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Nutritional composition and mineral contents of common edible wild mushrooms from Mamit and Champhai Districts of Mizoram, India

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Abstract - The present study was conducted to assess the nutritional and mineral composition of wild edible mushrooms from Mizoram, India. Mushrooms are primarily gathered as a significant food source in Mizoram, with certain species holding special value in Mizo traditional cuisine. However, their nutritional properties have not been thoroughly investigated and documented. Therefore, ten wild edible mushrooms collected from Mamit and Champhai Districts of Mizoram were analysed for their nutritional composition and mineral contents. The study revealed that mushrooms exhibit high levels of protein (16.04-32.08%) and carbohydrates (35.92-56.63%), while maintaining relatively low fat content (2.11 - 3.87%). The minimum and maximum mineral contents of mushrooms were determined as mg/g for K (11.6 - 22.4), mg/100g for Na (14.7 - 38.6), Fe (3.5 - 26.8), Zn (4.7 - 31.5), and Ca (1.5 - 14.1). Based on their nutritional composition, the selected wild edible mushrooms were found to be an excellent source of food, offering a balanced and high nutritional value. They possess the potential to significantly contribute to the nutritional needs of people, particularly in rural areas.

Keywords: Edible mushrooms, foods, health benefits, Indo-Burma biodiversity hotspot, proteins, nutritional profile.

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1. Introduction

An economic parity between the rich and the poor has emerged as a result of rising food costs. For instance, when food costs keep on rising, both the wealthy and the poor are facing the same constraints and economic challenges. In this regard, people living in rural areas may turn to foraging for wild edible mushrooms as a means of earning a livelihood (Mortimer *et al*., 2012; Zothanzama *et al*., 2018; Li *et al*., 2021). This economic opportunity can help those who are less fortunate to improve their financial situation. At the same time, the indigenous people of Mizoram, due to their limited knowledge of mycology, only harvest and consume a small number of wild edible mushroom species (Zothanzama *et al*., 2018). Currently, the importance of wild edible mushrooms in Mizoram is overshadowed by the appeal of cultivated mushrooms.

For thousands of years, the fruiting bodies of higher fungi have been recognized and utilized as a reliable source of food, and people have gathered and consumed these fungal fructifications due to their nutritional value and palatability (Mattila *et al.,* 2001; Hyde *et al*., 2019). Mushrooms have a long-standing association with humans and exert a significant biological and economic impact making them an essential component of sustainable development and human well-being (Hrudayanath & Sameer, 2015). Mushrooms are highly nutritious foods (Manzi *et al.,* 1999), rich in vitamins, proteins and minerals while being low in fats and calories (Gençcelep *et al.,* 2009; Kalač, 2009). The presence of natural antioxidants in wild edible mushrooms makes them a suitable and readily available source of antioxidants (Elmastas *et al.,* 2007; Chye *et al.,* 2008; Kalyoncu, 2010) and offers a valuable source of dietary nutrients, contributing to a well-rounded and healthy diet.

The Indo-Burma hotspot is renowned for its diverse flora and fauna (Rai & Lalramnghinglova, 2010) and extents across various ecosystems and covers parts of eastern India including Mizoram, southern China, Myanmar, Thailand, Vietnam, Lao PDR, and the non-marine regions of Cambodia (Rai & Lalramnghinglova, 2011; Rai & Panda, 2013). The high humidity experienced during the monsoon period in Mizoram creates an ideal environment for diverse fungi to thrive (Bisht, 2011; Zothanzama, 2011; Zohmangaiha *et al.,* 2019; Chawngthu *et al*., 2023, Thachunglura *et al*., 2023a). Nevertheless, wild edible mushrooms seem to be consumed solely due to their edibility and accessibility, rather than their nutritional value or other potential health benefits (Zothanzama *et al*., 2018; Thachunglura *et al*., 2023b). In Mizoram, a study on the nutritional properties of mushrooms remains insufficient, leaving their nutritional value largely unknown. Further studies and educational initiatives are crucial to increase awareness and understanding of mushrooms in Mizoram. Herein, the present study can contribute to promoting a broader understanding of the safety and nutritional value of various edible wild mushrooms, which are vital as a food source in the region.

