Ganoderma lucidum

Reishi mushroom is widely used in Asia and around the world as an immunostimulant. With extracts derived from both the cap and the stem of the mushroom, its biologic activity is thought to be due to beta-glucan polysaccharides and compounds called triterpenes. Reishi has demonstrated immunomodulatory and antitumor effects in a few studies. It is purportedly used to treat a wide variety of conditions, including fatigue, high cholesterol, AIDS, hypertension, inflammation, and viral infections. Further research is needed to determine the mechanisms responsible for any anticancer potential, and well designed clinical trials are needed to confirm the beneficial effects of Reishi.

Adverse effects from medicinal mushrooms are rare. However, because Reishi may interfere with immunosuppressant and chemotherapeutic agents, patients should use caution and consult their physicians before taking Reishi supplements.

ALSO KNOWN AS: Ling zhi, ling chi, lin zi, mushroom of immortality

USES: Reishi mushroom is used to treat hypertension, viral infections, inflammation, and liver disorders, to lower high cholesterol, and for immunostimulation in patients with cancer and AIDS.

BACKGROUND: Reishi is a medicinal mushroom of the class Agaricomycetes, prevalent in both tropical and temperate regions of the world. It has been used in traditional Chinese medicine for thousands of years as a tonic for strengthening and promoting longevity. Extracts of Reishi mushroom are commercially available as dietary supplements and are used by patients with cancer and AIDS to boost immune function.

RESEARCH: The active constituents of Reishi include beta-glucan polysaccharides and compounds known as triterpenes.[1] Reishi extracts were found to stimulate macrophages, alter the levels of tumor necrosis factor and interleukins,[2] and inhibit platelet aggregation[3] in vitro. Studies done in rats have shown that Reishi may alleviate chemotherapy-induced nausea.[4]

In clinical studies, Reishi increased plasma antioxidant capacity[5] and enhanced immune responses in advance-stage cancer patients.[6] It also reduced the severity of symptoms in men with lower urinary tract symptoms.[7]

HERB-DRUG INTERACTIONS:
- Anticoagulant/antiplatelet drugs: Reishi may increase the risk of bleeding.[8]
- Immunosuppressants: Reishi can enhance immune response.[6]
- Chemotherapeutic agents: Reishi can increase plasma antioxidant capacity, and can interact with chemotherapeutic agents that rely on free radicals.[5] Reishi polysaccharides inhibit CYP2E1, CYP1A2, and CYP3A enzymes, potentially interfering with the metabolism of drugs
Mechanisms of the Anticancer Action of 
Ganoderma lucidum

Source:

Ganoderma lucidum (Leyss. ex Fr.) Karst., a medicinal fungus called "Lingzhi" in China, has been used in traditional Chinese medicine in China for the prevention and treatment of various types of diseases, such as cancer, hepatopathy, arthritis, hypertension, neurasthenia, and chronic hepatitis. It is clear that the anticancer activity of G. lucidum is mainly due to polysaccharides and/or triterpenoids of the fungus. However, until now, the mechanism of the anticancer action of G. lucidum has not been
well understood and, previously, the activation of the immune response of the host was widely considered to be the only mechanism by which G. lucidum prevented and/or treated cancer. However, recent studies reviewed in the present paper have shown that the potential mechanisms of anticancer action include not only the activation of the immune response of the host, but also the induction of cell differentiation, the induction of Phase II-metabolizing enzymes, the inhibition of angiogenesis, and the inhibition of the expression of the urokinase-type plasminogen activator (uPA) and the uPA receptor in cancer cells. To further elucidate the mechanisms of action of G. lucidum, more in vivo tests and randomized controlled clinical trials should be carried out, and the molecular mechanisms should be studied intensively. Additionally, whether the anticancer compounds in G. lucidum act synergistically or independently should be further studied.

Antitumour activity and underlying mechanisms of ganopoly, the refined polysaccharides extracted from Ganoderma lucidum, in mice.


