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Research Article

MUSHROOM NUTRACEUTICALS ON DIFFERENT SUBSTRATES

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ABSTRACT

This paper deals with a comparative study of nutraceuticals on different substrates on two edible mushroom sp. viz. *Pleurotus sajor-caju* and *Agaricus bisporus*. Results revealed that *P. sajor –caju* gave maximum quantity of nutraceuticals when cultivated on domestic waste (vegetable peelings, garden waste etc.). Saw dust found poor substrate from nutraceutical point of view. *Agaricus bisporus* was gave best results when cultivated on compost-1, which contain wheat straw, wheat bran, saw dust, ammonium sulphate, super phosphate and gypsum. Thus both the sp. have high amount of nutraceutical and prefer to food in the diet of human beings

Keywords: Mushrooms**,** Nutraceuticals**,** *Pleurotus sajor-caju* and *Agaricus bisporus***.**

INTRODUCTION

In the era of 'healthy eating' by cutting down the calories, saturated fat and cholesterol, mushrooms were bound to attract the attention. Mushrooms have long been considered, especially in the orient, to have medicinal values[1]. Due to unique chemical composition, mushrooms are suited to the specific groups suffering with some ailments. As a low calorie-high protein diet with almost no starch and sugars mushrooms are the 'delight of the diabetic' Due to high K: Na ratio, few calories and low fat, mushrooms are the choice of the dietician for those with obesity, hypertension and atherosclerosis (heart disease). Alkaline ash and high fiber contents make them suitable for those suffering from hyperacidity and constipation[2]. The term Nutraceutical is proposed by DeFelice in 1979 and quoted by Brower in 1988 and reported[3]. These are often referred as phytochemicals or functional foods. These are natural, bioactive, chemical compounds that have health-promoting, disease-preventing or medicinal properties. It was the advances in understanding the relationship between nutrition and health, often at the molecular level, that led to the concept of 'nutraceuticals' as a practical and new approach to achieve optimal health and possibly reduce the risk of disease. Nutraceuticals constitute a rapidly growing focus for research, product development and consumer interest as well as regulatory efforts in recent years. Nutraceuticals represents a unique intersection of the pharmaceutical and food industries with a wide scope.

In the present study two mushroom sp. Viz. *Pleurotus sajor-caju* and *Agaricus bisporus* were used for the purpose. A comparative study was done on mushroom nutraceuticals on different substrates and four composts.

MATERIAL AND METHODS

In the present study two mushroom sp. Viz. *Pleurotus sajor-caju* and *Agaricus bisporus* were used for the purpose. *Pleurotus sajor-caju* was cultivated on different non conventional substrates viz. Domestic waste, fruit waste, used tea leaves, semal flowers, news paper, bamboo leaves and saw dust. For the cultivation of *Agaricus bisporus,* four different combinations of composts were taken. Composition is shown in below.

Compost-(1)

Wheat straw	-	300 Kg
Wheat bran	-	30 Kg
Saw dust	-	10-12 Kg
Ammonium sulphate	-	9 Kg
Super phosphate	-	2.4 Kg
Gypsum	-	30 Kg

Compost-(2)

Wheat	-	300 Kg
Calcium ammonium nitrate	-	9 Kg
Urea	-	3 Kg
Superphosphate	-	3 Kg
Muriate or potash	-	3 Kg
Wheat bran	-	15 Kg
Molasses	-	5 Kg
Gypsum	-	30 Kg
Lindane dust	-	250 Kg

Compost-(3)

Wheat straw	-	300 Kg
Molasses	-	12 Kg
Urea	-	4.5 Kg
Wheat bran	-	50 Kg
Muriate or potash	-	2 Kg
Cotton seed meal	-	5 Kg
Gypsum	-	15 Kg

Compost-(4)

Wheat straw	-	300 Kg
Chicken manure	-	125 Kg
Wheat bran	-	15 Kg
Gypsum	-	20 Kg
Urea	-	5.5 Kg
BHC (10%)	-	125 Kg

Analysis of nutrients

Protein estimation

The protein content of crude filtrate homogenate was assayed by the method of Lowry *et al.,* (1951)[5] , using BSA (bovine serum albumin) as standard. The method was based on the principle that different proteins contain different amount of aromatic residues which react with Folin Cicalteu's Reagent (Phenol reagent) and values are expressed as mg/ml of culture filtrate.

Carbohydrade analysis

Using the dinitrisalicylic acid as reagent, 25 g of 2,5 dinitrisalicylic acid and 75g sodium potassium tartrate were dissolved in 50 ml sodium suspension of each of the crushed oven dried mushroom species was added with 1.01 ml of reagent and mixed thoroughly. The mixture boiled in a water bath for ten minutes. After rapid cooling to room temperature, the absorbance was determined at 570 λmax. The values of component ingredients of carbohydrate determined from a glucose standard curve[6].