2. Materials and methods

2.1 Study sites

An ecologically relevant state of India, Mizoram covers an area of 21,081 sq. km and is positioned between the geographical coordinates of 21° 58' and 24° 35' N Latitude, and 92° 15' and 93° 20' E Longitude and crosses by the Tropic of Cancer precisely at the latitude of 23° 30' N. Mizoram, situated within a crucial biodiversity hotspot in India, is of significant importance due to its rich and diverse variety of flora and fauna, contributing substantially to the ecological wealth and global recognition of the region. The Mamit District features a milder climate with softly rolling hills, while the Champhai District, due to its higher elevation, offers cooler temperatures and hilly terrain (Figure 1).

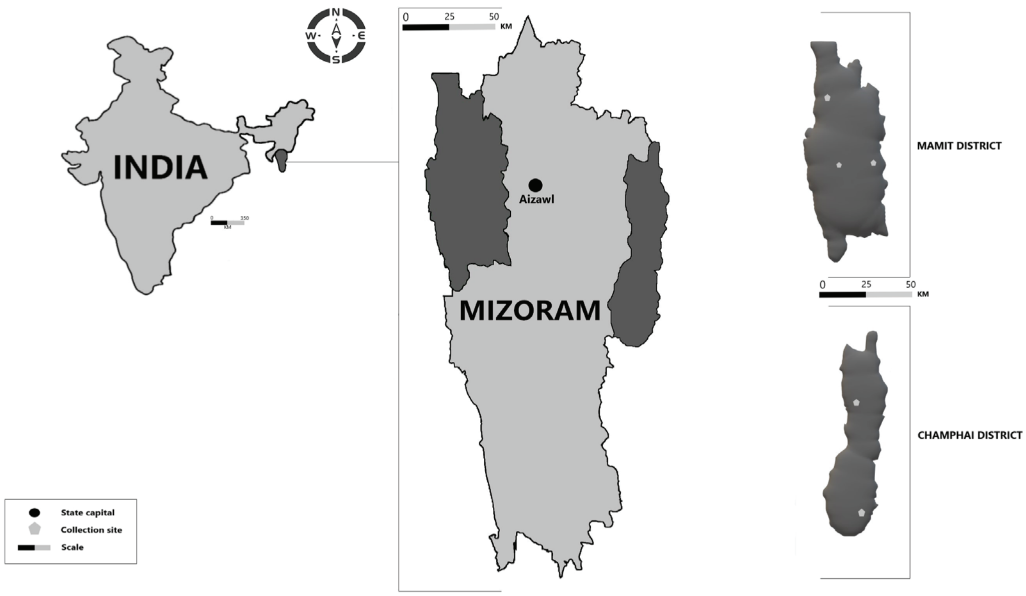

Figure 1. Map indicating study sites (Mamit and Champhai District)

2.2 Collection and preparation of specimen

Basidiome were collected from Mamit and Champhai District of Mizoram during the rainy season in 2021-2022. The samples were carefully cleaned to free them from extraneous material and stored in air-tight containers which were properly labeled immediately after the collection. Furthermore, photographs of each sample were taken both in the field and the laboratory (Zothanzama, 2011). Ten samples were selected for assessing their nutritional values, and 150 g of the respective species was initially oven dried at 45°C for two consecutive days to attain a consistent weight. The drying was performed without separating the stipe and pileus. Once completely dried, the samples were ground into a fine powder and transferred into polythene bags. These bags were properly labeled, sealed tightly to prevent moisture absorption, and stored in a refrigerator at 4 °C until further analysis.

2.3 Identification of specimen

The collected specimens were identified using standard methods based on macroscopic and microscopic characteristics. The identification process involved careful observation and comparison of various morphological features of the mushroom. To aid in the identification process, appropriate literature and references related to the taxonomy of mushrooms and identification were consulted (Arora, 1986; Bisht, 2011; Zothanzama, 2011; Phillips *et al.,* 2010; Mortimer *et al*., 2014).

2.4 Chemical analysis

The samples were analysed for moisture, fat, protein, ash, and crude fiber contents using the standard methods of the Association of Official Analytical Chemists (AOAC, 2000). Moisture content was determined by drying the sample at 105 °C. Total Nitrogen was determined by the micro-Kjeldahl method and protein content was calculated as total N × 6.25 . Fat content was determined by using the Soxhlet apparatus with petroleum ether. Crude fibre content was determined using a fibre digester. Ash content was determined by incinerating the sample in muffle furnace at 600 °C for 8 h. The carbohydrate content was determined by summing up the percentages of moisture, crude protein, fat, crude fiber and ash, then subtracting that total from 100% (Raghuramulu *et al*., 2003; Onwuka, 2005). Energy value [(2.62 × %protein) + (8.37 × %fat) + (4.2 × %carbohydrate)] of the samples was calculated using the conversion factors provided by Crisan and Sands (1978). Minerals such as potassium (K), sodium (Na), iron (Fe), zinc (Zn), and calcium (Ca) were determined by using an atomic absorption spectrophotometer after dry ashing of the sample (Gençcelep *et al.,* 2009).

