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Nutritional Studies on Five Wild *Lentinus* Species from North-West India

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Abstract: Five wild edible *Lentinus* species viz., *L. sajor-caju*, *L. connatus*, *L. torulosus*, *L. cladopus*, *L. squarrosulus* collected from different localities of North West India and studied for nutritional components viz., protein, carbohydrates, crude fat, fibres, minerals and ash content. Nutritional studies were carried out on mushrooms dried at 45°C. Protein content was found to be maximum in *L. torulosus* (2.45%) while *L. connatus* (0.48%) contained lowest amount of crude fat and *L. sajor caju* contained maximum percentage of crude fibres (3.99 %). Ash content was found to be maximum in *L. squarrosulus* (2.21 %). Amongst the minerals, Ca and Mg was found maximum in *L. connatus* (221.3 and 1722 mg/100 g of the dried sample, respectively), Zn and Na in *L. squarrosulus* (6.100 and 2.392 mg/100g, respectively) while Cu was found to be maximum in *L. torulosus* (3.33 mg/100 g) and K was maximum in *L. cladopus* (0.0579 mg/100 g).

Key words: Wild mushrooms · *Lentinus* · Nutritional studies · Mineral composition

INTRODUCTION

The genus *Lentinus* includes the wood decaying species, characterized by decurrent lamellae, homoiomerous context, dimitic sporocarp tissues and hyaline elliptical spores [1]. Most of the *Lentinus* species are edible and used by the people because of the presence of significant amount of proteins, lipids, fats, minerals, vitamins in them from dietary point of view as reported by Chang and Miles [2]. In recent times, lot of work in this regard is being done on Nigerian species of *Lentinus* because they have assumed greater importance in the diets of both rural and urban dwellers in the African subcontinent as stated by Ogundana and Fagade [3], Adejumo and Awosanya [4]; Nwanze *et al.* [5]. In this paper five wild *Lentinus,* namely *L. sajor-caju*, *L. connatus*, *L. torulosus*, *L. cladopus* and *L. squarrosulus* collected from North West India with an altitude ranging from 200-3400 m (Table 1) have been investigated with the objective to know their relative proximate nutritional and mineral composition.

Fig. 1-5: Basidiocarps of wild *Lentinus* species

Fig. 1: *Lentinus sajor - caju*

Fig. 2: *Lentinus connatus*

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Fig. 3: *Lentinus torulosus*

Fig. 4: *Lentinus cladopus*

Fig. 5: *Lentinus squarrosulus*

Table 1: Showing associated natural host and location with altitude and forest type

Species	Host	Location	Altitude (m)	Type of forest
Lentinus sajor-caju	*Bauhinia variegata*	Sirmour (Himachal Pradesh)	672	Mixed
Lentinus connatus	*Mangifera indica*	Chandigarh (Punjab)	200	Plains
Lentinus torulosus	*Pinus roxburghii*	Palampur (Himachal Pradesh)	850	Pine forest
Lentinus cladopus	*Albizzia chinensis*	Palampur (Himachal Pradesh)	1200	Mixed
Lentinus squarrosulus	*Juglans regia*	Rajouri (Jammu and Kashmir)	3400	Mixed

MATERIALS AND METHODS

All the five fully mature samples were collected from various localities of North West India given in Table 1. These were subsequently dried in a hot air drier at 45°C for preservation. The dried samples were taxonomically worked out and identified for undertaking the nutritional studies. The analysis of each collected sample for nutritional attributes was carried out following standard protocols.

Estimation of Total Protein [6]: Total protein was estimated by AOAC (1990) method through Kjeldahl apparatus and multiplying the nitrogen content by factor 6.25.

Estimation of Macro and Micro Minerals [7]: Minerals were determined with the help of Atomic Absorption Spectrophotometer (Perkin Elmer precisely A Analyst 400).

