Proximate Analysis and Mineral Content of *Laetiporus sulphureus* Strain MFLUCC 12-0546 from Northern Thailand

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Received: 16 January 2014
Accepted: 21 February 2014

**ABSTRACT**

*Laetiporus sulphureus*, a member of the fungal class *Aphyllophorales* (Polypores) of the Basidiomycota, is widely distributed in tropical countries. In this article, chemical composition and nutritional quality of the Thai *L. sulphureus* mushroom were investigated. Protein, fat, crude fibre and carbohydrate concentrations were 6.91, 1.70, 6.43, and 71.74% dry weight, respectively. Mineral contents were determined as mg/kg dry weight for Fe (2.28), Zn (1.20), Mn (0.35), Cu (0.14), Na (11.01), Ca (2.59), and Mg (1.09).

**Keywords:** *Laetiporus sulphureus*, edible mushroom, nutritional data, element composition

**1. INTRODUCTION**

The genus *Laetiporus* was introduced by Murrill 1904 and is typified by *Boletus sulphureus* Bull. [1]. *L. sulphureus* (Bull.:Fr.) Murrill 1904 is among the most readily recognized of all macrofungi due to its striking orange-coloured, bracket-like fruit-bodies. Some variation is recognized in the bright orange color, fleshy basidiocarps, and imbricate fruiting bodies. This fungus appears to be a cosmopolitan species; its presence is wide from cool temperate to tropical zones. It also has a wide host range, from hardwoods to conifers [2].

*L. sulphureus* is a wood-rotting basidiomycete and can cause red-brown cubical heart rot in many trees [3]. The species also has a long history of consumption especially in North America [4], Japan [5], and Thailand. In addition, this mushroom was found to medically active in several therapies, such as antitumor, antiviral, antimicrobial, and immunomodulating treatments [6]. Previous studies on this species have revealed many interesting metabolites that can be applied in the medicine and food industries. These compounds include laetiporic acids [7], polysaccharides and alkali-soluble polysaccharides [8], fatty acid and amino acid [9], and α-(1→3)-glucans [10]. In this study, we aim to determine the nutritional value and essential elements of *L. sulphureus* collected from Northern Thailand. Such data are absent from the literature although the species has been used as food. Therefore, our results obtained are expected to be used as a reference for food composition and nutritional value of this mushroom.
2. MATERIALS AND METHODS

2.1 Mushroom Sample

*L. sulphureus* specimen was collected from a field trip at Doi Mae Salong, Chiang Rai, Thailand. The sample was initially characterized based on its distinct morphology. The mushroom was brought to the laboratory and examined under the compound microscope. Detailed morphology was recorded based on macrocharacters. The sample was subsequently dried at 40°C for 24hr, wrapped with stencil paper and kept in a polyethylene bag. This dried specimen is deposited at Mae Fah Luang University (voucher specimen no. MFLUCC 12-0546).

2.2 Proximate Analysis

In general, proximate analysis was carried out based on the standard procedure of the AOAC [11]: moisture content by drying 1.0000g test sample at 105°C in a hot air oven (UM500, Memmert); ash content by igniting 2.0000g sample in an electric furnace (Eurotherm 2416CG, Lento) at 600°C; and crude fibre by acid treatment and subsequent heating 2.0000g at 600°C in the Fibertec System M1020 Extractor (Foss Tecator). The Kjeldahl method was performed to analyse nitrogen-free extract in which the protein content was estimated by multiplying with a conversion factor of 5.99 [12]. Fat content was determined by the Soxtec 2055 Extraction Unit (Foss Tecator) with petroleum ether. All the analyses were carried out in triplicate.

2.3 Mineral Content Analysis

Minerals (Fe, Zn, Mn, Cu, Na, Ca, Mg, and K) were analysed based on an atomic absorption spectrophotometric (AAS) technique. Dried mushroom sample (2.000g) was placed in a crucible and burned at 550°C for 8 h [13]. For microscopic analysis, the inner tissue of fresh mushroom was transferred on to potato dextrose agar (PDA) plate and incubated at 30°C for 14 days. The pure mycelium culture was then obtained by
Figure 1. Laetiporus sulphureus strain MFLUCC 12-0546. a. Fruiting bodies on the Castanopsis sp. Host. b. Basidiocarps characteristic. c. L. sulphureus powder prepared from dried mushroom. Scale bar: a–b = 5 cm).

subculturing the hyphal tip to new PDA plates, and kept as a stock culture (Figure 2a). When observed under the microscope, pore thama are generative and skeleton hyphae (Figures 2b–2c), the hyphae are dimitic and lack cystidia and clamp connections [14]. Hymenium of basidia are thin wall (Figure 2d).