2.5 Statistical analysis

For each one of the mushroom species three samples were used and all the assays were carried out in triplicate. The results are expressed as mean values and standard error (SE). The results were analyzed using one-way analysis of variance (ANOVA) followed by Tukey's HSD Test with $\alpha = 0.05$. This analysis was carried out using GraphPad Prism 5.0 (GraphPad Software, Inc., USA).

3. Results and discussion

From the collection, 10 wild edible mushrooms were identified based on their macro and micro-morphological characteristics (Table 1) and their fruiting bodies are presented in Figure 2. Among the identified species, *Termitomyces heimii* is revered as a highly valuable mushroom in Mizoram, and the *Termitomyces* species are also known for possessing exceptional nutritional value and offering significant benefits for consumption (Gunasekara *et al*., 2021). The other species *Auricularia auricula-judae*, *Lactifluus piperatus*, *Lentinula lateritia*, *Russula subfragiliformis* and *Volvariella taylorii* are commonly consumed by the local people of Mizoram whereas the species *Cantharellus cibarius, Russula crustosa*, *Russula cyanoxantha*, and *Tremella fuciformis* have not been known to be commonly consumed. However, these ten identified mushroom species have been documented as part of diets in various parts of India (Agrahar-Murugkar & Subbulakshmi, 2005; Karun *et al.,* 2017; Ao & Deb 2019; Kumar *et al.,* 2022; Ghosh *et al.,* 2022) and globally (Liu *et al.,* 2018; Ouali *et al.,* 2023; Dospatliev *et al.,* 2023).

Table 1. Description of the identified wild edible mushrooms (WEM)

No.	Species (Order)	Morphological description	Culinary uses in Mizoram
1	*Auricularia auricula-judae* (Auriculariales)	Basidiome rubbery-gelatinous and irregular, cap shaped or ear-shaped, pileus 3-16 cm; attached to the substrate by small stipe or laterally, reddish to tan brown, pink to pinkish brown or brownish grey with maturity, becoming black when dried. Gills; free from the stipe, short-gills; whitish when young, becoming pinkish brown to brownish pink with ages. Spore print white. Spores size up to 11- 18 x 5-7 µm in diameter, ellipsoid, smooth. Spore print white.	Local Name: Pu Vana beng It is frequently cooked or frying them alongside other vegetables, often served as a side dish in salads. It is also used to prepare a delectable soup, often occasionally consumed by boiling with chili pepper, eggplants, onions, and other vegetables (which is known as 'Bai' in Mizo, a stew made from a variety of vegetables) to make delightful recipes.
2	*Cantharellus cibarius* (Cantharellales)	Basidiome medium-sized to large, wavy and irregular, pileus 4-18 cm; broadly convex when young, becoming flat or infundibuliform with ages, shallowly depressed cap with ages; light yellow to yellow; become dark yellow when dried. Stipe up to 4-10 x 0.5-2 cm, usually tapered below, fleshy fibrous or solid; same colour as pileus or more paler. Spore size up to 6.5 -10 x 4.5-6 µm, smooth, ellipsoid, inamyloid; spore print creamish yellow.	It is not traditionally consumed in Mizoram.
3	*Lactifluus piperatus* (Russulales)	Pileus 4-15 cm, broadly convex, becoming flat, broadly-shallowly depressed, surface dry; white, sometimes brownish yellow in age. Gills adnate, crowded, narrow, forking; white then changing to pale cream. Flesh white, sometimes changing to whittish yellow. Stipe 1.5-7.5 x 1-2 cm; solid, white. Milk white, changing slowly to cream white to yellow after reaction or exposure. Basidiospores 5-10 x 5-8 µm, ellipsoid, amyloid. Spore print white.	Local Name: Pa lengvar Pa lengvar are frequently seen growing alongside *Lf. corrugis* and *Lf. volemus*, have a harsh taste, and are usually eaten by simmering or deep frying.
4	*Lentinula lateritia* (Agaricales)	Pileus 5-10 cm in diameter; reddish brown to deep brown, smooth, surface dry, convex to flat with age. Stipe 3-4 cm thick, brown, up to 5-7 cm long, flesh creamy white. Sores 3 - 4 × 5.8 - 6.5 µm, ellipsoid. Spore print white to cream.	Local Name : Pa pal Cooked or boiled alongside rice or pumpkin leaves or occasionally fried. It is commonly preserved through sun-drying and can be stored for up to a year, providing a valuable food source during times when other options are scarce.

