indian Mushroom Sciences I: 383-388.

Kaul, T.N., Kachroo, J.L. (1974). Common edible mushrooms of Jammu and Kashmir. Ind. Mush. Sci. 71:26-31.

Walde, S.G., Velu, V., Jyothirmayi, T., Math, R.G. (2006): Effects of pretreatments and drying methods on dehydration of mushroom, J Food Eng. 74, 108-115.

Kompany, E., René, A. (1995): Note on the Freeze-drying Conditions for Improved Aroma Retention in Cultivated Mushrooms (Agaricus bisporus), LWT. 28, 238-240.

Raquel P. F. Guiné1*, Maria João Barroca. Influence of freeze-drying treatment on the texture of mushrooms and onions. Croat. J. Food Sci. Technol. (2011) 3 (2) 26-31.

Anna Del Conte, Thomas Laessoe and Susan Campbell, 2008. The Edible Mushroom Book, DK Publishing (dorling Kindersley), 192 p.