

Ganoderma Lucidum (Reishi Mushroom): Potential Application as Health Supplement and Cosmeceutical Ingredient

Dr. Lana Jiang

Yiwu Fuyuan Women and Children's hospital, No. 72 Hongdi Road Yiwu City, Zhejiang province, 322000, CHINA

ABSTRACT

Ganoderma lucidum also well known as Reishi or Lyngzhi is one of the oldest medicinal mushroom used in oriental medicines. It has several potential application for improving health, Some of its biological activities such as protective activity against liver toxicity, antioxidant activity, antihypertensive, anti androgenic activity, anti allergic and antidiabetic activity has been discussed in this review.

KEYWORDS : Ganoderma lucidum, Reishi, Lyngzhi, macro fungus, Ganoderic acid.

INTRODUCTION

Fungal or mushrooms based products have been used by several civilization from centuries for medicinal purposes. Active molecules derived from mushrooms have found to be of great medicinal value, infact one of the major advances in antibiotics came after discovery of penicillin from *Penicillium Rubens*. Since then several biologically active molecules have been synthesized from these medicinal mushrooms. One of the oldest medicinal mushrooms is *Ganoderma lucidum*, which has longest history of use, as the Japanese name indicates- Mannentake or Reishi, which means 10,000 years mushroom. In China, *Ganoderma Lucidum*, also known as Lingzhi is regarded as herb of spiritual potency, and is associated with longevity, health and spiritual power. Usually all the parts of Reishi mushroom are regarded as medicinal and hence use of its fruiting body, spores and mycelia are common. Application of Reishi mushroom has been found in variety of forms such as infused tea, supplements, powder etc. In this review we look at some of the traditional application of *Ganoderma* as oral supplement and also its potential Cosmeceutical applications.

HABITAT

Ganoderma Lucidum belongs to class Basidiomycetes of the family Ganodermataceae. Fruiting body of *Ganoderma lucidum* can be found growing on variety of deciduous trees such as oak, pyrus, quercus, magnolia, plums etc., found in Fareast countries including China, Japan, Korea, upper parts of Himalayas. As the name indicates, fruiting body of these macro fungi can be identified as a shiny appearance on the place of growth (In Latin *Lucidum* means shiny). As the commercial use of *Ganoderma* increased, efforts were mad to cultivate it in countries like China, Japan, Taiwan and Korea to fulfill the demand of the market. (Kamra A and Bhatt AB, 2013)

CHEMISTRY

Though the fruiting body has been studied for its chemical constituents, the spores of *Ganoderma* have been in much focus for their biological activity against multiple diseases and health conditions which are related to inflammatory conditions. The spores have been studied for their chemical constituents by researchers and several biologically active compounds have been isolated from the spores. Many of the isolated active compounds belong to the family triterpenoids with common biosynthetic pathway namely mevalonic acid pathway. (Ma B et al 2011)

Some of the triterpenoids isolated from ethyl acetate fraction of *Ganoderma* spores are Ganoderic acid (Fig 1), Methyl ganoderate, Ganodermic Acid, esterosterol peroxide etc. (Zhang XQ et al 2008)

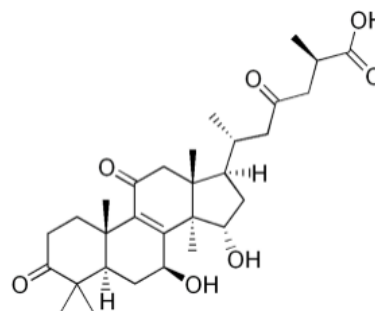


Fig 1. Ganoderic acid

In addition to the triterpenoids, *Ganoderma* mycelia are also known to contain high molecular weight bioactive polysaccharides. These polysaccharides have been found to be heteropolymers with monomer units of xylose, mannose and galactose. Several *Ganoderma* products such as Reishi teas are rich source of the water-soluble polysaccharides. (Galor SW et al 2011).

Biological Activities of Ganoderma**1. Anti-Androgenic activity**

One of the major androgen mediated disease is benign prostate hyperplasia (BPH), affecting almost 40% of men in age group of 50-60 years. 5 Alpha reductase enzymes cause it, which converts testosterone to dihydrotestosterone (DHT), which can play important role in development of BPH. Naturally occurring 5 Alpha reductase inhibitors can play important role in prevention of occurrence of BPH. In an In vitro animal model study, *Ganoderma lucidum* extract showed strongest 5-alpha reductase inhibitory activity among the 19 edible and medicinal mushroom evaluated for their anti-androgenic activity. (Fujita R et al 2005).