Table 1. Description of the identified wild edible mushrooms (WEM) (cont.)

No.	Species (Order)	Morphological description	Culinary uses in Mizoram
5	*Russula crustosa* (Russulales)	Pileus 3-10 cm wide, round to convex when young, becoming broadly convex or with ages, with a shallow depression; dry surface; yellowish green or brownish yellow, more brownish than yellow. Stipe 3 - 8.5 cm, 1.5-3.5 cm thick; white; surface dry, smooth. Flesh white. Gills closely attached to the stipe, crowded, ocassionally forking; white to creamish white. Basidiospores 6.5-9.5 x 5-6.5 µm, elliptical, round. Spore print creamish white. Scattered, solitary or gregarious in soil.	It is not traditionally consumed in Mizoram.
6	*Russula cyanoxantha* (Russulales)	Basidiome small to medium-size, cap size 4-12 cm; purple, green to olive green then pinkish white, convex when young, becoming flat or broadly convex with ages; surface dry, sometimes moist, smooth. Gills narrow, crowded, not forking, white when young, sometimes flush purplish, soft, softer when moist. Stipe, 6-12 cm, 1.5-3.5 cm thick, white; dry, smooth. Flesh white, thick. Basidiospores 6.5-9 x 5.5-7.5 µm with isolated warts. Pseudocystidia narrow and fusiform to subcapitate.	It is not traditionally consumed in Mizoram.
7	*Russula subfragiliformis* (Russulales)	Basidiome small sized to medium, pileus 4-9 cm in diamter, convex when young and slightly convex to flat in ages; smooth; jasper red, then pinkish red, surface dry, margin incurved; perforated sometimes broadly-shallowly depressed. Gills widely spaced, deep ochre. Stipe hollow, up to 2.5 - 5 x 1-2 cm, fleshy fibrous, solid, dry, white then slightly pinkish red. Spore print white. Spores 6-8.5 x 5-7 µm, elliptical to ovate.	Local Name: Pa lengsen Due to its bitter taste, the reddened portion of the cap/ pileus is peels off first, and the entire fruiting body is often boiled with *Hibiscus sabdariffa* (Roselle leaves) and consumed, occasionally it is immediately boiled at first, then fried on its own or with tomatoes or other vegetables.

Table 1. Description of the identified wild edible mushrooms (WEM) (cont.)

No.	Species (Order)	Morphological description	Culinary uses in Mizoram
8	*Termitomyces heimii* (Agaricales)	Basidiomata small to medium-sized, pileus 3-8 cm diameter; surface smooth, campanulate to convex when young, then convex, umbonate perforatorium; white, grayish brown, margin at first incurved, curved edge. Stipe up to 5-10 × 1.5-3 cm, fleshy fibrous, solid, cylindrical, white, silky white; attenuated towards apex; radicated. Pseudorhiza 8-20 cm, smooth, white. Spores 5-7.5×3.5-5 µm, ellipsoid, smooth, inamyloid.	Local Name: Pasawntlung It is generally regarded as the most favored mushroom in Mizoram. It is prepared in a variety of ways, including frying, mixing with rice, and even eating raw.
9	*Tremella fuciformis* (Tremellales)	Basidiome gelatinous, rubbery pileus up to 5-7 cm, 4 cm high; surface smooth and shiny; translucent, pure watery white, becoming more greyish in ages. Lack stipe. Basidiospores 7.5 - 12 x 5- 8.5 µm; subglobose to broadly ellipsoid, ovoid, smooth. Spore print white.	It is not traditionally consumed in Mizoram.
10	*Volvariella taylorii* (Agaricales)	Pileus 2.5-6 cm, convex, surface dry, Pileus 2.5-6 cm, broadly convex, surface dry, grayish brown to brownish gray, edge unlined, occasionally separating with age. Gills free from the stipe, close, white when young, turning pinkish brown in age. Stipe 3.5-6.5 cm, 6-12 mm thick, tapering gradually to apex, with a little inflated base, dry, finely hairy near the apex but bald elsewhere, whitish, discoloring brownish, with the base enclosed in a thick, whitish to gray or brownish. Spore print pinkish brown. Spores 7.5 x 4-5 µ, ellipsoid, ovoid, and smooth, with a flesh of white.	Local Name: Changel pa It is commonly consumed either cooked or fried, occasionally alongside bamboo shoots.

