



Micología Aplicada International

ISSN: 1534-2581

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Colegio de Postgraduados

México

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Nutritional value of edible wild mushrooms collected from the Black Sea region of Turkey
Micología Aplicada International, vol. 14, núm. 1, January, 2002, pp. 1-5
Colegio de Postgraduados
Puebla, México

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NUTRITIONAL VALUE OF EDIBLE WILD MUSHROOMS COLLECTED FROM THE BLACK SEA REGION OF TURKEY

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Accepted for publication October 6, 2001

ABSTRACT

Three edible wild mushrooms *Cantharellus cibarius* (yellow mushroom), *Lactarius piperatus*, and *Boletus edulis* were studied for chemical composition and nutritional value. The edible wild mushrooms have been consumed especially in rural and rainy area of Turkey for a long time. In this research, proximate composition; moisture, ash, carbohydrate, fat, protein, vitamins; vitamin C (L-ascorbic acid), B1 (thiamine), B2 (riboflavin), folic acid, panthotenic acid, niacin, minerals; Zn, Cu, K, Na, Fe, Ca, Cr, and P of edible wild mushrooms were investigated. The edible wild mushrooms that were investigated in this research have a balanced and high nutritional value.

Key words: *Boletus edulis*, *Cantharellus cibarius*, *Lactarius piperatus*, nutrition, minerals, vitamins.

INTRODUCTION

Mushrooms are familiar items that have long been consumed as a food high in nutritive value and as a contribution to a healthy diet. Mushrooms are produced today not only for their food,

but also for their metabolic products; many of which are said to possess antitumor, immunoregulatory and hypotensive functions without adverse side effects⁵.

The use of mushrooms as food is probably

as old as civilization. They were preferred only for culinary characteristics, while the nutritive value of mushrooms was recognized much later ^{6,12}.

It has been well established that cultivated mushrooms contain reasonable amounts of proteins, carbohydrates, minerals and vitamins. Nutritionally they rank between high grade vegetables and low grade meat ⁸. Although mushrooms can not directly substitute for meat, fish, or eggs, they can serve as a good substitute in preventing protein malnutrition. Mushrooms are rich in proteins and certain essential amino acids ^{8,12}. Mushrooms are a good source of protein and when examined in detail, they have a good balance of amino acids compared to most of plant foods ¹⁵. Amino acid content changes according to mushroom species, compost and atmospheric nitrogen ¹⁰.

Mushrooms have good dietary crude fiber and they are good sources of important food compounds which are valuable for human nutrition ^{12,13,14,15}. Nutritional value and chemical composition of *Agaricus bisporus* (cultivated mushroom) and some edible wild mushrooms grown in Turkey were investigated ²². *Cantarellus cibarius*, which grows in northern Turkey, was studied, NDF (detergent fibre) ranged from 40.01 to 43.09% (dry wt. basis) ²². Three species of wild mushrooms from Alexandria, Egypt, were investigated ²⁰. The mean ratio of crude fibre to total was found to be about 5.7 for mushrooms while being much smaller for vegetables ²³. Some polysaccharide-containing materials have been successively extracted from the fruiting bodies of *A. blazei*, fractionated and assayed for antitumor activity ¹¹. *Coriolus versicolor* (Fr.) Quel. has biological activity of PSK (krestin), a protein bound polysaccharide. PSK may be useful in preventing the risk of HIV infection, and for treatment of AIDS ¹⁷.

Mushrooms are rich and balanced sources of K, Na, Fe, and P. They are high in K and low in Na, so they are ideal foods for those wanting to reduce sodium intake for health reasons ⁶. Kikuchi, *et al.* ¹³ studied the metal content of mushrooms species including *Lactarius* sp. They found a good balance for human health, K averaged 2190 mg/g, while Na was 60 mg/g.

We have studied the composition of three commonly eaten wild mushrooms, in order to evaluate their nutritional value.

MATERIALS AND METHODS

Three species of edible wild mushrooms *Lactarius piperatus* (L. ex Fr.) S.F. Gray, *Cantharellus cibarius* Fr. (yellow mushroom) and *Boletus edulis* Bull. ex Fr. (Bear mushroom) were obtained from Mantar, a mushroom exporting company in Ismir. They had been collected from the Black Sea region of Turkey. They were kept at -20 C in a freezer until they were analyzed.

Moisture, ash, fat and protein contents were determined according to standard methods ¹. The 6.25 factor was used to convert nitrogen to crude protein. Total carbohydrate quantity was calculated by subtracting the ash, fat, and protein from the dry weight ¹⁴. Minerals (Ca, Cr, Cu, Fe, K, Na, and Zn) were analyzed by atomic absorption spectrophotometry (AAS) ¹. Lanthanum was added for Ca determination ²². P analysis was made by spectrophotometry using the method of Nagy ¹⁶, but methods used for all analyses of all other nutrients were the same as those we used previously ⁴. Vitamins B1, B2, C, folic acid, panthotenic acid, and niacin were determined using standard methods ^{1,2,21}. The analyses were obtained from samples of each species that had been mixed to obtain average samples. Each value represents the average of three analyses (P<0.05).

