



FOOD AND NUTRITION NEWS

Acharya N.G. Ranga Agricultural University

Vol. 3

APRIL 1998

No. 1

MUSHROOMS - FOR MANY USES

Mushroom is a simple form of fungus. It lacks chlorophyll and cannot therefore make its own food. It grows on dead organic matter or parasitically or symbiotically with other organisms. This constitutes an excellent means of recycling many of the farm wastes. Modern mushroom cultivation produces more proteins per unit area of land than by any other form of agriculture. Since these are grown indoors, no additional land is required for the cultivation. Therefore mushroom cultivation is labour intensive and can provide employment to both educated and illiterate persons. They can be produced in large quantity with in a short time. The efficiency with which mushrooms convert carbohydrates into proteins is about 65% in comparison to about 20% for pork, 15% for poultry and 4% for beef.

More than 2000 species of fungi are reported to be edible throughout the world. In India about 200 of these are available. Eight of these have been cultivated so far. In all, about two dozen mushrooms have been cultivated for edible purposes in different countries. *Agaricus bisporus* (European or white button) *Volvariella sp* (Paddy straw or Chinese), *Pleurotus sp* (Oyster or tropical) and *Lentinus edodes* (Shiitake) mushrooms are the most popular ones among the commercial growers.

Of these, the first three are popular in India as techniques for their cultivation have been developed. In addition, *Agaricus bitorquis* (Edulis) *pholiotanemeko*, *Tricholoma matsutake*, *stropharia rugosoannulate*, *Temella fusiformis*, *coprinus fimetarius*, *Auricular polytricha*, *Agrocybe egerita* and *Tuber melanospermum* are also being cultivated in different countries is given below.

The total production of mushrooms in India is 11,600 tonnes, Uttar Pradesh, Himachal Pradesh,

Haryana, Tamil Nadu and Punjab are the leading states and Rajasthan, Bihar and West Bengal are least producing states.

There are a number of mushrooms which are poisonous. It is often very difficult to identify the edible mushrooms from the poisonous ones. There are no prescribed standards to identify them. Some tests are often suggested, but none are reliable. It is stated that silver spoon or silver coin would turn blackish when they are dipped in a dish of poisonous mushrooms, exudations of milky

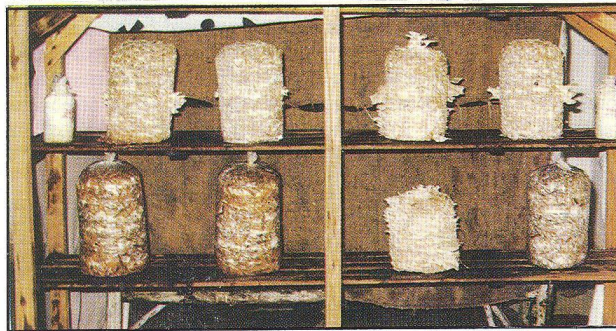


substances from damaged fruit bodies, unusual changes in colour of onion while cooking with mushrooms etc., are some tests mentioned. Some of the highly poisonous ones are - *Amanita phalloides* (death cap), *A. pantherina* (Panther cap), *A. muscaria* (fly agaric), *Inocybe pattouillardi*, *Cortinarius speciosissimus*, *C. orellanus* etc.

Cultivation

Oyster mushrooms grow easily at 20-25° C and take a lesser time to reach maturity than others. Oyster mushrooms can be cultivated for the family table, since the harvest is quite bountiful, it can also prove to be a profitable hobby.

Things needed include a tub, a few polythene bags (14 inches by 24 inches for home cultivation) and about 3 kgs of paddy straw. The seeds, called the spawn, are available at any nursery or with horticulturist, or pathologist.



Different Stages of Oyster Mushroom Cultivation

Paddy straw is cut into two to three inches and soaked in tap water for 10 hours. Soaked paddy straw bits are drained well and boiled in fresh water for 45 minutes (sterilization). After sterilization, the paddy straw bits are drained of excess water and dried in shade. The straw bits are arranged in layers of 3 or 4 inches at the bottom of polythene bag. Two table spoons of spawn is sprinkled all along the periphery, like a border. This process is operated till the bag is filled and the mouth of the bag is tightly tied which is known as 'bed'.

Two or three holes are made at the bottom of the bag for aeration. The beds are kept in cool and shady place (never in direct sunlight) for 15-20 days. During this period there will be mycelium growth. After 20th day polythene covers are removed. Mycelium growth has fused all layers of straw together into one compact cake-like block. A little water is sprinkled on it twice a day. At about 3rd or 4th day after opening the bag, oyster-like mushrooms sprout all around the bed. Fully grown mushrooms are harvested after 3 days. One bed will yield 4 to 5 crops.

