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Vitamin and mineral content of *Agaricus bisporus* (white button) and *Pleurotus sajor-caju* (dhingri) mushrooms

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Abstract
The present study was aimed to determine the contents of vitamins (thiamine, riboflavin and ascorbic acid) and minerals (K, P, Zn, Cu, Zn, Mn, Ca and Fe) in cultivated mushrooms *viz*. *Agaricus bisporus* and *Pleurotus sajor caju*. Both *Agaricus bisporus* and *Pleurotus sajor caju* mushroom were found to be an excellent source of potassium and phosphorus. The contents of K, P, Ca, Zn and Fe in *Agaricus bisporus* was 4015, 1350, 47 and 13.23 mg/100g dry weight respectively, whereas in *Pleurotus sajor caju* mushroom the contents of K, P, ca and Zn was found to be 3218, 1246, 73 and 12.77 mg/100 dry weight, respectively. However, comparison of both the mushrooms revealed that *Agaricus bisporus* mushroom contained significantly higher amount of phosphorus, potassium, zinc, copper and manganese and lower amount of calcium and iron as compared to *Pleurotus sajor caju* mushroom. Both the mushrooms contained good amount of water-soluble vitamins namely, thiamine, riboflavin and ascorbic acid. The amount of ascorbic acid (4.43%) was almost double in *Pleurotus sajor caju* as compared to *Agaricus bisporus* mushroom (2.25%).

Keywords: Mushroom, *Agaricus bisporus*, *Pleurotus sajor caju*, vitamin, mineral

1. Introduction
Mushrooms are one of the marvelous food items which are cultivated in many parts of India and commercially available throughout the year. Mushrooms have been used both as a food as well as medicine since ancient civilization. They have gained wide popularity as nutraceuticals owing to their higher nutritional and medicinal value as well as their ability to grow on agricultural wastes. The disposal of agricultural waste is of the primary concern now a days. Mushrooms helps to overcome this problem as they need organic matter to grow. They secrete enzymes to digest surrounding foodstuff and to get nutrients from organic matter, which is generally called as compost. The nutrients absorbed by the mycelium out of decaying organic matter accumulate and get transformed into various constituents of fruit body. As a result, nutritional value of mushroom largely depend on chemical composition of the compost which is a mixture of wheat straw, paddy straw, rice straw, rice bran, banana leaves, cotton straw, cotton seed meal and nitrogen supplement [1]. The cultivation of mushroom does not compete with food crops for land and they help in providing ecofriendly solution for proper recycling of agricultural wastes. Therefore, mushroom production is being encouraged in India [2].
Mushrooms are rich source of proteins and can be used as alternative source of meat for vegetarian population which is quite dominant in India. The protein content generally ranges between 20-30% by dry weight [3, 4]. The use of mushrooms as a food item is advocated because the protein content in most species is higher than in most vegetables, the cultivation takes a short time and it is inexpensive as fertilizers are not needed [5]. They are low in fat content and high in fiber. Besides, studies have shown that mushrooms are rich in polyunsaturated fatty acids and linoleic acid being the predominant one [6] which makes mushroom a preferred food for persons suffering from diabetes, heart disease and hypertension.
They have high contents of vitamins and minerals, which act as protective foods. As compared with vegetables, mushrooms have been found to contain reasonably higher amount of many minerals especially potassium, phosphorus, magnesium, copper and zinc [7, 8]. Potassium is an important mineral that helps in the maintenance of fluid and control blood pressure. Phosphorus along with calcium forms the structure of our teeth and bones. Mushrooms contain many essential vitamins including thiamine, riboflavin and ascorbic acid.
There are about 38000 varieties of mushrooms known to exist; however, about 100 of these are considered edible [9]. In India, three species of mushrooms namely *Agaricus bisporus* (white button), *Pleurotus sajor caju* (dhingri) and *Volvariella volvacea* (paddy straw) mushrooms are commercially cultivated in many parts of India. Annual production of mushrooms has been estimated to be 40000 MT. *Agaricus bisporus* contribute 80-85 per cent, *Pleurotus* species contribute 15-19 per cent and other varieties contribute 1 per cent of total production [10]. The present study was conducted to evaluate the vitamins and minerals in *Agaricus bisporus* (white button) and *Pleurotus sajor caju* (dhingri) mushrooms.

2. Material and Method
2.1 Procurement of Material
Fresh mushrooms were procured from the Department of Plant Pathology CCS Haryana Agricultural University, Hisar (INDIA). The samples were cleaned of dust and other

foreign material. These samples were dehydrated in hot air oven for 12hr at 60±0.5 C. The dried samples were made into fine powder in an electric grinder and stored in polythene bags for further use.

2.2 Nutritional Analysis

2.2.1 Vitamins

Riboflavin and thiamine contents were determined by Fluorometeric method of AOAC [11]. Ascorbic acid was determined by 2, 6-dichlorophenol indophenols method AOAC [11].