Fat analysis

Mushroom materials were placed on extraction tube. And 1 ml 0.88% ammonia solution was added and mixed thoroughly; 10 ml of alcohol was added and mixed to dissolve the protein. The tube was then immersed in boiling water and liberated component fat rose to the surface. When the tube cooled the fat extracted by shaking with 1:1 mixtures of diethyl-ether and petroleum spirit (20 ml). The bulked solution was distilled from the extract and sample dried and weighed to determine weight and fat components[6].

Minerals analysis

An aliquots of the digest was taken for determination of Ca, Na, K, P and Mg using spectronic at 430 λmax and EDTA complex metric titrations, these minerals were determined by flame emission after appropriate dilution, using a plan photometer equipped with optical filter[6].

Crude fiber determination

Crude fiber was determined using a Hennenberg- Stohmann method. A 2 g sample from mushroom species was boiled in antifoaming solution (1-octanol) for 30 min. Pyrex glasses were used to filter the solution where the residues were thoroughly washed with boiling water (3 times) to remove hydrochloric acid. The Pyrex glasses containing the residues were dried at 100°C for five hours, cooled to room temperature and then weighed. The crucibles were then placed in a muffle furnace at 555°C for 5 hrs. cooled to room temperature and then reweighed to find the fiber content percentage.

Moisture content determination

A 2 g sample from each of the mushroom sp. used in the study was oven dried at 105°C to constant weights. The difference between the weight of the sample before drying and after drying was used to calculate the percentage moisture content[7].

Ash determination

A 2 g sample from the finely ground mushroom was placed in a crucible and converted into ash at 550 - 600°C for 5 hrs. in a carbolated muffle furnace after which it was allowed to cool in a desiccator. The difference in the weight of the crucible without the sample before and after ashing was used to calculate the ash content[8].

RESULTS AND DISCUSSION

Table 1 showed the nutritive content of *P. sajor-caju* on different non- conventional substrates. Maximum protein (29.0%) reported from domestic waste and minimum (24.1%) from saw dust substrate. Minimum carbohydrate (45.4%) reported from semal flowers and maximum from (54.5%) saw dust. Fat content reported 1.83% to 2.65% in used tea leaves and bamboo leaves. Moisture content reported 82.4% to 90.9% and ash from 5.73% to 6.40%. Maximum fiber content (7.80%) from fruit waste and minimum (6.80%) from used tea leaves.

Table 1: Nutritive content of *P. sajor-caju* on different non- conventional substrates:

Substrates	Protein (%)	Carbohydrate (%)	Fat (%)	Moisture (%)	Ash (%)	Fibre (%)
Domestic waste	29.0	45.5	1.92	90.9	6.18	7.63
Fruit waste	25.4	50.7	2.47	90.26	6.25	7.80
Used tea leaves	24.7	45.4	1.83	88.5	6.40	6.80
Semal flowers	22.0	46.4	1.87	86.76	5.73	7.56
News paper	28.0	50.4	2.41	88.43	5.73	7.59
Bamboo leaves	25.1	48.2	2.65	87.63	6.40	7.59
Saw dust	24.1	54.5	1.92	82.4	6.23	7.61
CD (0.05%)	0.99	0.65	0.05	0.77	0.18	0.15
S Em (±)	0.32	0.21	0.018	0.25	0.06	0.05

Values are given in average of three replicates

Table 2 shows the mineral contents of *P. sajor-caju* on different non-conventional substrates. Maximum Ca (323.4) reported from fruit waste and minimum (272.4) from saw dust. The highest potassium concentration was recorded on fruit waste (2646.7 mg/100g) and minimum was obtained on saw dust (1818.4 mg/100g). The highest sodium concentration was recorded on fruit waste (318.4 mg/100g) and minimum was obtained on news paper (272.4 mg/100g). The highest magnesium concentration was recorded on fruit waste and domestic waste (157.7 mg/100g) and minimum was obtained on news paper (149.7 mg/100g). The highest phosphorus concentration was recorded on domestic waste (915.0 mg/100g) and minimum was obtained on news paper (865.0 mg/100g). The highest iron concentration was recorded on fruit waste (131.7 mg/100g) and minimum was obtained on news paper (91.0 mg/100g).