Ganopoly is an aqueous polysaccharide fraction extracted from G. lucidum by patented biochemical technique and has been marketed as an over-the-counter product for chronic diseases including cancer and hepatopathy in many Asian countries. This study was undertaken to explore the anti-tumour effect and the underlying mechanisms of Ganopoly in mice and human tumor cell lines. The maximum tolerated dose (MTD) of Ganopoly in mice was estimated to be 100 mg/kg from a pilot study. Treatment of mice with oral Ganopoly for 10 days significantly reduced the tumour weight of sarcoma-180 in a dose-dependent manner, with inhibition rates of 32.3, 48.2 and 84.9% and growth delays of 1.5, 3.5, and 13.1 days at 20, 50, and 100 mg/kg, respectively. Incubation of Ganopoly at 0.05-1.0 mg/ml for 48 hours showed little or negligible cytotoxicity against human tumor CaSki, SiHa, Hep3B, HepG2, HCT116 HT29, and MCF7 cells in vitro. In contrast, 10 mg/ml of Ganopoly caused significant cytotoxicity in all tumour cells tested except MCF7, with marked apoptotic effect observed in CaSki, HepG2, and HCT116 cells, as indicated by nuclear staining and DNA fragmentation. In addition, Ganopoly enhanced concanavalin A-
stimulated proliferation of murine splenocytes by 35.3% at 10 mg/ml, and stimulated the production of nitric oxide in thioglycollate-primed murine peritoneal macrophages in a concentration-dependent manner over 0.05-10 mg/ml. Addition of Ganopoly at 1 mg/ml to murine peritoneal macrophages also potentiated lipopolysaccharide-induced nitric oxide production by 64.2%. Treatment of healthy mice or mice bearing sarsoma-180 with oral Ganopoly over 20-100 mg/kg for 7 day significantly increased the expression of both TNF-alpha and IFN-gamma (at both mRNA and protein levels) in splenocytes in a dose-dependent manner. Moreover, treatment of Ganopoly over 20-100 mg/kg significantly increased cytotoxic T lymphocyte cytotoxicity and NK activity in mice. The overall findings indicated that Ganopoly had antitumor activity with a broad spectrum of immuno-modulating activities and may represent a novel promising immunotherapeutic agent in cancer treatment.

**Anticancer effects of Ganoderma lucidum: a review of scientific evidence.**


"Lingzhi" (Ganoderma lucidum), a popular medicinal mushroom, has been used in China for longevity and health promotion since ancient times. Investigations into the anticancer activity of lingzhi have been performed in both in vitro and in vivo studies, supporting its application for cancer treatment and prevention. The proposed anticancer activity of lingzhi has prompted its usage by cancer patients. It remains debatable as to whether lingzhi is a food supplement for health maintenance or actually a therapeutic "drug" for medical proposes. Thus far there has been no report of human trials using lingzhi as a direct anticancer agent, despite some evidence showing the usage of lingzhi as a potential supplement to cancer patients. Cellular immune responses and mitogenic reactivity of cancer patients have been enhanced by lingzhi, 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 lingzhi have been established by in vitro studies; however, clinical studies should not be neglected to define the applicable dosage in vivo. At present, lingzhi is a health food supplement to support cancer patients, yet the evidence supporting the potential of direct in vivo anticancer effects should not be underestimated. Lingzhi or its products can be classified as an anticancer
agent when current and more direct scientific evidence becomes available.

**Dendritic Cells as a Pharmacological Target of Traditional Chinese Medicine**


Dendritic cells (DCs) represent a heterogeneous population of professional antigen-presenting cells (APCs) that play a central role in the initiation and regulation of immune responses. There is considerable evidence that DCs can be used as therapeutic targets for pharmacological modulation of immune responses. Traditional Chinese medicine (TCM) has a long-standing history of using herbal medicine in the treatment of a variety of human diseases. Many of the clinical effects of TCM have reportedly been attributed to the up- or down-regulation of immune responses. Accumulating evidence indicates that TCM and its components can interfere with immune responses at the earliest stage by targeting key functions of DCs. Here, we review those published studies of TCM with respect to their effects on immunobiological functions of DCs. Investigations based on both chemical entities derived from TCM as well as TCM herbal mixtures are presented. These studies suggest that various TCM herbal medicines have the capacity to inhibit or promote major functions of DCs, such as differentiation, maturation, cytokine production, survival, antigen uptake and presentation as well as trafficking. These studies have revealed novel biological effects of TCM and documented the utility of this approach to discover novel biological modifier of DC functions derived from natural sources.

