Chemical compounds and health benefits of Tremella, a valued mushroom as both cuisine and medicine in ancient China and modern era

Mohamad Hesam Shahrajabian1, Wenli Sun1, Hong Shen3, Qi Cheng1,2*

1 Biotechnology Research Institute, Chinese Academy of Agricultural Sciences, Beijing 100081, China
2 College of Life Sciences, Hebei Agricultural University, Baoding, Hebei, 071000, China; Global Alliance of HeBAU-CLS&HeQiS for BioAI-Manufacturing, Baoding, Hebei 071000, China
3 NMPA Key laboratory for Testing and Risk Warning of Pharmaceutical Microbiology, Biological Inspection Department, Zhejiang Institute for Food and Drug Control, Hangzhou 310052, China

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Abstract
For many years, traditional Chinese medicine has used mushrooms to treat various ailments. Tremella mushroom is also famous as snow mushroom, slider ear mushroom, snow fungus or white jelly mushroom. This review is focused on pharmacological and pharmaceutical uses of Tremella in modern and traditional sciences. Tremella fuciformis is a species of fungus; it produces white, frond-like, gelatinous basidiocarps. The most important tremella mushroom benefits are anti-aging, anti-inflammatory, lower cholesterol, combat obesity, protect nerves and may fight cancer. The most powerful nutritional constituents of Tremella are amino acids, vitamins, minerals, polysaccharides, Glurcurmomannan 1,3-alpha-glucan, Epitope 9beta-D-glucuronosyl), Glucuronic acid, Glucurmic acid, Glucuronoxylomannan, N-acetylglucosamine, Flavonoids, Polyphenols, Alkaloids and Organic acids. Functional foods are making inroads into Chinese diets with their promises to improve health and nutrition. Chinese consumers should choose nutritional and healthy food to maintain general health and reduce the risk of health problems. Nutrition therapy on the basis of traditional Chinese medicine such tremella is quite effective at treating common diseases.

Key-words: Traditional Chinese Medicine, Tremella, Ancient Beauty, Super-Food

Introduction

Traditional Chinese medicine (TCM) has played a positive role in the management of so many diseases (Ogbaji et al., 2019; Shahrajabian et al., 2018; Shahrajabian et al., 2019a,b,c; Sun et al., 2019). TCM is an empirical healthcare system based on human experience dating back several thousand years ago and stands out as the only one with long history among the worlds traditional medical system (Ogbaji et al., 2013; Soleymani and Shahrajabian, 2018; Shahrajabian et al., 2019e,f,g,h). The most important parameter is providing healthy diets for the decades to come in a world with rapid population growth (Soleymani and Shahrajabian, 2012; Shahrajabian et al., 2019i,j; Shahrajabian et al., 2020a,b,c; Sun et al., 2020a,b,c). Tremella mushroom is also famous
snow mushroom, silder ear mushroom, snow fungus or white jelly mushroom. According to Chinese history, the use of Tremella as a fountain of youth goes back to the Tang Dynasty, and in traditional Chinese medicine (TCM), it is believed to have various benefits for the body. Tremella fuciformis is a species of fungus; it produces white, frond-like, gelatinous basidiocarps. Tremella is commercially cultivated and is one of the most important fungi in the cuisine and medicine of China. The aim of this review is survey on traditional use of Tremella by Chinese and other Asian herbalists and its role in modern pharmaceutical science.

Tremella

Origin, Chemical Constituents and Health Benefits

Tremella is a genus of fungi in the family Tremellaceae. Over 100 species of Tremella are currently recognized worldwide (Han et al., 2015). Two species, Tremella fuciformis and Tremella aurantialba, are commercially cultivated for food. It is rich in polysaccharides, triterpenoids, protein, dietary fiber, vitamins and chitin (Zhang et al., 2011). Tremella was one of the original genera created by Linnaeus in his Species Plantarum of 1753. The name comes from the latin tremere meaning to temble (Liu and Wu, 2019). Linnaeus placed Tremella in the algae, including within it a variety of gelatinoid growth, including seaweeds, cyanobacteria and myxomycetes as well as fungi (Ruan et al., 2018). Tremella fuciformis is one of the great superfood mushrooms and longevity tonic herbs in traditional Chinese medicine (TCM). It is use dates back as far as 200 A.D. when it was including in one of the earliest TCM classics- the material by Shen Nong ben Cao Jing, the father of Chinese medicine. In ancient times, like many of the other revered medicinal mushrooms such as Reishi and Cordyceps sinensis, Tremella was only reserved for royalty, ruling family members or for rich people who could afford this highly valued superfood (Wu et al., 2019). Tremella mushroom belongs to the jelly fungus family and has many different names. In Chinese, it is called silver ear mushroom, white wood-ear mushroom and in Japanese, it is called shiro kikurage which translates to white tree jellyfish. It is also commonly known as snow fungus, and the beauty mushroom. Tremella has been a popular staple of Chinese cuisine for centuries, rich in dietary fibers, protein, minerals, antioxidants, and high in vitamin D. Its used in China in a variety of dishes from anti-aging soups to desserts. Tremella has traditionally been used by Chinese and Japanese herbalists as a potent Jing and Chi (Qi) tonic for thousands of years. It is believed to nourish the lungs, kidneys, heart, brain, stomach, and acts as a powerful tonic for the immune system. Tremella has been clinically used to help clear heat and dryness, replenish fluids in the body (Yin deficiency), to treat chest congestion, asthma, constipation, balance blood sugar levels and cholesterol (reduces LDL), and lower inflammation. Its rehydration and fluid replenishment qualities may be the best reasons to support its claims as one of the best beauty foods for the skin. In ancient China, Yang Guidei was one of the Four Great Beauties, an imperial concubine that is considered one of the most beautiful women in Chinese history. She used it regularly to maintain her glowing complexion and youthful skin. Tremella,s polisaccharides also stimulates the production of superoxide dismutase (SOD) in the brain and liver. SOD is one of the most important super antioxidant enzymes in the body. SOD helps to protect and regenerate skin and effectively prevent wrinkling and sagging of the skin. Tremella consists of lots of vitamin D, lots of protein, and also contain other vitamins, minerals, immune boosting polysaccharides, trace minerals, carbs, and a little fat (Kuot et al., 2015). Wang et al. (2015) reported that Tremela polysaccharides (TP) are the major component and activity unit of Tremella. Park et al. (2007) concluded that T. fuciformis might potentially be used as a precautionary agent in neurodegenerative disease, such as Alzheimer disease. Shen et al. (2017) indicated that Tremella fuciformis polysaccharide (TFPS) alleviated hydrogen peroxide-induced oxidative stress and apoptosis in skin fibroblasts via upregulation of SIRT1 expression, indicating that TFPS may act as a potential therapeutic agent for oxidative agent for oxidative-stress-associated skin diseases and aging. Results of the GC-MS analysis of the constituent oil from T. fuciformis is shown in Table 1. Composition of Tremella
polysaccharides is presented in Table 2. The most famous beauty and skin enhancing properties of Tremella mushroom is presented in Table 3.