Paddy Husk as a Substrate for Cultivation of *Plurotus Sajor-Caju*

Different substrates have been tried for the cultivation of several species of *Plurotus* in India and abroad. Mushrooms cultivated on two different substrates such as paddy straw and paddy husk in the

Department of Foods & Nutrition, College of Home Science, Bapatla. The results indicate that the yield obtained from paddy straw was high (500g/bed) as compared with paddy husk (400g/bed). Paddy straw is considered as the best substrate for cultivating *plurotus sajor-caju* in terms of yield. As the cost of the paddy straw is increasing day by day it is advantageous to find out a low cost and alternate substrate for mushroom cultivation.

Vijaya Khader

Economics

Economics of mushroom cultivation mainly depends on the equipments, nutrients used, their initial cost and yield performance. The expenditure for preparing the mushroom bed is Rs.10-15 which include the cost of the straw, polythene bags, expenditure towards labour charges, spawn and miscellaneous. One bed gives 1-2 kg of mushrooms from four pickings within a duration of 4 weeks. The market price varies between Rs.20-40/kg from place to place. The net income varies depending on the sale price of the spawn. If the sale price is Rs. 30/kg of mushroom the net income per bed after deductions is Rs.40-70. In the rural areas a women can easily manage 4-10 beds depending on the space available, helping them to earn Rs.180 to 450 per month as a supplementary income.

Nutritive Value of Mushrooms

Mushrooms are considered as delicacy as well as a good supplementary item of food. From the nutritional point of view, they are in between meat and vegetables (Table 1 & 2). They provide high quality proteins and are low in calories. Hence, it is recommended as a special item for therapeutic use.

The protein in mushroom is rich in all the essential amino acids required by an adult. Some of the amino acids like tryptophan and lysine, which are absent in vegetable proteins are present in mushroom protein. Approximately 25-35 percent of total amino acid occur as free amino acids. They are also known to be excellent sources of riboflavin, niacin and pantothenic acid. The crude fat in mushrooms consistute less than one per cent. Mushrooms also contain appreciable amount of thiamine, folic acid and ascorbic acid. They are rich in minerals, and the mineral content in fresh mushrooms is higher than that in many fresh veg-

Table 1
Proximate content of edible mushrooms - (Percentage fresh wt. basis)

Species	Moisture	Ash	Protein	Fat	Crude fibre
<i>Agaricus bisporus</i>	89.5	1.25	3.9	0.19	1.09
<i>Lepiota species</i>	90.0	1.09	3.3	0.18	0.86
<i>Pleurotus sp.</i>	90.0	0.97	2.8	0.65	1.08
<i>Termitomyces sp.</i>	91.3	0.81	4.1	0.22	1.13
<i>Volvariella volvacea</i>	88.4	1.46	5.0	0.74	1.38
<i>V. diplasia</i>	90.4	1.10	3.9	0.25	1.67

Table 2
Vitamin and mineral content of edible mushrooms (mg/100g dry wt.)

Species	Thia- mine	Ribof- lavin	Nia- cin	Ascorbic acid	Ca	P	Fe	Na	K
<i>Agaricus bisporus</i>	1.1	5.0	55.7	81.9	23	1429	0.2	---	4762
<i>Lentinus edodes</i>	7.8	4.9	54.9	0.0	33	1348	15.2	837	3793
<i>Pleurotus ostreatus</i>	4.8	4.7	108.7	0.0	98	476	8.5	61	---
<i>Volvariella volvacea</i>	1.2	3.3	91.9	20.2	71	677	17.1	374	3455

etables and fruits. Phosphorus and potassium are the main constituents, where as copper and iron are also present in appreciable amounts.

Nutritive Value of Oyster Mushroom at Three Different Stages of Maturity

Mushrooms were collected from two different places and analysed the nutrients like protein, fat, crude fibre, ash, calcium, iron, phosphorus and energy for the different stages of both white and grey varieties of oyster mushroom as per the standard methods of A.O.A.C. Carbohydrate content was calculated.

White and Grey varieties of oyster mushrooms were used in the present study. Three different stages of maturity such as immature (two days before harvesting), mature (at the time of harvesting) and dried (mature and sun-dried) stages were used.

Significant difference was observed between white and grey varieties of mushrooms with respect to their nutrient content, except crude fibre. No significant difference was observed between immature and

mature stages of both varieties. Dried mushroom contain high nutrient contents when compared with immature and mature stages because during drying process the food also losses moisture and there is an increase in concentration of nutrients in the remaining mass.

Vijaya Khader

Bio-Availability

Studies on *in vivo* digestibility of mushroom protein carried out on young male albino rats at 10% level of protein revealed 87% of over all digestibility of mushroom protein as against 93% for edible soya bean cake, which is significantly different at 5% level. Apparent digestibility of mushroom protein is very low (37%) as compared to edible soya bean cake (84%) which may be due to the use of raw dried mushroom powder being used in rat diets.