Estimation of Crude Fat [8]: Crude fat was determined by extraction through Soxhlet apparatus using petroleum ether by employing the formula:

$$\% \text{ Crude fat} = \frac{\text{Weight of ether soluble material}}{\text{Weight of sample}} \text{ X } 100$$

Estimation of Crude Fibres [8]: Crude fibres were estimated through acid alkali treatment method on fat free samples by using formula:

$$\text{Crude fibre (\%)} = \frac{\text{Weight of crude fibre}}{\text{Original weight of sample}} \text{ X } 100$$

Ash contents were calculated by ignition of silica dishes containing the 5-10 g sample up to 525°C for 4-6 hrs and calculated with the formula.

$$\text{Ash content (\%)} = \frac{\text{Weight of the ash (g)}}{\text{Weight of the sample taken (g)}} \text{ X } 100$$

Moisture content were estimated by taking 5 g of sample in pre weighed moisture dishes and dried in the hot air oven at 70°C for a period of 16-18 hours. After drying the lid was replaced, samples were cooled in a desicator and reweighed.

$$\text{Moisture content (\%)} = \frac{\text{Loss of weight (g)}}{\text{Weight of the sample (g)}} \text{ X } 100$$

Estimation of Total Carbohydrates [8]: Total carbohydrates were calculated with following formula:

Carbohydrates (%) = 100- (Moisture content + Protein content + Crude fat + Ash content + Crude fibers)

RESULTS AND DISCUSSION

Evaluation of Nutritional Components: The results of the studies carried out on the five species of *Lentinus,* namely *L. sajor-caju*, *L. connatus*, *L. torulosus*, *L. cladopus* and *L. squarrosulus* showed that about 85.82 - 89.10 % composition of these dried mushrooms is constituted by the carbohydrates, 1.83 - 3.99 % fibres, 0.525 - 2.450 % protein, 1.52 - 2.21 % ash content and remaining part is constituted by the water (Table 2). Among these samples *L. cladopus* contained maximum percentage of carbohydrates (89.10%) followed by *L. connatus* (88.32%), *L. squarrosulus* (87.42%) and *L. torulosus* (87.33 %) and minimum amount was observed in *L. sajor-caju* (85.82%). Mushrooms are found to be richer in carbohydrate composition than protein as reported by Chang and Miles [9]. Dietary fibres were found to be maximum in *L. sajor-caju* (3.99 %) followed by *L. torulosus* (2.11 %), *L. connatus* (2.02 %), *L. cladopus* (1.91 %) and least amount of dietary fibers were observed in *L. squarrosulus* (1.83 %). Mushrooms are richer in fibres content as stated by Nuhu Alam *et al.* [10], Arun Ingale and Anita Ramtek [11]. Protein content were found maximum in *L. torulosus* (2.450 %) followed by

