

## Comparative Account of Vitamin Content in Termitophilous and Lepiotoid Mushrooms of North-West India

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**Abstract:** The objective of present study was to determine the vitamins content (vitamin A, vitamin B<sub>1</sub>, B<sub>2</sub> and vitamin C) in seven wild edible termitophilous and lepiotoid mushrooms viz. *Termitomyces reticulatus*, *T. heimii*, *T. mammiformis*, *T. radicans*, *Macrolepiota dolichaula*, *M. rhacodes* and *Lepiota humei* collected from different localities of North- West India. The evaluated mushrooms were found to be good sources of vitamins. In these samples, vitamin A ranged from 0.01- 0.16 mg/100 g, vitamin B<sub>1</sub> 0.021- 0.80 mg/100 g, vitamin B<sub>2</sub> 0.13- 0.23 mg/100 g and vitamin C ranged from 0.18- 1.45 mg/100 g.

**Key words:** Edible mushroom • Vitamins • India

### INTRODUCTION

Mushrooms have been a food supplement in various cultures and they are cultivated and eaten because of their excellent culinary credentials including delicacy. Wild edible mushrooms are being collected for consumption because they are a good source of digestible proteins, carbohydrates, fibres, fats and vitamins [1-4]. Amongst the vitamins, riboflavin, biotin and thiamine [5] are commonly reported. Vitamins are essential for the normal growth and development as these have hormone-like functions as regulators of mineral metabolism (e.g., vitamin D). In view their relevance in general growth and development, the present study was undertaken to evaluate the vitamin content on seven wild edible species of termitophilous and lepiotoid mushrooms of North West India viz. *T. reticulatus*, *T. heimii*, *T. mammiformis*, *T. radicans*, *M. dolichaula*, *M. rhacodes* and *Lepiota humei* following standard biochemical procedures.

### MATERIALS AND METHODS

**Collection of Material:** Fully mature samples of all seven species were collected from North West India during monsoon season. The specimens were dried at 45° C for

preservation. The dried samples were used for undertaking the nutritional studies. The analysis of each collected sample for vitamins was carried out following standard methods [6].

#### Estimation of Vitamins

##### Estimation of Retinol (Vitamin A)

**Procedure:** For this purpose 3 g of sample, 5 ml of 50% (w/v) potassium hydroxide solution and 50 ml of ethyl alcohol were added and refluxed in a water condenser for 1 hr. The solution was then cooled and transferred to a 500 ml separator, to which 50 ml of hexane was added and shaken vigorously for 5 minutes resulting in formation of two separate layers. The organic layer was passed through sodium sulphate anhydrous into a 200 ml volumetric flask while the aqueous layer was shaken 3 times by taking 30 ml hexane each time. All the organic layers were pooled together and diluted to 200 ml with required amount of hexane. The absorbance in UV spectrophotometer at 325 nm was recorded. Using the factor 1830, the vitamins A content was calculated which is expressed as International units (IU), which primarily refers to their biological potency.

$$\text{Vitamin A (IU)/100 g sample} = \frac{\text{Sample absorbance} \times 200 \times 1830}{\text{Weight of the sample}} \times 100$$

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**Estimation of Thiamine (Vitamin B<sub>1</sub>)**

**Preparation of Buffer Solution:** To 6.8 g of potassium dihydrogen phosphate, 8 ml of 1 M sodium hydroxide solution was added and diluted with 1000 ml with water.

**Preparation of Dye Solution:** To prepare it, 0.06 g Bromothymol blue was dissolved in 100 ml of chloroform.

**Preparation of Standard Solution:** For this purpose Thiamine hydrochloride RS (100 mg) was dissolved in 100 ml of water.

**Working Standard Solution:** One ml of stock was diluted with 100 ml of sample buffer for preparation of sample solution. To 10 g of sample powder, 100 ml of buffer was added and filtered through Whatman filter paper.

**Procedure:** 10 ml of sample solution and working standard solution were taken in two different dry separating funnels. 10 ml of chloroform and 10 ml of dye solution were added to both of the solutions and shaken for 2 minutes continuously. Then, these were allowed to stand for 5 minutes with occasional shaking. The chloroform layer was collected by passing it through sodium sulphate anhydrous. The readings were taken at 420 nm using Shimadzu UV 118 spectrophotometer (chloroform was used as blank).

$$\text{Thiamine HCl (mg)/100 g of sample} = \frac{\text{SAA} \times \text{STW} \times 1 \times 10 \times 10 \times 1 \times \text{STP}}{\text{STA} \times 100 \times 100 \times 1 \times \text{SAW} \times 10 \times 10} \times 100 \times 1000$$

Where SAA represents sample absorbance; STA represents standard absorbance; SAW represents sample weight, STP represents standard purity while STW represents standard weight.