Vijaya Khader

Effect of cooking on nutritive value

Moisture and vitamin C content decreased on maturation of *Volvariella volvacea* mushrooms

(paddy straw). Mature buttons were cooked by three common methods namely (a) boiling in water for 10 min (b) shallow frying in refined oil and (c) deep frying in refined oil for 10 minutes. Among the three methods of cooking, the loss of nutrients were more in shallow frying, followed by deep frying and minimum in boiling. Vitamin C losses varied from 50-75% based on the type of cooking. Heat treatment did not affect the crude fibre, fat and ash contents.

P. Shobha Devi

G. Sarojini

Food Uses

Therapeutic Uses

There are many therapeutic effects attributed to mushrooms. It is true that only a fraction of this has been so far exploited. Many of the folklores in different countries provide ample evidence for the therapeutic use of mushrooms from very ancient times.

Hypolipidemic Action

Inclusion of paddy straw mushroom powder in the hypercholesterolaemic diets, (64% starch; 10% ground nut oil; 15% protein; 4% salt mixture; 1% yeast powder; 5% cellulose and 1% cholesterol) reduced the plasma total lipids, total cholesterol and glyceride level significantly whereas free fatty acids and phospholipid levels were not much affected. The lowering of total cholesterol (TC) level was equally reflected both in HDL and LDL + VLDL fractions. Hypolipidemic action of *Volvariella volvacea* could be due to the increased catabolism or decreased absorption as evident by the lower plasma levels without lipid accumu-

lowering was more evident only at 5% level of mushroom powder in the diet than that at 10% level.

Vijaya Khader

Hypoglycemic Action

The effect of fibre from oyster mushroom, spinach and isabgol on blood glucose response was studied in twenty four non-insulin dependent diabetic patients (NIDDM) from a diabetic clinic. The experimental diets included a normal breakfast, *pulkha*, mushroom powder incorporated *pulkha*, spinach powder incorporated *pulkha* and isabgol incorporated *pulkha*. Two levels of fibre i.e., 10% and 15% were studied. The breakfast was served with cucumber curry and a cup of coffee

els tested 15% fibre from mushroom was found to be effective.

J. Alakananda

Vijaya Khader

Weaning Foods

Mushroom powder can be effectively incorporated in weaning foods which serves as useful protein source and also contributes major nutrients like protein, and calcium.

The chemical analysis indicate the weaning food I is better as compared with other two weaning foods in respect of protein, fat, calcium and calorific value. All the three weaning foods are quite acceptable without any remark. The keeping quality of weaning foods was quite satisfactory up to a period of five months, as indicated

Preparation of Weaning Foods with Mushrooms

WEANING FOODS					
Weaning food I			Weaning food II		
			(a)		(b)
Puffed rice powder	-	20g	Rice powder	- 40 g	Korra powder
Whole Bengal gram (germinated, dried and roasted)	-	20 g	Red gram dhal powder	- 10 g	Green gram dal powder,
Mushroom powder	-	20 g	Bengal gram dal powder	- 10 g	Bengal gram dal powder
Jaggery	-	10 g	Mushroom Powder	- 40 g	Mushroom powder
Cardamom	-	One			
Preparation : Above ingredients were mixed thoroughly and packed in a clean dry glass bottle with cover.			Preparation : The cereal or millet, pulse and mushroom powders were mixed and batter was prepared, fermented overnight. Jaggery 10 g, salt to taste and pinch of soda were added and mixed well and baked at 150°C for 10-15 minutes. Allowed to cool at room temperature dried well and powdered, packed in a clean dry glass bottle with cover.		

Vijaya Khader
Nayana Pandya

lation in liver inspite of higher cholesterol intake.

Heart lipids (total lipid, cholesterol, free fatty acids, phospholipids and glycerides) decreased with inclusion of mushroom powder. But effect was significant only in case of glycerides and phospholipids. Moreover, the lipid

made with skim milk powder without sugar for a period of three days. Blood samples were drawn before and after fibre rich breakfast consumption and analysed for plasma glucose. Mean peak rise over fasting was significantly lower when compared with the test and normal (low fibre) breakfast. Of the two fibre lev-

by the acceptability studies. The microbiological observations showed no drastic changes in the weaning foods at the end of fifth month.

Culinary Uses

With the idea of popularising the mushrooms among the local communities, some recipes have been

prepared and evaluated for their acceptability. The overall acceptability of chutney powder was excellent compared to pickle and ketchup. The keeping quality of the preparation were good upto a period of 2 months. Subtle in flavour, characteristic of biting, texture and attractive in appearance, mushrooms lend themselves to several dishes, some of which are : *Mushroom soup, Mushroom curry; creamy mushroom, Mushroom pizza, Mushroom stuffed capsicum, Mushroom pan cakes, Mushroom pakoda, Mushroom omlette, Mushroom sandwiches, Mushroom Ketchup, Mushroom chutney, Mushroom pickle, Baked mushrooms, Mushroom flavoured rice, Mushroom garlic sauce, Mushroom flakes, Mushroom chips and Mushroom instant soup powder*. They also go well with *noodles, macaroni* and vegetables like cauliflower, peas, potatoes and tomatoes.