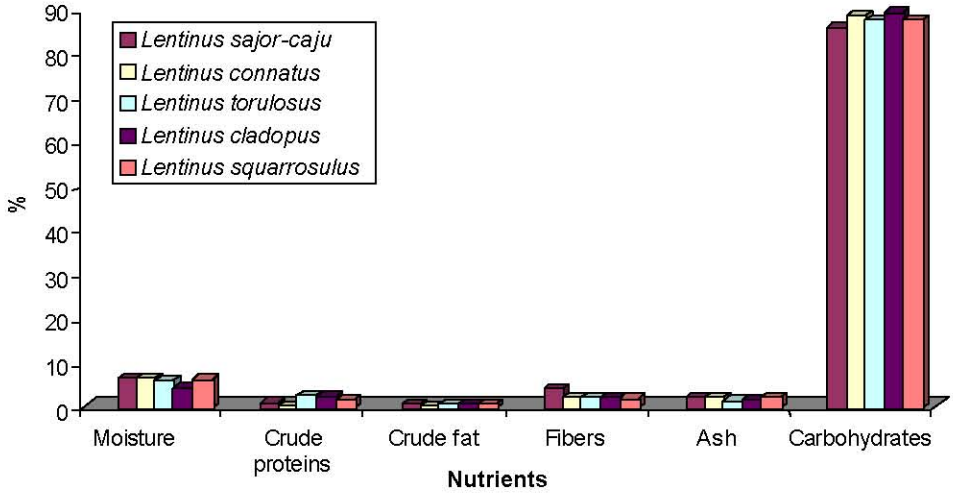

Fig. 6: Proximate analysis of five wild *Lentinus* species

Table 2: Nutritional components in five wild *Lentinus* species

Species	Moisture (%)	Proteins (%)	Crude fat (%)	Fibers (%)	Ash (%)	Carbohydrates (%)
Lentinus sajor-caju	6.43	1.050	0.80	3.99	1.91	85.82
Lentinus connatus	6.54	0.525	0.48	2.02	2.11	88.32
Lentinus torulosus	5.97	2.450	0.62	2.11	1.52	87.33
Lentinus cladopus	4.16	2.362	0.80	1.91	1.66	89.10
Lentinus squarrosulus	6.20	1.712	0.62	1.83	2.21	87.42

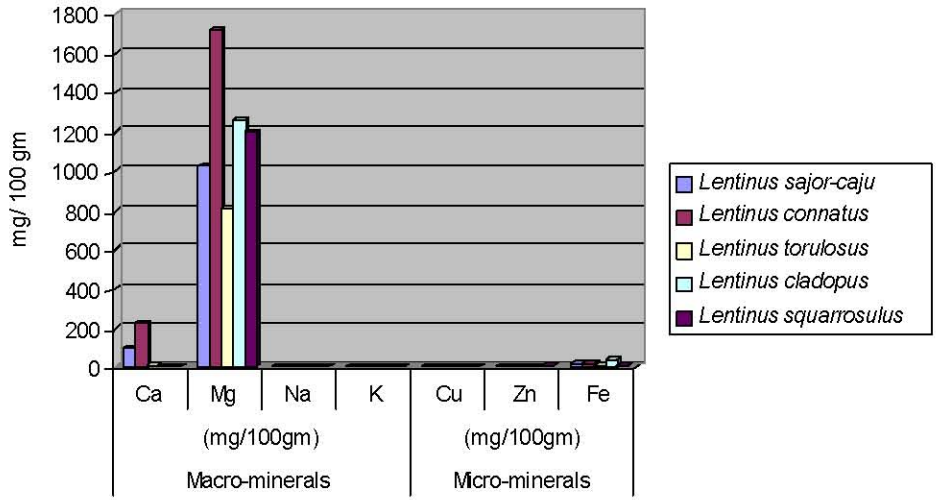

Fig. 6: Macro and Micro minerals of five wild *Lentinus* species

Table 3: Macro and Micro mineral elements in five studied wild *Lentinus* species

		Macro-minerals (mg/100gm)				Micro-minerals (mg/100gm)		
S.No.	Species Name	Ca	Mg	Na	K	Cu	Zn	Fe
1	*Lentinus sajor-caju*	97.30	1,028.6	0.726	0.0274	1.33	4.00	14.00
2	*Lentinus connatus*	221.30	1,722.0	0.708	0.0181	1.00	3.00	18.66
3	*Lentinus torulosus*	6.00	807.0	0.837	0.0196	3.33	3.33	11.00
4	*Lentinus cladopus*	5.66	1,260.0	1.150	0.0579	2.33	4.00	37.00
5	*Lentinus squarrosulus*	3.33	1,200.0	2.392	0.0530	0.75	6.10	6.41