Determination of thiamine

$$\text{Thiamine (mg) /100 g of sample} = \frac{\text{Thiamine HCl (mg) / 100 g of sample} \times \text{Molecular wt. of thiamine (300.77)}}{\text{Molecular wt. of thiamine HCl (337.2)}}$$

**Estimation of Riboflavin (Vitamin B<sub>2</sub>)**

**Procedure:** To 5 g of sample powder, 150 ml of water and 5 ml of glacial acetic acid were added. The solution was boiled for 5 minutes and then cooled. After that, 30 ml of 1.0 M sodium hydroxide solution was added and diluted to 550 ml with water. The solution was filtered and absorbance was measured at 444 nm in Shimadzu UV-1201 spectrophotometer(water was used as blank).

$$\text{Riboflavin (mg) /100 g of sample} = \frac{\text{SA} \times 500 \times 1}{328 \times \text{SW} \times 100} \times 100 \times 1000$$

Where 328 represents molar extension coefficient; SA represents sample absorbance; while SW represents the sample weight.

**Estimation of Ascorbic Acid (Vitamin C)**

**Preparation of Metaphosphoric Acetic Acid Solution (MPAA):** To 15 g of metaphosphoric acid, 40 ml of glacial acetic acid was added and diluted with 100 ml of water.

**Preparation of 2,6-Dichlorophenol Indophenol Solution:** 2, 6-dichlorophenol indophenols salt (0.05 g) was diluted with 100 ml of water and the solution was filtered.

**Preparation of Standard Solution**

**Stock Solution:** To 0.05 g of L-ascorbic acid standard, 20 ml of MPAA solution was added and diluted with 250 ml water.

**Preparation of Sample Solution:** To 10 g of sample powder, 20 ml of MPAA solution was added and then it was diluted with 500 ml water. Subsequently the solution was filtered through filter paper.

**Procedure:** To 10 ml of standard stock solution, 5 ml of MPAA solution was added and titrated against 2, 6-dichloro-phenole indophenol solution till the appearance and persistence of pink colour for 10 seconds. The titration was completed within 2 minutes. The titer value was noted. Sample solution (100 ml) was taken and same procedure was repeated.

$$\text{Ascorbic acid (mg)/ 100g of sample} = \frac{\text{SAV} \times \text{STV} \times 10 \times 500 \times 1 \times \text{STP}}{\text{STV} \times 250 \times 1 \times \text{SAW} \times 100 \times 100} \times 100$$

Where SAV refers to sample titre value; STV refers to standard titre value; STW refers to standard weight; SAW refers to sample weight and STP refers to standard purity.

**Statistical Analysis:** For each one of the mushroom species three samples were analyzed and also all the assays were carried out in triplicate. The results are expressed as mean values and standard deviation (SD).

Table 1: Vitamins in different species of termitophilous and lepiotoid mushrooms

Sr. No.	Species	Vitamin A(mg/100g)	Vitamin B1(mg/100g)	Vitamin B2(mg/100g)	Vitamin C(mg/100g)
1	<i>T. reticulatus</i>	0.01±0.00	0.26±0.02	0.23±0.01	1.45±0.10
2	<i>T. heimii</i>	0.12±0.01	0.21±0.01	0.25±0.01	0.24±0.01
3	<i>T. mammiformis</i>	0.11±0.01	0.28±0.01	0.21±0.01	0.30±0.01
4	<i>T. radicans</i>	0.10±0.02	0.42±0.04	0.20±0.01	0.96±0.03
5	<i>M. dolichaula</i>	0.07±0.01	0.75±0.05	0.13±0.02	0.48±0.02
6	<i>M. rhacodes</i>	0.09±0.00	0.80±0.04	0.13±0.03	0.36±0.01
7	<i>Lepiota humei</i>	0.16±0.01	0.49±0.01	0.20±0.03	0.18±0.01