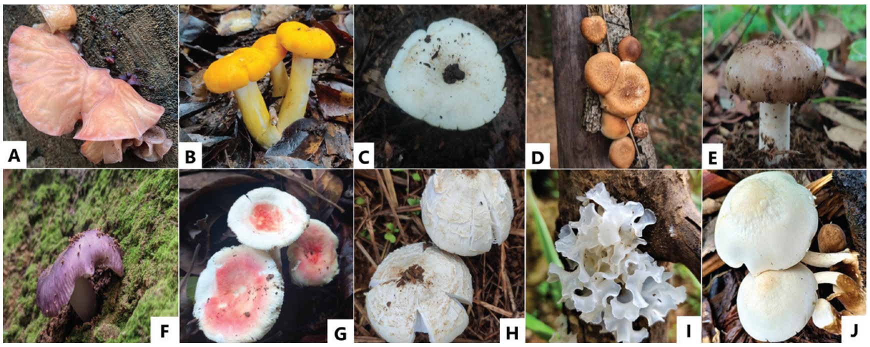

Figure 2. Fruiting body of wild edible mushrooms collected from Mamit and Champhai, Mizoram, India. (A) *A. auricula-judae* (B) *C. cibarius* (C) *Lf. piperatus* (D) *L. lateritia* (E) *R. crustosa* (F) *R. cyanoxantha* (G) *R. subfragiliformis* (H) *T. heimii* (I) *Tr. fuciformis* (J) *V. taylorii*

The results of the proximate nutritional composition of the 10 wild edible mushrooms collected from Mamit and Champhai District of Mizoram are given in Table 2. The studied mushrooms have moderate moisture content, ranging from 9.3% in *Tr. fuciformis* to 12.72% in *A. auricula-judae*. Moderate to high moisture content in wild edible mushrooms promotes susceptibility to microbial growth and enzymatic activity (Johnsy *et al.,* 2011). Fresh edible mushrooms generally contain around 90% moisture and 10% dry matter, while dried mushrooms typically consist of approximately 90% dry matter and 10% moisture (Crisan & Sands, 1978).

Table 2. Proximate composition of wild edible mushrooms in dry weight basis (g/100g)

Mushroom specimen	Moisture	Protein	Fat	Fiber	Ash	Carbohydrate	Caloric values (Kcal/100g)
A. auricula-judae	12.72 ± 0.08[a]	16.33 ± 0.29[e]	2.27 ± 0.04d[e]	5.94 ± 0.22[ef]	7.08 ± 0.11[bc]	55.64 ± 0.15[a]	295.86 ± 1.09[a]
C. cibarius	10.7 ± 0.03[d]	23.33 ± 0.29[d]	2.54 ± 0.05[de]	8.05 ± 0.05[b]	6.67 ± 0.1[d]	48.69 ± 0.44[b]	286.94 ± 0.74[b]
Lf. piperatus	10.12 ± 0.03[e]	26.54 ± 0.3[c]	2.63 ± 0.02[cd]	6.63 ± 0.03[de]	6.24 ± 0.05[e]	47.82 ± 0.33[bc]	293.26 ± 0.42[a]
L. lateritia	11.17 ± 0.02[c]	28.29 ± 0.58[b]	2.69 ± 0.02[cd]	7.4 ± 0.02[bc]	6.91 ± 0.01[cd]	43.52 ± 0.57[d]	279.44 ± 0.93[c]
R. crustosa	9.54 ± 0.05[fg]	25.95 ± 0.29[c]	3.87 ± 0.04[a]	7.08 ± 0.02[cd]	7 ± 0.07[cd]	46.57 ± 0.25[c]	295.73 ± 0.42[a]
R. cyanoxantha	12.10 ± 0.03[b]	16.04 ± 0.3[e]	2.11 ± 0.03[e]	5.97 ± 0.03[ef]	7.11 ± 0.07[bc]	56.63 ± 0.32[a]	294.74 ± 2.30[a]
R. subfragiliformis	10.96 ± 0.04[cd]	25.66 ± 0.29[c]	2.67 ± 0.03[cd]	6.98 ± 0.06[cd]	6.97 ± 0.02[cd]	46.94 ± 0.38[bc]	286.73 ± 1.04[b]
T. heimii	12.71 ± 0.09[a]	31.79 ± 0.29[a]	2.14 ± 0.05[e]	10.03 ± 0.38[a]	7.39 ± 0.06[b]	35.92 ± 0.45[e]	252.15 ± 1.71[d]
Tr. fuciformis	9.3 ± 0.14[g]	26.83 ± 0.29[bc]	3.37 ± 0.19[b]	7.22 ± 0.13[cd]	6.01 ± 0.06[e]	47.27 ± 0.24[bc]	296 .91 ± 1.68[a]
V. taylorii	9.7 ± 0.05[f]	32.08 ± 0.29[a]	3.03 ± 0.04[bc]	5.7 ± 0.13[f]	7.81 ± 0.10[a]	41.67 ± 0.47[d]	284.51 ± 1.04[bc]