Proven health benefits of Tremell is shown in Table 4.

| S/N | Compound | Retention time (min) | Percentage of the total | Molecular formula | Molecular weight (g/mol) |
|-----|----------|----------------------|-------------------------|-------------------|-------------------------|
| 1   | 9,19-Cyclolanost-24-en-3-ol, (3.beta)-Lanosterol | 20.766 24.672 23.034 | 32.681 17.845 21.334 | C_{32}H_{52}O_{2} | 468.754 426.710 294.390 |
| 2   | Acetic acid, 7-Isopropenyl-1,4a-dimethyl-3-oxo-2,3,4,4a,5,6,7,8-octahydropthalen-2-yl ester | 22.42 | 21.334 | C_{17}H_{26}O_{4} | 294.390 |
| 3   | 2(1H)Naphthalenone, 3,5,6,7,8,8a-hexahydro4,8a-dimethyl-6-(1-methylthlenyl)- Lupeol | 22.560 9.609 | C_{15}H_{22}O | 218.335 |
| 4   | 2(1H)Naphthalenone, 3,5,6,7,8,8a-hexahydro4,8a-dimethyl-6-(1-methylthlenyl)- Lupeol | 22.825 23.230 | 18.531 | C_{30}H_{50}O | 426.729 |

Table 2. Composition of *Tremella* polysaccharides (Khondkar, 2009).

| Organism | Moisture content (%) | Ash content (%) | Protein content (%) | Protein content (%) | Acetyl group content (%) | Carbohydrate content (%) |
|----------|----------------------|-----------------|--------------------|---------------------|--------------------------|--------------------------|
| *T. fuciformis* (TFU) | 11.4 (±0.1) | 3.4 (±0.2) | 5.7 (±0.2) | 0.8 (±0.1) | 2.9 (±0.1) | 76.6 (±0.0) |

Table 3. The most famous beauty and skin enhancing properties of Tremella mushroom.

1- Nourishes Skin
2- Naturally Moisturises
3- Improves Elasticity
4- Slows Skin Aging
5- Brightens Complexion
6- Deeply Hydrates Inside and Out
Table 4. Proven health benefits of Tremella mushrooms.

| Number | Benefit                                      |
|--------|----------------------------------------------|
| 1      | Creates youthful skin                       |
| 2      | Improved memory and learning capabilities    |
| 3      | Lowers Cholesterol                           |
| 4      | Neurological Damage Repair                   |
| 5      | Lowers Blood Sugar                           |
| 6      | Anti-inflammatory for the Skin and Whole Body|
| 7      | Great for Chronic Coughs                    |
| 8      | Cancer                                       |
| 9      | Protects the Liver                           |
| 10     | Prevents Osteoporosis                        |
| 11     | Stomach Health                               |
| 12     | Intestinal Health                            |
| 13     | Weight Loss                                  |
| 14     | Protects the Circulatory System              |
| 15     | Anti-Aging Agent                             |

Conclusion and recommendation

Traditional Chinese medicine is an important part of the health care system in most Asian countries, relies on natural products and has been playing a significant role in health protection and disease control for many years. Tremella use dates back as far as 200 A.D. when it was including in one of the earliest TCM classics- the material by Shen Nong ben Cao Jing, the father of Chinese medicine. Tremella has been a popular staple of Chinese cuisine for centuries, rich in dietary fibers, protein, minerals, antioxidants, and high in vitamin D. Its used in China in a variety of dishes from anti-aging soups to desserts. Tremella has traditionally been used by Chinese and Japanese herbalists as a potent Jing and Chi (Qi) tonic for thousands of years. It is believed to nourish the lungs, kidneys, heart, brain, stomach, and acts as a powerful tonic for the immune system. Tremella has been clinically used to help clear heat and dryness, replenish fluids in the body (Yin deficiency), to treat chest congestion, asthma, constipation, balance blood sugar levels and cholesterol (reduces LDL), and lower inflammation. Traditional Chinese Medicine included fruits and herbs are increasingly and extensively used by a substantial part of the population. Jujube has numerous important pharmacological activities and it can be considered as a valuable source of nutraceuticals.

Conflict of interest: The authors declared that there was no conflict of interests regarding the publication of this paper.

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