Anti-Hepatitis B activity

It is estimated by "WHO" that over 240 million people are chronically affected by Hepatitis B, with over 780,000 deaths occurring every year due to complications arising from Hepatitis B. Though vaccines are now available, prevention is still highly recommended. Supplements with anti-hepatitis activity can play important role in the prevention of this disease. Traditionally medicinal mushrooms such as Reishi have been used in the Chinese traditional system as liver protectant. The triterpenoids Ganoderic acid found in the *Ganoderma* possess potent anti-viral activity. Ganoderic acid was shown to inhibit the replication of Hepatitis B virus by inhibiting the Hepatitis surface antigens HBsAG and HBeAG. In the same study it was observed that isolated Ganoderic acid protects the mice liver from Carbon tetrachloride induced injury. (Li YQ and Wang SF, 2006)

Antioxidant activity

Several studies have been done to evaluate the antioxidant potential of various parts of *Ganoderma lucidum* including the fruiting body; mycelia and crude extracts obtained using different solvents. The methanolic extract as well as aqueous extracts have shown remarkable free radical scavenging activity. Both these extracts were able to scavenge the superoxide free radicals, hydroxyl radicals and also inhibit the lipid peroxidation (Jones S and Janardhanan KK, 2000).

Using different models of antioxidant activity assay, Alcoholic, Aqueous alcoholic, Petroleum ether and chloroform extracts of *Ganoderma lucidum* were assayed for the antioxidant activity. The antioxidant activity was determined to be highest in hot water extract followed by aqueous alcoholic extract. The Petroleum ether extract was found to be least effective in scavenging the free radicals in any of the models of Antioxidant assays such as DPPH radical, ABTS radical, Superoxide radical scavenging assay. (Agarwal K et al 2012).

Anti-allergic activity

Ganoderma lucidum has long history of use in Traditional Chinese medicine for allergic conditions such as bronchitis. Allergies such as bronchitis are mediated by release of histamine due to faulty immune system. Infact the studies on the sputum of patients with bronchitis and asthma have increased amount of histamine. Chloroform extract of *Ganoderma lucidum* showed marked inhibition of histamine release in animal model studies. According one to study the active component involved in Anti-allergic activity of *Ganoderma lucidum* is oleic acid. (Tasaka K et al 1998).

While in another study, the methanolic extract of *Ganoderma lucidum* has shown inhibitory effect on the histamine release from the mast cells. The methanolic fraction was analyzed to contain Ganoderic acids C and D, which were believed to be principle compounds to cause inhibition of histamine release (Kohda H et al 1985).

Antidiabetic activity

Today diabetes is regarded as an epidemic worldwide due to our changing food habits and life style. It is estimated to affect more than 300 million people by 2025 world wide. While several hypoglycemic compounds are now recognized in the pharmaceutical world as hypoglycemic agents, compounds from natural sources are considered safer with longer history of use from the traditional applications from centuries. *Ganoderma lucidum* is also regarded as a potential natural antidiabetic extract. Several extracts of *Ganoderma lucidum* have been studied for their antidiabetic potential. Studies have shown that the bioactive polysaccharides are major source of *Ganoderma lucidum*'s antidiabetic activity. In an animal model study, streptozotocin induced diabetic rats were administered polysaccharide fraction for 28 days. The results at the end of the animal trial showed that not only the fasting blood glucose levels were reduced in the *Ganoderma lucidum* polysaccharide groups, but also the lipid levels were improved with lower LDL-cholesterol, total cholesterol and triglyceride levels. This dual benefits of *Ganoderma lucidum* can be very beneficial in patients with high lipid levels along with higher serum blood sugar levels. (Li F et al 2011).

Antihypertension activity

In a clinical study performed on 53 hypertensive subjects in Japan, 6 tablets containing 240mg of *Ganoderma lucidum* extract were administered daily to the active group. After 6 months of treatment, it was noted that active group administered with *Ganoderma lucidum* had shown lowering of blood pressure, thus having the ameliorating effect on hypertension. The results also showed no side effects of the *Ganoderma lucidum*. (Kanmatsuse K et al 1985).

Safety Study of Ganoderma

Though its application has been recorded from centuries and in various traditional medication system, well controlled human clinical trials are few very. In order to assess the safety of the *Ganoderma lucidum* supplementation, a double blind placebo controlled cross over clinical trial was conducted. In this study 4 weeks fasting blood and urine was collected before and after 4 weeks of supplementation of *Ganoderma lucidum* supplementation in healthy volunteers. There was no significant change in any of the biochemical parameters, nor there was any evidence of liver, renal toxicity noticed in the patients. Infact the study showed that there was trend towards lower lipid levels and antioxidant capacity in urine samples were increased by the end of the trial. This controlled clinical trial was helpful in assessing the safety of the *Ganoderma lucidum* supplementation in healthy and borderline subjects. (Galor SW et al 2004).

Cosmeceutical application

Ganoderma lucidum is part of several cosmetic products in the Chinese beauty products, many of which are used in the skin lightening function. Hence a study was conducted to assess the skin lightening activity of *Ganoderma lucidum* extract. In an enzyme based assay, *Ganoderma lucidum* extract was found to be potent tyrosinase inhibitor. Tyrosinase enzyme is a key enzyme in the melanin formation. Importantly the IC50 levels were much lower than other Basidiomycetes mushroom, thus justifying its use as a skin lightening active in cosmeceutical products. (Chien CC et al 2008)

CONCLUSION

Ganoderma lucidum is now days cultivated and hence can be commercially available for formulation in health supplements. The health benefits of *Ganoderma lucidum* are well known and documented in various traditional medicinal systems. With the status of dietary supplement ingredient in USA and Natural health product in Canada and hence is gaining popularity in western countries as a mainstream health supplement.

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