RESULTS AND DISCUSSION

The results of proximate composition, minerals and vitamins are given **Tables 1-3**.

Table 1, shows results of proximate composition of three species of edible wild fungi which were collected from Northern Turkey. Fat contents were between 0.72-1.70%. In the literature the fat contents of other kinds of wild mushrooms are given as follows: *P. ostreatus*, 0.14%; *Volvariella volvacea*, 0.74%; *Terfezia claverigi*, 0.68%; *Tirmania nivea*, 1.76%; *Morchella esculenta*, 0.22%; and *Lactarius deliciosus*, 0.36% ^{3,18,22}. The fat content of edible wild mushrooms in this study (0.72-1.70%) are in agreement with those reported above.

Table 1. Proximate composition of *C. cibarius*, *L. piperatus* and *B. edulis*. Analysis type (%).

	Mushroom species		
	<i>C. cibarius</i>	<i>L. piperatus</i>	<i>B. edulis</i>
Fat	0.72	0.18	1.70
Protein	3.10	2.67	7.39
Moisture	85.56	89.94	80.53
Ash	1.77	0.81	1.15
Carbohydrate	8.86	6.50	9.23

The highest value of protein content was *B. edulis*, 7.39%, and the lowest value *L. piperatus*, 2.67%. Zakhary, *et al.* ²³ determined protein content of *Te. clovergi* (4.82%) and *Ti. nivea* and 6.68%. The range of protein was determined for *Agaricus rodmani* and *A. campestris* to be between 4.50% and 4.73% ²⁰. Protein contents of edible wild mushrooms vary according to species. Moisture content of *B. edulis* was the lowest, 80.53% and *L. piperatus* was the highest, 89.94%. *C. cibarius* had the highest ash content, 1.77 %. *B. edulis* had the highest total carbohydrate, 9.23%, (**Table 1**). These results show

differences among the species, but they are in agreement with those reported by others ^{18,22,23}.

Table 2. Mineral contents of *C. cibarius*, *L. piperatus* and *B. edulis*. Minerals (ppm).

	Mushroom species		
	<i>C. cibarius</i>	<i>L. piperatus</i>	<i>B. edulis</i>
Zn	41.72	5.72	41.72
Cu	9.20	3.79	7.86
K	5289.45	2749.30	2032.54
Na	388.00	150.30	252.50
Fe	10.47	33.83	7.39
Ca	21.32	29.74	11.95
Cr	Trace	Trace	Trace
P	107.93	1363.90	222.60

Results obtained for K and Na are agreement with those reported in the literature ²⁰. The mineral content shows some differences between species. The results in **Table 2** are usually in agreement with those previously reported ^{9,16,19,23}.

The data in **Table 3**, shows the amounts of B-complex vitamins and vitamin C in the wild mushroom species. B1 vitamin content of *C. cibarius* was the highest among the three species. Compared with results in the literature for *Lactarius* sp. of 0.054 mg/100g ⁷, our specimens were rich in vitamin B1. Our results show that some other edible wild mushrooms grown in Turkey have even higher B1 vitamin content. Our analyses for both *L. piperatus* and *B. edulis* also showed greater folic acid (**Table 3**); 0.075 mg/100g has been reported for *L. esculenta* and 0.036 mg/100g for *L. deliciosus* ²². However our vitamin B2 determinations in all three species were low; 0.844 mg/100g has been reported for *Lactarius deliciosus* ⁷.

Vitamin C contents of studied species were between 4.21 and 6.05 mg/100g. It had been

Table-3 Water soluble vitamin contents of some edible wild mushrooms Vitamins (mg/100g)

	Mushroom species		
	<i>C. cibarius</i>	<i>L. piperatus</i>	<i>B. edulis</i>
B1 (thiamin)	0.300	0.124	0.105
B2 (riboflavin)	0.117	0.092	0.092
Folic acid	0.055	0.31	0.290
Vitamin C	4.97	6.05	4.21
Panhotenic acid	2.38	2.83	2.64
Niacin	5.94	6.37	6.07

reported between 5.22 and 7.36 mg/100 g for *Lactarius deliciosus* by Duda, *et al.* ⁷, but others found only 2.83 mg/100g for *L. deliciosus*, 2.5 mg/100g for *A. rodmani* and 2.3 mg/100g for *A. campestris*. Vitamin C levels are variable among species ^{22,23}.

Panhotenic acid contents of *M. esculenta* and *L. deliciosus* of 3.16 and 2.62 mg/100g have been reported ²². Our results (**Table 3**) are similar even for the other genera. Variations in niacin contents were also similar to those reported for other edible wild mushrooms ²².

Mushrooms are a well balanced food stuff when compared with other vegetables. Mushrooms are good source of amino acids, minerals and water soluble vitamins. They can be recommended for the countries suffering from insufficient nutrition; especially developing or third world countries.

Mushrooms have long been a popular food in Turkey and particularly in the Black Sea area where the climate is wet and there are large forests. Local people collect mushrooms for their own table and for sale. They recognize the benefit of the additional food, added flavor, and the income from local sales, and from export to Switzerland, Germany, and other countries. However, the nutritional value of these mushrooms has not been known and so that value has not previously been well appreciated.

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