

Research References for Edible Medical Mushrooms

Blood Clotting

A prospective, randomized, double-blind, placebo-controlled study of the platelet and global hemostatic effects of *Ganoderma lucidum* Ling-Zhi in healthy volunteers. Reishi is a Chinese herbal medicine popular with cancer patients. Previous in vitro studies suggested that it might impair hemostasis. In this prospective, randomized double-blind study, healthy volunteers received orally reishi capsules 1.5 g or placebo daily for 4 wk. We monitored subjects before drug administration and at 4 and 8 wk thereafter by routine coagulation screen, fibrinogen concentration, von Willebrand ristocetin cofactor activity, platelet function analyzer PFA-100, and thrombelastography. There were no significant between-group differences and all measurements remained within the normal range. Reishi ingestion over 4 wk was not associated with impairment of hemostasis. *Anesth Analg.* 2005.

Blood sugar

Hypoglycemic effect of *Ganoderma lucidum* polysaccharides. *Acta Pharmacol Sin.* 2004.

AIM: To investigate the hypoglycemic effect of reishi polysaccharides in the normal fasted mice and its possible mechanism. Normal fasted mice were given a single dose of reishi 25, 50, and 100 mg/kg by i.p. and the serum glucose was measured at 0, 3, and 6 h after administration. Reishi 100 mg/kg were also given by i.p. and the serum glucose and insulin levels were measured. Pancreatic islets were isolated and incubated with glucose and different concentration of reishi, the insulin content of islets and insulin release were examined. Verapamil and egtazic acid were used to testify whether the insulin-releasing effect of reishi was mediated by its ability to raise the Ca²⁺ influx. Reishi dose-dependently lowered the serum glucose levels at 3 h and 6 h after administration. Reishi 100 mg/kg raised the circulating insulin levels at 1 h after administration. The insulin-releasing effect of reishi was inhibited by verapamil / egtazic acid. Reishi possesses hypoglycemic effect on normal mice; one mechanism is through its insulin-releasing activity due to a facilitation of Ca²⁺ inflow to the pancreatic beta cells.

Cancer

Reishi has been shown to be a potential agent in the treatment or prevention of certain cancers. In one study, reishi suppressed cell adhesion and cell migration of highly invasive breast and prostate cancer cells, suggesting its potency to reduce tumor invasiveness. Reishi clearly demonstrates anticancer activity in experiments with cancer cells and has possible therapeutic potential as a dietary supplement for an alternative therapy for breast and prostate cancer. Additional studies show water soluble extracts from reishi inhibit colon tumors in mice. And, it may enhance the immune response in those with end stage cancer. As of March 2009, extensive human studies are not available to make any firm conclusions regarding the dosage and safety of reishi in terms of human cancer treatment.

Anti cancer effects of *Ganoderma lucidum*: a review of scientific evidence.
Nutr Cancer. 2005.

Reishi a popular medicinal mushroom, has been used in China for longevity and health promotion since ancient times. Investigations into the anti cancer activity of reishi have been performed in both in vitro and in vivo studies, supporting its application for cancer treatment and prevention. The proposed anti cancer activity of reishi has prompted its usage by cancer patients. It remains debatable as to whether reishi is a food supplement for health maintenance or actually a therapeutic "drug" for medical purposes. Thus far there has been no report of human trials using reishi as a direct anti cancer agent, despite some evidence showing the usage of reishi as a potential supplement to cancer patients. Cellular immune responses and mitogenic reactivity of cancer patients have been enhanced by reishi, as reported in two randomized and one nonrandomized trials, and the quality of life of 65% of lung cancer patients improved in one study. The direct cytotoxic and anti-angiogenesis mechanisms of reishi have been established by in vitro studies; however, clinical studies should not be neglected to define the applicable dosage in vivo. At present, reishi is a health food supplement to support cancer patients, yet the evidence supporting the potential of direct in vivo anti cancer effects should not be underestimated.

Anti-tumor and immunoregulatory activities of *Ganoderma lucidum* and its possible mechanisms.

Acta Pharmacol Sin. 2004.

The most attractive character of this kind of medicinal fungus is its effect on the immune system and anti-tumor activities. Large numbers of studies have shown that reishi modulates many components of the immune system such as the antigen-presenting cells, NK cells, T and B lymphocytes. The water extract and the polysaccharides fraction of reishi exhibited significant anti-tumor effect in several tumor-bearing animals mainly through its immune system enhancing activity. Recent studies also showed that the alcohol extract or the triterpene fraction of reishi possessed anti-tumor effect, which seemed to be related to the cytotoxic activity against tumor cells directly. Preliminary study indicated that antiangiogenic effect may be involved antitumor activity of reishi.

Ganoderma lucidum in cancer treatment.

Integr Cancer Ther. 2003.