3.2 Proximate Analysis

Laetiporus sulphureus, commonly known as a wild edible mushroom, was selected to determine its nutritional value. In this study, a wild strain of L. sulphureus (MFLUCC 12-0546) was collected in northern Thailand and the data of chemical composition of this mushroom are shown in Table 1.

Thai L. sulphureus is a good source of carbohydrate (71.74%), protein (6.91%), and fibre (6.43%). This Thai strain is also low in fat content (1.70%). In general, wild mushrooms are protein-rich and low in fat content compared to cultivated mushrooms. Cultivated mushrooms generally contain 19-35% protein [15]. According to Sanmee et al. [16], the protein content of some Thai wild mushrooms was between 14 and 24.2%. The protein content of other wild mushrooms also varied ranging from 16.5–59.4% for European [17] and 23.17-47.41% for Mexican mushrooms [18]. It is understood that the protein content (as well as other nutritional values) are affected by a number of factors, such as the type of mushrooms, the stage of development, the part sampled, level of nitrogen available and the location [17, 19, 20].

Figure 2. Microscopic features of L. sulphureus strain MFLUCC 12-0546. a. Mycelium appearance culture on PDA media was incubated at 30°C for 14days. b. Thamal generative hyphae. c. Thamal skeletal hyphae. d. Hymenium of basidia. Scale bar: a = 1 cm, b = 10 μm, c–d = 5 μm.
Table 1. Chemical composition (% dried weight) of *L. sulphureus* strain MFLUCC 12-0546.

<table>
<thead>
<tr>
<th>Chemical compositions</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Ash</td>
<td>2.06 ± 0.81</td>
</tr>
<tr>
<td>Moisture</td>
<td>11.32 ± 0.08</td>
</tr>
<tr>
<td>Fat</td>
<td>1.70 ± 0.12</td>
</tr>
<tr>
<td>Protein</td>
<td>6.91 ± 0.43</td>
</tr>
<tr>
<td>Fibre</td>
<td>6.43 ± 0.19</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>71.74 ± 0.77</td>
</tr>
</tbody>
</table>

Data shown are means and standard deviations of triplicate determinations.

3.3 Mineral Content

Mineral concentrations of wild *L. sulphureus* were investigated and the data are given in Table 2. For Thai *L. sulphureus*, the most abundant element was found to be Na, followed by Ca, Fe, Zn, and Mg. Manganese and copper were found at low concentrations whereas potassium is not found in this mushroom sample (Table 2).

Table 2. Total elemental compositions (mg/kg dw) of *L. sulphureus* strain MFLUCC 12-0546.

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Concentrations</th>
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<tbody>
<tr>
<td>Fe</td>
<td>2.28 ± 0.03</td>
</tr>
<tr>
<td>Zn</td>
<td>1.20</td>
</tr>
<tr>
<td>Mn</td>
<td>0.35 ± 0.02</td>
</tr>
<tr>
<td>Cu</td>
<td>0.14 ± 0.01</td>
</tr>
<tr>
<td>Na</td>
<td>11.01 ± 0.12</td>
</tr>
<tr>
<td>Ca</td>
<td>2.59 ± 0.01</td>
</tr>
<tr>
<td>Mg</td>
<td>1.09</td>
</tr>
<tr>
<td>K</td>
<td>ND</td>
</tr>
</tbody>
</table>

Data shown are mean values of triplicate determinations; dw, dry weight; ND, Not detectable.

Several publications deal with trace element contents in wild mushrooms [16, 21, 22]. The mineral profiles of mushrooms vary and, similar to the proximate analysis data, this variation can be caused by various environmental factors including soil content, growth substrate, and climate [19, 20]. In general, the mean element content across all fungi were in the order Fe > Zn > Mn > Cu > B > Se [16]. A 20-fold difference in Fe and Se concentrations has been reported in some wild edible fungi [16, 23]. In Thailand, the mineral content of some Thai wild mushrooms is reported [16]. Of all elements determined in this study, there are only Ca and Mg that are found in similar content.

3. CONCLUSIONS

Proximate and mineral contents of mushrooms are important and useful in food industry as they can be used as a reference for food compositional data [17]. Our study reveals the proximate and mineral content of Thai *L. sulphureus* for which there has been no report. This mushroom is edible, and thus this data is important and can be used to indicate its nutritive quality.

ACKNOWLEDGEMENTS

This work was financially supported by the Thailand Research Fund grant (No. BRG 5580009), and Mae Fah Luang University.

REFERENCES


