



Termitomyces Marvel Medicinal Mushroom Having a Unique Life Cycle

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Abstract

The medicinal uses of the mushroom still need to be worked out for their biological activities. Current review demonstrate that *Termitomyces* mushrooms have medicinal properties possesses a number of beneficial medicinal properties such as antioxidants, immunomodulators, antitumors, and antimicrobials. These activities have been reported for various extracts and isolated compounds, such as phenolic compounds, polysaccharides, cerebrosides, serine protease, ergostanes, saponins, and fatty acid amides from *Termitomyces* fruiting bodies.

Keywords: Medicinal Mushrooms; *Termitomyces*; biological activities; Termite nests

Introduction

Mushrooms need antibacterial and antifungal compounds to survive in their natural environment. Hence, they are rich sources of natural antibiotics [1,2]. Mushrooms are worldwide appreciated for their taste and flavour and are consumed both in fresh and processed. Apart from being delicacy and tasty foods, they have special biochemical compositions, with significant contents of proteins, carbohydrates, lipids, enzymes, minerals, vitamins and water which attract more attention as functional health promoters [2-5].

Termitomyces Mushrooms Ecology

Termitomyces a genus of edible mushrooms commonly consumed in Africa and Asia among the mushrooms collected from the wild. *Termitomyces* mushrooms grow as symbionts in the termite nests, where they produce various enzymes to help termites digest lignocellulosic substrates.

On the termite comb white spherical yeast like colony fungal structures are commonly observed. These structures of *Termitomyces* have been described by various authors under different names [6]. Heim, [7] proved these structures exclusively as sporodochia which are found on the combs of Macro terminae and represent the anamorph of the genus *Termitomyces*. The fruiting bodies of *Termitomyces* are rich in nutritional and medicinal constituents. Many species of *Termitomyces* are used by different ethnic groups with ethnomedicinal knowledge [8]. *Termitomyces* R. Heim, a fungal genus belonging to the family Lyophyllaceae [9,10].

Termitomyces mushrooms grow exclusively inside nests of macrotermite termites, Figures 1 & 2. These mushrooms are regularly collected both for home consumption and for sale in local markets or along roadsides [11,12]. The fungi *Termitomyces* are known to have a unique life cycle. These fungi are distributed in tropical and subtropical areas from Africa to Southeast Asia [13], and are found only in nests of Macrotermite termites in the wild. They live in a medium

called the fungus comb, located in a special chamber, fungus garden, inside the nest. The termites collect plant materials from outside the nest to maintain the fungus combs, which they later eat [14,15]. Various species of *Termitomyces* are widely dispersed in Africa and Southeast Asia [16,17]. *Termitomyces* mushrooms production of their fruiting bodies under artificial cultivation has not been successful yet [18].

Termitomyces Mushrooms Benefits and uses

Termitomyces mushrooms become an important source of nutrients as well as micronutrients including vitamins and minerals [19, 20]. Bioactive components that *Termitomyces* mushrooms contain have potential uses as antioxidants, immunomodulators, antitumors, and antimicrobials. *Termitomyces* also has a potential for treating neurodegenerative disorders. [8]. Several species of *Termitomyces* are commonly used ethnomedicinally for health promotion and treatment of illnesses. *Termitomyces albuminosus* is used in China for improving brain and stomach functions and curing hemorrhoids. In India, *T. heimii* and *T. microcarpus* are used in treatment for fever, cold, and fungal infections [21]; *T. heimii* is as blood tonics during wound healing and blood coagulation [22]; and *T. eurhizus* is for curing of rheumatic disorder and diarrhea, and for lowering high blood pressure [23]. In Nigeria, gonorrhoea is treated with a preparation containing *T. microcarpus* [24]. In Cameroon, *T. titanicusis* used for treatment of stomach complications [25].

Termitomyces mushrooms (methanolic, ethanolic, aqueous) extracts were selected for in-vitro studies against selected pathogenic microorganism to investigate the efficacy

of their different. The antifungal activity of various solvent extracts of *Termitomyces* was tested against five species of fungus *Aspergillus flavus*, *Aspergillus niger*, *Candida albicans*, *Penicillium notatum*, *Mucor racemosus*. The different extracts showed wide spectrum of a fungal activity [26].

Li, et al., [27] results that *Termitomyces albuminosus* possess the pharmaceutical potential for Alzheimer's disease, and it was an effective way to dig new pharmaceutical agent of *T. albuminosus* with the microbial fermentation technique. *Termitomyces* mushrooms extracts have revealed potent antioxidant activities and they have also shown promising antimicrobial activities against *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* [28].

Termitomyces Mushrooms Bioactive Compounds

Termitomyces mushrooms rich in proteins (27–36%) and ascorbic acid (10–18 mg/g) [8]. Some of the ethnomedicinal uses of *Termitomyces* mushrooms can be related to certain bioactive compounds that these mushrooms contain. The bioactive compounds from *Termitomyces* species that have been isolated including phenolic compounds, polysaccharides, cerebrosides, serine protease, ergostanes, saponins, and fatty acid amides [8]. Many compounds with medicinal capabilities have been obtained from *Termitomyces* dried fruiting bodies, such as novel cerebrosides termitomycesphins A–H with significant neurotogenic activity and cerebroside A with the potent neuroprotection activity. *Termitomyces* has also displayed antioxidant capacity and high content phenolic ingredients [29–32].



Figure 1: *Termitomyces* mushrooms (Photographs taken by Glen van Niekerk, Locality: South Africa, Pretoria, Gauteng, Sinoville, hosted by <http://mycoportal.org>).



Figure 2: *Termitomyces* mushrooms showing attachment to termite nest in soil cross-section (Photographs taken by Masana Izawa, Locality: Only available to clients in Canada, Mexico, and United States, hosted by <https://www.mindenpictures.com>).

Conclusion

As a conclusion *Termitomyces* mushrooms is an edible mushrooms, grow as symbionts in the termite nests. Like several well-known edible mushrooms such as button mushroom (*Agaricus blazei*), wood ear mushroom (*Auricularia auricular-judae*), and *Ganoderma lucidum* (polypore mushroom), *Termitomyces* mushrooms are also effective in antioxidation, anti-inflammation and antitumor [33, 34, 35]. *Termitomyces* mushrooms may be developed into health care products as dietary supplements. Polysaccharides prepared from *Termitomyces* may be beneficial for the control of hyperlipidemia. The cultivation of *Termitomyces* for the fruiting body production is unavailable at present. The chemical analysis of the various compounds obtained from *Termitomyces* mushrooms fruiting bodies showed that it is a rich source of bioactive compounds with various potential uses as antioxidants, immunomodulators, antitumors, and antimicrobials. Much effort is still needed in discovering further bioactive materials from *Termitomyces* mushrooms and establishing a system to test their potential uses.

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