The dried powder of reishi was popular as a cancer chemotherapy agent in ancient China. The authors recently demonstrated that reishi inhibits constitutively active transcription factors nuclear factor kappa B (NF-kappaB) and AP-1, which resulted in the inhibition of expression of urokinase-type plasminogen activator and its receptor uPAR. Reishi also suppressed cell adhesion and cell migration of highly invasive breast and prostate cancer cells, suggesting its potency to reduce tumor invasiveness. Thus, reishi clearly demonstrates anticancer activity in experiments with cancer cells and has possible therapeutic potential as a dietary supplement for an alternative therapy for breast and prostate cancer. However, because of the availability of reishi from different sources, it is advisable to test its biologic activity.

Lymphoma

Regression of gastric large B-Cell lymphoma accompanied by a florid lymphoma-like T-cell reaction: immunomodulatory effect of Ganoderma lucidum Reishi?

Int J Surg Pathol. 2007. Department of Pathology, Queen Elizabeth Hospital, Wylie Road, Kowloon, Hong Kong.

Complete regression of high-grade lymphoma is extremely rare. We report 1 such case that might have been conceivably mediated by reishi. A 47-year-old man presented with epigastric pain. Endoscopy revealed a large gastric ulcer, which on biopsy was diagnostic of large B-cell lymphoma. At gastrectomy 11 days later, no evidence was found of large B-cell lymphoma despite thorough sampling. Instead, there was a dense and permeative infiltrate of CD3(+) CD8(+) cytotoxic small T lymphocytes spanning the whole thickness of the gastric wall. In situ reverse transcription polymerase chain reaction for T-cell receptor beta-chain family did not detect a monoclonal T-cell population. We postulate that the cytotoxic T cells may represent an active host-immune response against the large B-cell lymphoma that resulted in a complete regression. On questioning, the patient had taken megadoses of reishi, which might have triggered the successful immune reaction.

Prostate cancer

Ganoderma lucidum inhibits proliferation and induces apoptosis in human prostate cancer cells PC-3.

Int J Oncol. 2004.

Our data demonstrate that reishi inhibits cell proliferation in a dose- and time-dependent manner by the down-regulation of expression of cyclin B and Cdc2 and by the up-regulation of p21 expression. Furthermore, reishi induced apoptosis of PC-3 cells with a slight decrease in the expression of NF-kappaB-regulated Bcl-2 and Bcl-xl. Reishi exerts its effect on cancer cells by multiple mechanisms and may have potential therapeutic use for the prevention and treatment of cancer.

Cholesterol reduction

Animal studies indicate reishi has the ability to lower cholesterol levels.

Immune function

Oral administration of reishi results in Th1-associated immune enhancement in vivo.

Neurasthenia

Neurasthenia does not have a good definition, but mostly involves lack of vitality, fatigue, and lack of sense of wellbeing.

A randomized, double-blind and placebo-controlled study of a Reishi Ganoderma lucidum polysaccharide extract in neurasthenia.

J Med Food. 2005. New Zealand Institute of Natural Medicine Research, Auckland, New Zealand.

Reishi has been widely used to treat various diseases, including cancer, diabetes, and neurasthenia in many Asian countries. This randomized, double-blind, placebo-controlled parallel study aimed to investigate the efficacy and safety of a polysaccharide

extract of Reishi (Ganopoly) in Chinese patients with neurasthenia. One hundred thirty-two patients with neurasthenia according to the diagnosis criteria of the 10th International Classification of Diseases were included in this study. Ganopoly was well tolerated in the study patients. These findings indicated that Ganopoly was significantly superior to placebo with respect to the clinical improvement of symptoms in neurasthenia.

Reishi and prostate health

Randomized clinical trial of an ethanol extract of Reishi *Ganoderma lucidum* in men with lower urinary tract symptoms.

Asian J Androl. 2008; Noguchi M, Kakuma T, Tomiyasu K, Yamada A, Itoh K, Konishi F, Kumamoto S, Shimizu K, Kondo R, Matsuoka K. Department of Urology, Kurume University School of Medicine, 67 Asahi-machi, Kurume, Japan.

To evaluate the safety and efficacy of an extract of reishi *ganoderma lucidum* that shows the strongest 5 α -reductase inhibitory activity among the extracts of 19 edible and medicinal mushrooms by a double-blind, placebo-controlled, randomized and dose-ranging study in men with lower urinary tract symptoms (LUTS). In this trial, we randomly assigned 88 men over the age of 49 years who had slight-to-moderate LUTS to 12 weeks of treatment with reishi extract (6 mg once a day) or placebo. The primary outcome measures were changes in the International Prostate Symptom Score (IPSS) and variables of uroflowmetry. Reishi extract was effective and significantly superior to placebo for improving total IPSS. No changes were observed with respect to quality of life scores, peak urinary flow, mean urinary flow, residual urine, prostate volume, serum prostate-specific antigen or testosterone levels. Overall treatment was well tolerated with no severe adverse effects. The extract of reishi was well tolerated and improved IPSS scores. These results encouraged a further, large-scale evaluation of phytotherapy for a long duration using the extract of reishi extract on men with LUTS.