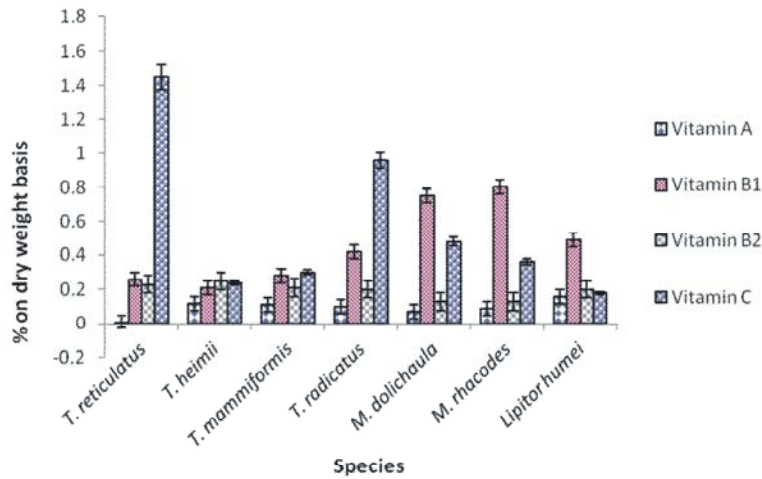


Fig. 1: Histogram showing contents of various vitamins in different species of termitophilous and lepiotoid mushrooms

All the studied mushrooms possessed significant amount of vitamins (Fig.1). The maximum content of vitamin A in the analyzed mushrooms was observed in *Lepiota humei* (0.16 mg/100 g) followed by *T. heimii* (0.12 mg/100 g) and minimum quantity was documented in *T. reticulatus* 0.01 mg/100 g. The thiamine (vitamin B<sub>1</sub>) content ranged from 0.21 mg/100 g in *T. heimii* to 0.80 mg/100 g in *M. rhacodes*. The riboflavin (vitamin B<sub>2</sub>) content was maximum in *T. heimii* (0.25 mg/100 g) and minimum in *M. rhacodes* and *M. dolichaula* (0.13 mg/100 g). Ascorbic acid (vitamin C) was 1.45 mg/100 g in *T. reticulatus* which was maximum in comparison to other species while minimum amount of Vitamin C was documented in *Lepiota humei* (0.18 mg/100 g).

### DISCUSSION

The vitamins content of many mushrooms have been investigated and such investigations show that they are rich in vitamins C, B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub> and vitamin D [7, 8]. Since vitamins are essential in the diet of man and conventional sources of vitamins are scarce [9]. It is therefore pertinent therefore, that efforts were made to evaluate the cheap sources of vitamins from nature. Vitamin C is one of the

major contributors to the antioxidant activity of fruits, vegetables and mushrooms [10]. The amount of vitamin C in the presently investigated mushrooms is significantly higher in comparison to the amount of vitamin C in *Lycoperdon perlatum*, *Clavaria vermiculris*, *Marasmius oreades*, *Russula delica*, *Morchella conica* and *Pleurotus pulmonarius* [11-13]. *Pleurotus ostreatus* has been reported to contain higher amount of vitamin C followed by niacin and riboflavin [14]. The presently examined mushrooms were also found to be rich in vitamin B complex which helps in the breakdown of proteins, fats and carbohydrates. These species contained good amounts of thiamine (up to 0.75 mg/100 g) and riboflavin (up to 0.23 mg/100 g). Furlani *et al.* [15] analyzed vitamins B<sub>1</sub> and B<sub>2</sub> contents in cultivated mushrooms (*Agaricus bisporus*, *Lentinula edodes* and *Pleurotus* sp.) and the results showed that the amount of thiamine (vitamin B<sub>1</sub>) ranged from 0.004 to 0.08 mg/100 g in comparison to riboflavin (vitamin B<sub>2</sub>), which ranged from 0.04 to 0.3 mg/100 g. As compared in the presently investigated taxa, the amount of vitamin B<sub>1</sub> evaluated is 0.80 mg/100 g and vitamin B<sub>2</sub> 0.25 mg/100 g, which is substantially high. The results obtained in the present study are in agreement with the similar nature of work from elsewhere [16, 17].

The amount of riboflavin in *T. reticulatus* (1.45 mg/100 g dw) was somewhat higher than that obtained by Bano and Rajarathnam (0.9 mg/100 g dw) [7, 8] and lower than reported in data compiled by Crisan and Sands [18] and Miles and Chang [19] (4.9 mg/100 g dw).

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