Table 2: Mineral contents of *P. sajor-caju* on different non-conventional substrates

Substrates	Ca (mg/100g)	K (mg/100g)	Na (mg/100g)	Mg (mg/100g)	P (mg/100g)	Fe (mg/100g)
DW	306.0	2343.4	300.0	157.7	915.0	120.0
FW	323.4	2646.7	318.4	152.4	875.0	131.7
UTL	284.7	1966.7	294.4	157.7	891.7	105.
SF	273.4	2115.0	285.0	153.7	868.4	93.0
NP	313.4	1923.4	272.4	149.7	865.0	91.0
BL	283.4	1926.7	283.4	151.7	873.4	131.7
SD	272.4	1818.4	291.7	156.0	890.0	100.0
CD (0.05%)	20.31	111.34	9.83	4.72	14.79	4.37
S Em (±)	6.69	36.70	3.24	1.55	4.87	1.44

Values are given in average of three replicates

Table 3 shows the nutrients of *Agaricus bisporus* on four different composts. Different substrates affected the nutritional composition of mushroom. Compost (1) shows maximum protein (34.0%), minimum fat (2.3%) and ash (9.8 %) Carbohydrate (45.7%), moisture (89.0%) and fiber (8.8%) reported. Minimum protein content (32.7%) reported from compost (3). Carbohydrate (3.2%), maximum fat content (3.2%) reported. Moisture content 90.3% and ash 9.7%, fiber content (8.4%) reported. Table 4 show the mineral contents of *Agaricus bisporus* on four different composts. Maximum Ca (71 mg/100g) reported compost (1) and minimum (70.0) from compost (2) and (3). The highest potassium concentration was reported compost (1) (4543.4 mg/100g) and minimum was obtained on compost (4) (4513.4 mg/100g). The highest sodium concentration was recorded on compost (1) and (2) (52.4 mg/100g)

and minimum (51.0 mg/100g) was obtained on compost (3). The highest magnesium concentration was recorded on compost (4) (11.7 mg/100g) and minimum was obtained on .compost (3) (10.4 mg/100g). The highest phosphorus concentration was recorded on compost (1). (115.0 mg/100g) and minimum was obtained on compost (3) (105.0 mg/100g). Iron concentration was recorded similar (2.0 mg/100g) on compost (1), (2) and (4) and minimum was obtained on compost (3) (1.9 mg/100g).

Table 3: Nutritive content of *A. bisporus* on different composts

Compost	Protein (%)	Carbohydrate g/Kg	Fat (%)	Moisture (%)	Ash (%)	Fiber (%)
1.	34.0	45.7	2.3	89.0	9.8	8.8
2.	33.4	46.6	3.0	89.5	9.9	8.3
3.	32.7	51.4	3.2	90.3	9.7	8.4
4.	32.9	53.4	2.9	89.8	9.8	8.5
CD (0.05%)	0.49	0.63	0.32	0.86	0.13	0.73
S Em (±)	1.50	0.19	0.1	0.26	0.04	0.22

Values are given in average of three replicates

Table 4: Mineral contents of *A. bisporus* on different composts

Compost	Ca (mg/100g)	K (mg/100g)	Na (mg/100g)	Mg (mg/100g)	P (mg/100g)	Fe (mg/100g)
1.	71	4543.4	52.4	11.4	115.0	2.0
2.	70.3	4526.7	52.4	11.0	106.7	2.0
3.	70	4526.7	51.0	10.4	105.0	1.9
4.	70	4513.4	52.0	11.7	115.0	2.0
CD (0.05%)	1.71	55.16	2.24	2.30	9.79	0.15
S Em (±)	0.52	16.91	0.68	0.70	3.00	0.04

Values are given in average of three replicates

Mushroom has been recognized as food contributing to ameliorate the protein malnutrition of the countries which are largely depending upon cereals[8,9]. Different substrates affected the nutritional composition of mushroom. Protein is one of the most important food factors. The sufficiency of protein in a diet is an important measure of its adequacy and quality[10]. It has been reported that not only the protein content of the substrate but also nature of protein in the substrate influences the protein content of the fruiting bodies[11]. The present results showed that protein content of *P. sajor-caju* was significantly higher when grown on domestic waste than other substrate. Minerals in the diet are essential for metabolic reactions, healthy bone formation, transmission of nerve impulses, regulation of water and salt balance. The mineral content of *P. sajor- caju* and *Agaricus bisporus* harvested varied with different substrates and their combination. This is obvious that minerals- micro and macro nutrients needed for the fruiting of the mushroom are similar to that of plants. P, K, Mg and S are necessary nutrients for the fungal growth many nutrients like Na, Mg and Ca are required for fruiting body is reported by Sueli *et al*.,[12]. K is essential since it is a co-factor of several enzymatic reactions and is available in plenty in mushrooms. K is available for the fungus usually in the form of phosphate thus providing two essential minerals for metabolism[13]. The presence of high potassium content over sodium in diet suggests the effectiveness against hypertension[14].

White button mushroom and oyster mushroom (*Pleurotus sajor-caju*) offers an important nutritious and cheap food for human beings. These are rich source of proteins, minerals and vitamins. White button mushroom has also been recognized as the alternative source of food quality protein per unit area and time from the worthless agro wastes.

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