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Short Communication

Morphological characterization and nutritional value of *Lentinula edodes*

Zohmangaiha C[1*], Thachunglura VL[1], Lalnuntluanga[1], Zothanzama J[2]

[1]Department of Environmental Science, Mizoram University, 796004, Tanhril, Aizawl Mizoram, India
[2]Department of Biotechnology, Mizoram University, 796004, Tanhril, Aizawl Mizoram, India

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***Corresponding Author**

Zohmangaiha C, E-mail: xohmaa1990@gmail.com

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A B S T R A C T

Lentinula edodes has gathered significant attention over the past decade due to its remarkable nutritional and therapeutic values. However, little research has been conducted in Mizoram on the nutritional value of wild edible mushrooms, thus this study was carried out to access a complete rundown of the second most cultivated mushroom *Lentinula edodes*, highlighting its macro and micro-morphological characteristics along with its significant nutritional profiling. The nutritional profile of *Lentinula edodes* collected from Dampa Tiger Reserve is thoroughly studied and contained high protein and carbohydrate with low fat content which is essential for human health and supplementary diet.

Introduction

Edible mushrooms are used to promote human health due to their excessive nutritional value containing high levels of essential amino acids, vitamins, fiber, and a low fat content (Valverde *et al.*, 2015; Jedidi *et al.*, 2017; Dimopoulou *et al.*, 2022). *Lentinula edodes* is one of the most popular edible and cultivated mushrooms in the global market due to its nutritional properties, therapeutic applications and regards as medicinal mushroom (Bisen *et al.*, 2010; Li *et al.*, 2018). It can easily be cultivated using sawdust medium accounting for 25% of the production over the world (Spim *et al.*, 2020; Kobayashi *et al.*, 2023). Pertaining to *L. edodes*, it is commonly known as shiitake mushroom, saw tooth oak mushroom or golden oak mushroom (Stamets, 2000). Regular consumption of *L. edodes* enhances immunity as evidenced by increased sIgA synthesis, cell proliferation, and activation (Dai *et al.*, 2015). Polysaccharides derived from *L. edodes* have proven to be highly beneficial compounds, exhibiting anticancer, antioxidant, antimicrobial and immunomodulatory activities (Roszczyk *et al.*, 2022).

Despite its popularity in neighbouring countries and within India, Mizoram is not conversant with this wild edible mushroom. However, the same genus, *Lentinula lateritia*, locally known as "Pa pal" in Mizo, is a cherished delicacy and preserved through drying to ensure constant availability during food shortages. Taxonomic, molecular, and diversity of wild macrofungi within the region of Mizoram have been extensively documented (Zothanzama, 2011; Vabeikhokhei *et al.*, 2019; Zohmangaiha *et al.*, 2019) including nutritional value of certain wild edible mushrooms (Lallawmsanga *et al.*, 2016; Thachunglura *et al.*, 2023). However, limited research has been done on nutritional properties of edible wild mushrooms in Mizoram. This may be due to the limited exposure to traditional practices related to the consumption of *L. edodes*. Therefore, the present study is crucial for promoting sustainable foraging practices and harnesses the potential of this valuable resource, which could contribute to food security and economic growth, and aimed to comprehensively investigate the distribution, morphology and nutritional value of *L. edodes* in Mizoram, India.

Materials and Methods

Study site and area

Dampa Tiger Reserve (DTR) is situated in the western region of Mizoram, adjacent to Bangladesh, and falls within the boundaries of Mamit District in Mizoram. It's covers 500 square km. and stands as the largest protected area in Mizoram.

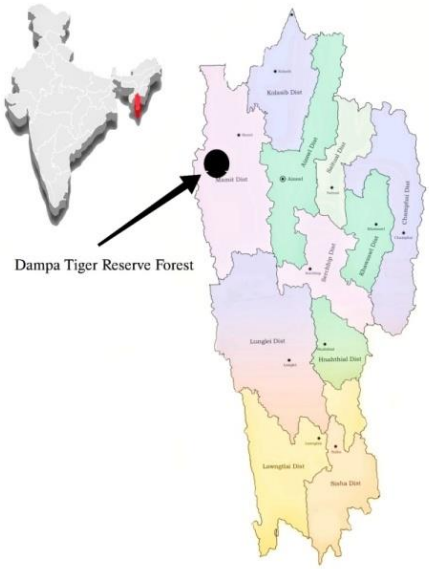

Figure 1. Map indicating study site

Collection and identification

The sample was carefully cleaned from forest debris, labelled and kept in containers before transporting to the laboratory. A photograph of the sample was taken both in the field and in the laboratory, along with a scale bar. The collected specimen was identified using standard microscopic and macroscopic characteristics (Pegler, 1983; Arora, 1986).

Nutritional analysis

The nutritional composition of the collected sample was analyzed by following the guidelines set by the Association of Official Analytical Chemists (AOAC, 2000). The analysis involved determining the content of moisture, protein, fat, fiber, and ash. The total carbohydrate and energy value were calculated using the conversion factors of Crisan and Sands (1978). Data were presented in means and standard errors of triplicate determinations.