L. cladopus (2.362 %), *L. squarrosulus* (1.712 %), *L. sajor-caju* (1.05%) and least amount were observed in *L. connatus* (0.525%). Ash content was maximum in *L. squarrosulus* (2.21%) followed by *L. connatus* (2.11 %), *L. sajor-caju* (1.91 %), *L. cladopus* (1.66 %) and least amount was found in *L. torulosus* (1.52 %). Crude fat was maximum in *L. sajor-caju* and *L. cladopus* (0.80%) followed by *L. torulosus* and *L. squarrosulus* (0.62 %) and out of these *L. connatus* (0.48%) was found to be the mushroom with least amount of crude fats. All the species contained lower in fat content. As it is further stated by Nuhu Alam *et al.* [10] that mushrooms contain least values for fat Although the nutritional study was carried out on dry preserved wild samples, however, small percentage of moisture was still found in these samples with maximum percentage of moisture in *L. connatus* (6.54%) and least in *L. cladopus* (4.16 %). It is also known that chemical composition of mushrooms are affected by number of factors. The results obtained are presented in Table 2.

Determination of Macro and Micro Mineral Elements: Out of the five wild samples examined for micro and macro mineral elements, maximum amount of Ca (221.3 mg) was recorded in *L. connatus* followed by *L. sajor-caju* (97.3 mg). As compared, in the other three species, the amount of Ca was insignificant. Mg was maximum in *L. connatus* (1,722 mg) followed by *L. cladopus* (1,260 mg). The other three species also possesses significant levels of this mineral with *L. torulosus* having minimum quantity (0.807 mg). Maximum amount of copper (3.33 mg) was recorded in *L. torulosus* followed by 2.33 mg in *L. cladopus* where as minimum quantity of this mineral (0.75 mg) was recorded in *L. squarrosulus*. Zn was maximum (6.10 mg) in *L. squarrosulus* followed by 4.0 mg in both *L. cladopus* and *L. sajor-caju* whereas minimum quantity (3.0 mg) of Zn was recorded in *L. connatus*. Maximum amount of Fe (37.0 mg) was recorded in *L. cladopus* followed by 18.66 mg in *L. connatus* whereas minimum amount (6.41 mg) was recorded in *L. squarrosulus*. Na was maximum (2.392 mg) in *L. squarrosulus* followed by 1.150 mg in *L. cladopus* whereas minimum quantity of this element (0.708 mg) was recorded in *L. connatus*. K was maximum (0.0579 mg) in *L. cladopus* followed by 0.053 mg in *L. squarrosulus*. Minimum amount of K (0.0181 mg) was recorded in *L. connatus* (Table 3). Using this proximate analysis, the mineral and analytical food value as approximate indices of nutritional quality, it would appear that some of these mushrooms fall between most legumes and meat.

In earlier studies, Gruen and Wong [12] indicated that edible mushrooms were highly nutritious and compared favorably with meat, egg and milk.

In conclusion all the studied *Lentinus* species possessed good amount of nutritional components as well as macro and micro mineral elements in them when the proximate composition was evaluated from 100 g of the dry sample. Although differences were observed in the net amount of individual mushroom components, however, each of the species exhibited richness in one or the other nutritional attributes and hence are good from culinary point of view. The results of the nutritional analysis of the mushroom samples showed that although the samples were dried at 45°C still these retained substantial moisture in them. Studies also revealed that these mushrooms contain relatively substantial amount of fibers which may be responsible for their good amount of ash contents thereby increasing their utility in the prevention of atherosclerosis [13]. The relatively high carbohydrates content recorded in the samples (Table 2) is a proof of their culinary potential for human consumption. This is in line with the report of Fasidi and Kadiri [14] in case of mature fruit bodies of *L. subnudus*. The samples examined presently showed appreciable quantities of protein in them. With regard to crude fats the observations made revealed that all the samples contain lower value of crude fat. Such properties of mushrooms are very useful for persons suffering from heart ailments as reported by Fukushima *et al.* [15]. The mineral levels, mainly potassium, iron and sodium in the mushrooms were higher than those reported for several cowpea varieties by Aletor and Aladetimi [16], but lower than those reported for fish, snails and broiler meat [17].

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