Each value is expressed in mean ± SEM, ($n = 3$)
In each column, different letters mean significant differences between species ($p < 0.05$).

With an average protein content of 23.80 g ± 9.82 g/100g dry weight, mushrooms are known for having more naturally occurring bioactive proteins and peptides than most vegetables (Zhou *et al*., 2020). The protein contents were generally high and the highest protein contents was obtained in *V*. *taylorii* (32.08%) while the lowest was obtained from *R. cyanoxantha* (16.04%). The protein contents of edible mushrooms depend on the composition of the substratum, size of pileus, harvest time and vary according to their genetic structure, level of nitrogen available, as well as physical and chemical differences in growing medium (Flegg & Maw, 1977; Zakhary *et al.,* 1983; Bernas *et al.,* 2006). Fat contents ranged from 2.11% in *R. cyanoxantha* to 3.87% in *R. crustosa*. The low fat content in the studied wild edible mushrooms can be attributed to their high moisture contents. This high protein and low fat characteristic of the edible mushrooms has been previously reported (Lallawmsanga *et al.,* 2016; Khumlianlal *et al.,* 2022; Thachunglura *et al*., 2023a).

The fiber concentrations were within the range of 5.7% for *V. taylorii* and 10.03% for *T. heimii*. Ash content ranged from 6.01% in *Tr. fuciformis* to 7.81% in *V. taylorii*. These values are in agreement with previous report (Chittaragi & Naika, 2014). The fiber and ash contents varied slightly depending on the variety of mushrooms. Generally, carbohydrates constitute approximately 40-70% of the total weight of mushrooms (Crisan & Sands, 1978). Carbohydrate constitutes the largest fraction within the studied dried fruiting bodies, ranging from 35.92% in *T. heimii* to 56.63% in *R. cyanoxantha*. Caloric values ranged from 252.15 kcal/100g in *T. heimii* to 296.91 kcal/100g in *Tr. fuciformis*. The carbohydrates, caloric values and other macro-nutrients contents are almost consistent with the values reported earlier (Ouzouni & Riganakos, 2007; Khan *et al.,* 2013; Liu *et al.,* 2016; Sifat *et al.,* 2020; Jacinto-Azevedo *et al.,* 2021).

The nutrients profiles in terms of mineral concentrations are presented in Table 3. The minerals concentration in wild edible mushrooms can be different if they emerged at polluted sites (Falandysz & Borovička, 2013). Additionally, the chemical composition, substrate properties, and environmental contamination play a significant role in determining the element composition of wild mushrooms (Gałgowska & Pietrzak-Fiećko, 2020).

The results indicated that potassium was found to be the most abundant element and ranged from 11.6 mg/g in *Tr. fuciformis* to 22.4 mg/g in *T. heimii*. Sodium (14.7 mg/100g), iron (3.5 mg/100g), zinc (4.7 mg/100g) and calcium (1.5 mg/100g) contents were varied from *Tr. fuciformis* to 38.6 mg/100g of sodium in *Lf. piperatus,* 26.8 mg/100g of iron in *T. heimii*, 31.5 and 14.1 mg/100g of zinc and calcium in *Lf. piperatus.*