Results and Discussion

Morphological characteristics

Description of the specimen - *Lentinula edodes* (Berk.) Pegler

Basidioma generally light coloured to reddish brown or black. Cap 4.5 - 25 cm across, dark black when young, changing to reddish brown, vinaceous brown or black with age, hemispheric, expanding to convex to nearly flat at maturity and covered with white specs. Gills even at first, serrated after age, whitish, occasionally developing reddish brown spots. Stipe central to eccentric; 2.5-5.5 cm long; fibrous, tough. Veil absent, mycelium creamy white to white at first, becoming longitudinally linear and cottony-aerial in age, rarely rhizomorphic. With age or in response to damage, the mycelium becomes dark to dark brown. Spore print pure white to buff. Spores 5.5 - 6.5 x 3 - 3.5µm; ovoid to oblong ellipsoid, hyaline, inamyloid, smooth.

Figure 2. A. Field Photo B. Close-up Photo C. Basidiospores (Scale Bar: A= 5cm; B = 2cm; C = 10µm)

Nutritional composition

The nutritional composition of wild edible mushroom *L. edodes* (Shiitake mushroom) was shown in Table 1. In this study, a significant presence of essential nutrients was observed in *Lentinula edodes* and it was found to contain a substantial amount of protein and carbohydrate. The sample holds 10.87% of moisture, 26.65% of protein, 6.99% of fiber, 47.98% of carbohydrate, 6.93% of ash, 2.54% of fat and 277.98% of calories. The acquired results indicated that *L. edodes* is rich in nutrients and can be used as a daily supplement, as well as cultivating this species is enormously sustainable in order to accomplish the UN-SDGs objective of zero hunger and poverty.

Table 1. Chemical composition (% dried weight) of *Lentinula edodes.*

Chemical Composition	Amount
Moisture	10.87 ± 0.17 g/100g
Protein	26.65 ± 0.5 g/100g
Fiber	6.99 ± 0.06 g/100g
Carbohydrate	47.98 ± 0.85 g/100g
Ash	6.93 ± 0.06 g/100g
Fat	2.54 ± 0.06 g/100g
Energy value	277.98 ± 4.94 Kcal/100g

Wild edible mushrooms as well as cultivated mushrooms can contribute nutrition daily requirements for human health (Çağlarırmak, 2007). Moreover, it is well documented that wild edible mushrooms contained great quantity of protein and carbohydrate (Díez and Alvarez, 2001; Heleno *et al.*, 2015; Roy, 2017). However, they contain low amount of fat (Chye *et al.*, 2008; Mridu, 2017; Jacinto-Azevedo *et al.*, 2021) which holds beneficial implications for human well-being and also makes them versatile ingredient in several culinary preparations. The nutritional quantity obtained in this study also shows similar results with those mentioned above.

In their respective studies on *L. edodes*, Li *et al.* (2018) reported that the stipes contained higher levels of fiber and carbohydrates compared to the caps, suggesting that the stalks of *L. edodes* might be a potential source of fiber and carbohydrate. In contrast, Mau *et al.* (2021) reported that the caps contained more fiber and carbohydrate content than the stipes, indicating that the mushroom caps could be a valuable nutritional resource. This suggests that the composition of nutritional value in *L. edodes* as well as other mushrooms can vary, possibly due to the factors like maturity, growth conditions, or regional differences in mushroom specimens. Furthermore, the nutritional value obtained from *L. edodes* varies greatly amongst authors (Longvah and Deosthale, 1998; Li *et al.*, 2018; Ho *et al.*, 2020). The nutritional quantity of shiitake mushroom obtained from this study is comparable to those previously reported mentioned above. Due to regional variations in climate, species age and maturity, and other environmental factors, the nutritional properties of wild edible mushrooms may not be similar.

Conclusion

In conclusion, it has been recognized that the edible mushroom *L. edodes* appears as a nutrient-rich reservoir, characterized by the presence of proteins and carbohydrates with a minimal fat content. Delving into the identification of wild mushrooms, accurate species identification is essential and it is critical to differentiate edible and toxic mushrooms, safeguarding a person from the risks associated with consuming poisonous mushrooms. Wild edible mushrooms are often praised as a functional food and offer health-promoting properties. Their rich composition of minerals, vitamins, antioxidants, and dietary fiber contributes to the overall health of humans. Moreover, wild edible mushrooms reduced fat intake, thereby supporting weight management and cardiovascular health. The study of nutritional value within the region of Mizoram carries insightful significance due to the limited exploration of mushrooms nutrition in Mizoram. The present study can serve as a crucial point for further reference. However, focusing solely on *L. edodes* in the current study may restrict the potential to gain comprehensive insights into the nutritional qualities of other mushroom species that are prevalent in Mizoram, India as well as other countries. As a result, the nutritional qualities of various wild edible mushrooms should be studied more thoroughly.

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