2.2.2 Minerals

For estimation of minerals the samples were digested with diacid mixture. For digestion 1g ground sample was taken in a 150 ml conical flask and 25-30 ml diacid mixture (HNO3: HCIO4: 5: 1 v/v) was added and kept overnight. The contents were digested by heating until clear white precipitates settle down at the bottom. The crystals were dissolved by adding double distilled water. The contents were filtered through whatman no. 42 filter aper. The filtrate was made to 50 ml volume with double distilled water and used for determination of macro and micronutrients.

Potassium was estimated by Vando molybdate yellow color method [12] given by Jakson (1967). Phosphorus was estimated by Flame Photometer method [13]. Micronutrients were estimated by atomic absorption spectro- photometer and expressed in per cent. All the observations were carried out in triplicate and mean have been given.

2.3 Statistical analysis

All data were statistically analyzed in completely randomized design (CRD) for mean, standard deviation and per cent [14]. On the basis of CRD, critical difference (CD) has been calculated. Whenever, the differences between two treatments were more than the CD value, the differences were significant at the 5% level (P<0.05)

3. Results and Discussion

3.1 Mineral content

It is clear from the Table 1 that both mushrooms were rich in minerals especially potassium, calcium, phosphorous and iron. The most abundant element was potassium (4015 & 3218 mg/100g) followed by phosphorous (1350 &1246 mg/100g) in *Agaricus bisporus* and *Pleurotus sajor caju* mushroom, respectively on dry weight basis.

Pleurotus sajor caju mushroom contained one and half times more amount of calcium than that present in *Agaricus bisporus* mushroom. Besides these macro elements, both mushrooms also contained good amount of micro elements viz, Zn, K, Cu and Mn. The iron content was 10.15 and 12.64 m.g/100g in *Agaricus bisporus* and *Pleurotus sajor caju* mushrooms respectively. On the whole, *Agaricus bisporus* mushroom contained significantly higher content of P, Zn, K, Cu and Mn than *Pleurotus sajor caju* mushroom and lower amount of Ca and Fe.

Mushrooms are considered to be an excellent source of potassium [7, 8, 16] and good source of iron and phosphorus [15]. As mushrooms are grown on waste agro wastes, so its mineral content is largely dependent on the amount of minerals present in the substrate. Mineral content of the substrate used influences the mineral content of the sporophore because minerals present in the substrate taken by growing mycelium and translocated to the fruit bodies [17, 18].

3.2 Vitamin content

Thiamine and riboflavin contents were 1.05 and 1.12mg/100g and 4.13 and 3.71/100g on dry weight basis in mushrooms *Agaricus bisporus* (white button), *Pleurotus sajor-caju* (dhingri), respectively (Table 2.).

Agaricus bisporus mushroom contained significantly higher per cent of riboflavin than *Pleurotus sajor caju* mushroom, whereas the differences were non-significant with respect to thiamine content. The amount of ascorbic acid was almost double in *Pleurotus sajor caju* mushroom. On fresh weight basis, ascorbic acid content was 2.25 and 4.34 mg/100g in *Agaricus bisporus* and *Pleurotus sajor-caju* mushrooms respectively.

Thus, both mushrooms were found to be rich in riboflavin and contained appreciable amount of thiamine and vitamin C. Hundred gram of mushroom seems to take care of daily requirement of thiamine of an adult, whereas, 25-40g of mushroom can meet the daily requirement of riboflavin of an adult. The results of the present study are in agreement with those reported by various workers [8, 19, 20].

3.3 Tables

Table 1: Thiamine, riboflavin and vitamin C (mg/100g) contents of white button (*Agaricus bisporus*) and dhingri (*Pleurotus sajor caju*) mushrooms.

Mushroom variety	Thiamine (Dry weight basis)	Riboflavin (Dry weight basis)	Ascorbic acid (Fresh weight basis)
White button mushroom *(Agaricus bisporus)*	1.05 ± 0.05	4.13 ± 0.02	2.25 ± 0.13
Dhingri mushroom *(Pleurotus sajor- caju)*	1.12 ± 0.01	3.71 ± 0.01	4.34 ± 0.27
t calculated	NS	17.64	7.00

Table 2: Mineral content of white button (*Agaricus bisporus*) and dhingri (*Pleurotus sajor caju*) mushrooms (mg/100g dry weight basis).

Mushroom variety	Iron	Calcium	Phosphorus	Zinc	Potassium	Copper	Manganese
White button mushroom (*Agaricus bisporus*)	10.15 ± 0.13	47.00 ± 2.52	1350 ± 6.66	13.23 ± 0.01	4015 ± 4.02	5.02 ± 0.14	4.90 ± 0.10
Dhingri mushroom *(Pleurotus sajor caju)*	12.64 ± 0.01	73.00 ± 1.15	1246 ± 1.53	12.77 ± 0.01	3218 ± 2.45	3.80 ± 0.21	4.50 ± 0.10
t calculated	18.70	9.39	15.22	24.02	167.40	4.82	2.83

4. Conclusion

Agaricus bisporus and *Pleurotus sajor caju* mushroom were excellent source of potassium and phosphorus and contained appreciable amount of calcium, zinc, iron, copper and manganese. They are very good source of thiamine, riboflavin and ascorbic acid. Being rich source of vitamins and minerals, they should be included in diet.

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