Anti-androgenic activities of *Ganoderma lucidum* .

J Ethnopharmacol. 2005. Department of Forest and Forest Products Science, Faculty of Agriculture, Kyushu University, Fukuoka

The inhibitory effects of methanol extracts of 19 edible and medicinal mushrooms on 5 α -reductase activity were examined. The extract of *Ganoderma lucidum* Fr. Krast (*Ganodermataceae*- Reishi) showed the strongest 5 α -reductase inhibitory activity. The treatment of the fruit body of reishi or the extract prepared from it significantly inhibited the testosterone-induced growth of the ventral prostate in castrated rats. These results showed that reishi might be a useful ingredient for the treatment of benign prostatic hyperplasia (BPH).

Virus infection

Reishi has compounds that may have antiviral activity, including activity against the Epstein-Barr virus.

Reishi toxicity, safety, risk, side effects

Giving reishi to human volunteers for a period of 4 weeks did not lead to any toxicity.

Ganoderma lucidum, a Chinese medicinal mushroom: biomarker responses in a controlled human supplementation study.

Br J Nutr. 2004.

The present double-blinded, placebo-controlled, cross-over intervention study investigated the effects of 4 weeks reishi supplementation on a range of biomarkers for antioxidant status, CHD risk, DNA damage, immune status, and inflammation, as well as markers of liver and renal toxicity. It was performed as a follow-up to a study that showed that antioxidant power in plasma increased after reishi ingestion, and that 10 d supplementation was associated with a trend towards an improved CHD biomarker profile. In the present study, fasting blood and urine from healthy, consenting adults (n 18; aged 22-52 years) was collected before and after 4 weeks supplementation with a commercially available encapsulated reishi preparation (1.4 g reishi/d; equivalent to 13 g fresh mushroom/d) or placebo. No significant change in any of the variables was found, although a slight trend toward lower lipids was again seen, and antioxidant capacity in urine increased. The results showed no evidence of liver, renal or DNA toxicity with reishi intake, and this is reassuring.

Availability

Reishi is sold in various forms, including tablets, coffee or tea, and extract capsules. One common extract sold online has 6% Polysaccharides / Triterpenoids.

Reishi Research studies

Effects of ganopoly (a Ganoderma lucidum polysaccharide extract) on the immune functions in advanced-stage cancer patients.

Immunol Invest. 2003.

Preclinical studies have established that the Ganoderma lucidum polysaccharide (reishi) fractions have potent anti-tumor activity, which has been associated with the immunostimulating effects of reishi. However, it is unclear whether reishi has immunomodulating effects in humans in vivo. This study aimed to investigate the effects of Ganopoly, the polysaccharides fractions extracted from reishi, on the immune function of advanced-stage cancer patients. Thirty-four advanced-stage cancer patients were entered onto this study, and treated with 1800 mg Ganopoly (reishi), three times daily orally before meals for 12 weeks. Immune parameters (cytokines, T cell subsets, and natural killer activity) were compared between baseline and after 12-week treatment. Thirty patients are assessable for their immune functions. Treatment of reishi for 12 weeks resulted in a significant increase in the mean plasma concentrations of interleukin (IL-2), IL-6, and interferon (IFN)-gamma, whereas the levels of IL-1 and tumor necrosis factor (TNF-alpha) were significantly decreased. A marked variability among patients with advanced-stage cancer was observed in the numbers of each lymphocyte subset at baseline. The mean absolute number of CD56+ cells was significantly increased after 12-week treatment of reishi, whereas the numbers of CD3+, CD4+, and CD8+ were just marginally increased compared to baseline levels, with the CD4:CD8 T cell ratios unchanged. In addition, reishi treatment resulted in a significant increase in the mean NK activity compared to baselines. The present study indicates that Ganopoly enhanced the immune responses in patients with advanced-stage cancer. Clinical evaluations of response and toxicity are ongoing.

Mechanism of the antiulcerogenic effect of *Ganoderma lucidum* polysaccharides (reishi) on indomethacin-induced lesions in the rat.

Life Sci. 2002 .

Many cytokines, in particular tumor necrosis factor (TNF)-alpha have been known to play an important role in the pathogenesis of gastric mucosal lesions caused by various factors such as drugs and *Helicobacter pylori* infection. Our previous studies have shown that the polysaccharide fractions isolated from the fruiting bodies of *Ganoderma lucidum* (reishi) prevented indomethacin- and acetic acid-induced gastric mucosal lesions in the rat. However, the mechanisms remain unclear. This study aimed to investigate whether reishi had a direct mucosal healing effect in the indomethacin-treated rat, and to explore the possible mechanisms by determining the gastric mucosal mRNA and protein levels of TNF-alpha and ornithine decarboxylase activity. These findings indicated that reishi produced a mucosal healing effect in the rat model, perhaps due partly to the suppression of TNF-alpha.