Table 3. Minerals concentration of wild edible mushrooms in dry weight basis

Mushroom specimen	K	Na	Fe	Zn	Ca
	mg/g	mg/100g	mg/100g	mg/100g	mg/100g
Auricularia auricula judae	11.9 ± 0.3[de]	18.3 ± 0.4[g]	5.4 ± 0.4[f]	6.2 ± 0.2[e]	1.6± 0.3[f]
Cantharellus cibarius	21.1 ± 0.2[a]	31.3 ± 0.2[b]	14.6 ± 0.3[de]	17.2 ± 0.3[c]	5.6 ± 0.2[d]
Lactifluus piperatus	17.6 ± 0.4[b]	38.6± 0.2[a]	22.4 ± 0.4[b]	31.5 ± 0.3[a]	14.1± 0.4[a]
Lentinula lateritia	14.7 ± 0.1[c]	28.1 ± 0.4[d]	6.7 ± 0.2[f]	18.1 ± 0.1[c]	6.9 ± 0.3[cd]
Russula crustosa	12.3 ± 0.2[d]	27.6 ± 0.3[d]	14.3 ± 0.6[de]	17.1 ± 0.4[c]	2.8 ± 0.4[ef]
Russula cyanoxantha	12.8 ± 0.2[d]	29.7 ± 0.2[c]	13.7 ± 0.2[e]	17.4 ± 0.3[c]	3.5 ± 0.2[e]
Russula subfragiliformis	14.7 ± 0.3[c]	24.1 ± 0.2[e]	15.7 ± 0.4[d]	11.8 ± 0.2[d]	5.4 ± 0.4[d]
Termitomyces heimii	22.4 ± 0.2[a]	24.5± 0.2[e]	26.8 ± 0.2[a]	26.5 ± 0.6[b]	11.1 ± 0.2[b]
Tremella fuciformis	11.6 ± 0.5[e]	14.7 ± 0.4[h]	3.5 ± 0.3[g]	4.7 ± 0.3[e]	1.5 ± 0.4[f]
Volvariella taylorii	18.9 ± 0.3[b]	21.2 ± 0.5[f]	17.6 ± 0.3[c]	25. 7 ± 0.4[b]	8.3 ± 0.3[c]

Each value is expressed in mean ± SEM, (n = 3).
In each column, different letters mean significant differences between species ($p < 0.05$).

Potassium serves crucial roles as an essential mineral in mushrooms (Falandysz & Borovička, 2012), and it was shown to be the most abundant mineral in the present study. Calcium, however, exhibited the lowest mineral content, consistent with previous findings of Gałgowska and Pietrzak-Fiećko (2020). The studied mushrooms are also an excellent source of minerals and the findings in this study are comparable to previous studies (Ouzouni *et al.,* 2009; Manjunathan & Kaviyarasan, 2011; Mallikarjuna *et al.,* 2013; Nakalembe *et al.,* 2015). Wild edible mushrooms are famous for their vital nutrients and minerals crucial for human health. Indeed, the mineral concentrations can vary greatly, ranging from 2.34 to 75,180 mg/kg (in Zn) even within the same species from the same geographical region (Mleczek *et al*., 2020). The nutritional composition and mineral content of wild edible mushrooms can also vary significantly due to several factors like their growth characteristics, the stage of development at harvest, and their post-harvest condition (Zakhary *et al.,* 1983; Gençcelep *et al.,* 2009; Valverde *et al.,* 2015).

4. Conclusion

The study shows that wild edible mushrooms are good sources of nutrients with high carbohydrate and protein contents along with other essential nutrients, making them a valuable addition to combat malnutrition in human populaces and they can be used as well-balanced diets due to their low contents of fat. Wild edible mushrooms have the potential to provide sustainable solutions by sustaining the production of food and security and play a significant role in meeting the demands of food scarcity. Thus, the present study is important in reflecting the presence of these wild edible mushrooms in Mizoram and their nutritional importance. Mushrooms are highly nutritious and can serve as an excellent source of dietary supplements for the indigenous people of Mizoram. We highly advise that these ten edible wild mushrooms offer accessible nutrients as food supplements and can be consumed without any health risk. However, it is recommended to seek guidance from a local expert on the identification and selection of edible wild mushrooms to avoid any potential risks. Further research on the enzymatic activity, antioxidant properties, levels of heavy metal and nutritional properties of various wild edible mushrooms in Mizoram is essential to comprehensively understand both the potential benefits and health risks related to heavy metal intake through mushroom consumption.

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