On account of being cereal based, Indian diet suffers from inadequate protein content. Mushroom protein has been universally accepted to be superior to vegetable proteins and as good as animal proteins. Mushrooms are therefore, recognised as non-conventional source of protein which can bridge the protein gap

in the Indian diet. Mushrooms are essential supplements to the cereal based diet and go a long way in making it a healthy diet. As, it is rich in fibre, low calorific value and absence of cholesterol, mushrooms find application in diet therapy (treating obesity, diabetes and various heart diseases).

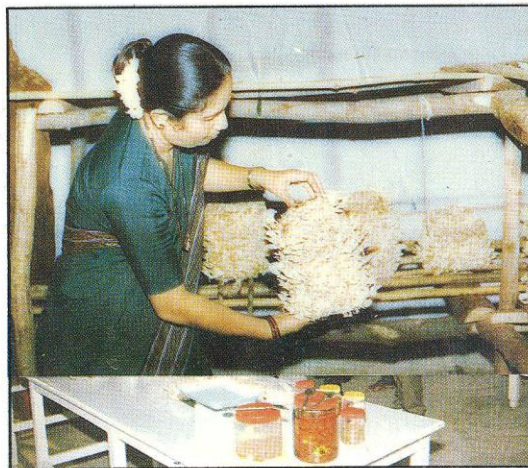
Pickle

The most common method of preserving mushroom is preparation of pickle. Two types of pickles can be prepared using fresh mushrooms. The details of preparation are as follows:

Mushrooms are fried in oil and all the spice powders were mixed well.

Pickles were kept at room temperature for a period of 5 months and regular observations were carried out to see the shelf life. Acceptability studies indicate that the scores for taste, flavour and overall acceptability for both the pickles are markedly different from each other. The second pickle stored well for 5 months without fungal growth. The first pickle got spoiled within a week. The microbiological observation of spoiled pickle showed the presence of *streptococci* and *staphylococci*.

**Vijaya Khader
Nayana Pandya**



Mushroom Pickles

Pickle I		Pickle II	
Mushroom	125g	Mushrooms	125g
Cumin seed powder	1/2 tsp	Mustard seed powder	1/2 tsp
Fenugreek seed powder	1/2 tsp	Turmeric powder	1/2 tsp
Coriander seed powder	1/2 tsp	Chilli powder	1/2 tsp
Turmeric powder	1/2 tsp	Salt	1/2 tsp
Mustard seed powder	1/2 tsp	Asafoetida	Pinch
Green chillies	5Nos	Sesame oil	30 ml
Vinegar (Commercial)	45 ml		
Sesame oil	45 ml		
Salt	to taste		

BOOKS PUBLISHED BY Dr. (MRS.) VIJAYA KHADER

Sl.No.	Name of the book	Address
1.	Money from Mushrooms (English)	Information & Communication Centre A.N.G.R.A.U. Rajendranagar Hyderabad 500 030.
2.	Mushrooms (Telugu)	Information & Communication Centre A.N.G.R.A.U. Rajendranagar Hyderabad 500 030.
3.	Mushrooms for Lively hood (English)	Kalyani Publishers, 1/1, Rajinder Nagar, Ludhiyana - 141 008.
4.	Mushrooms for Lively hood (Hindi - under progress)	Kalyani Publishers, 1/1, Rajinder Nagar, Ludhiyana - 141 008.
5.	Puttagodugulu (Telugu)	Sri Lakshmi Press, Bapatla-522 101. Guntur District.

The Food and Nutrition News is published by the Centre of Advanced Studies, Department of Foods & Nutrition, College of Home Science, A.P. Agricultural University. The funds for the centre have been granted by the Indian Council of Agricultural Research, New Delhi.

For any correspondence

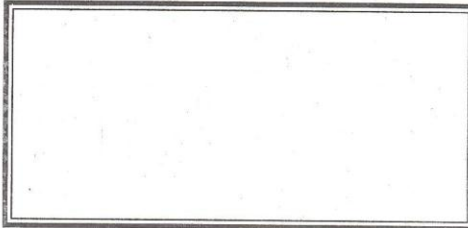
Address to

Editor :

Dr (Mrs) Vijaya Khader
Director
Centre of Advanced Studies
Post graduate and Research Centre
ANGR Agricultural University
Rajendranagar, Hyderabad 500 030.

FOOD AND NUTRITION NEWS

Mail to :



Issue Editor :

Dr (Mrs) Vijaya Khader
Director