**Highly Oligomeric Procyanidins Ameliorate Experimental Autoimmune Encephalomyelitis via Suppression of Th1 Immunity.**

Extracts of Jatoba, a South American herb, when injected i.p. into a mouse model of experimental autoimmune encephalomyelitis (EAE), inhibited the aggravation of clinical symptoms. At the same time, production of myelin oligodendrocyte glycoprotein Ag-specific IFN-\(\gamma\) and TNF-\(\alpha\) by spleen cells was markedly suppressed. After administration of Jatoba there was minimal evidence of the demyelination that is characteristic of the EAE model. Decreases in clinical scores were observed when Jatoba extracts were injected just before Ag. The purified active compounds are likely to be polyphenols that are absorbable to polyvinylpolypyrrolidone. The active compounds were polymerized polyphenol polymers (procyanidins) and at least five degrees of polymerization were necessary for activity. In addition, extracts of other plant materials containing such procyanidins had similar activity. After administration of highly polymerized procyanidins, there was a decrease in both dendritic and CD4+ T cells. Although macrophages were increased in number, the expression of CD80 and MHC class II molecules was depressed indicating that the macrophages were immature. The results indicate that the suppression of development of EAE by the highly polymerized procyanidins resulted from an inhibition of Th1 and the effects might be associated with depression of Ag-presenting capability.

**Oral Administration of Highly Oligomeric Procyanidins of Jatoba Reduces the Severity of Collagen-Induced Arthritis. Bioscience, Biotechnology, and Biochemistry.**


We have previously reported that highly oligomeric procyanidins (HOPC) purified from Jatoba, a South American herb, ameliorated experimental autoimmune encephalomyelitis (EAE) in mice. In this present study, we report that symptoms of arthritis were also significantly reduced by administering the Jatoba extract, when compared with the vehicle-alone-treated control. Interferon-gamma (IFN-\(\gamma\)) production by the splenocytes from mice injected with procyanidins was also dramatically decreased. The oral administration of purified HOPC was significantly more effective in disease prevention than the ethanol (EtOH) extract of Jatoba. Green tea polyphenol administration, however,
surprisingly facilitated disease development. Observation of the joint histopathology on whole paws derived from the HOPC-treated mice showed complete abrogation of collagen induced arthritis (CIA), a characteristic of chronic inflammation in the synovial tissue. These results demonstrate that HOPC administration had an inhibitory effect on both chronic arthritis and EAE and that the oral administration of HOPC exerted its effect after the induction of secondary immunity.

The impact of acculturation on the use of traditional Chinese medicine in newly diagnosed Chinese cancer patients.


Goals of work This study assessed the impact of acculturation on the prevalence of traditional Chinese medicine and other complementary and alternative medicine (TCM/CAM) use in newly diagnosed Chinese cancer patients. The individual determinants of TCM/CAM use among patients were also investigated.

Materials and methods A consecutive sample of Chinese cancer patients treated at the British Columbia Cancer Agency was surveyed at admission using a 15-item questionnaire. Items included TCM/CAM use, sociodemographics, as well as medical and cultural factors. Data were analyzed using bivariate methods including Pearson’s X² test and Student’s t test. As well, multiple logistic regression was used to obtain the final causal model.

Main results Of the 230 respondents, 57% completed the survey in Chinese and 94% were immigrants. The average age was 59. Participants had a mean disease duration of approximately 2 months and 79% had already received at least one conventional treatment. Overall, TCM/CAM was used by 47% of respondents. Herbal remedies, vitamins/minerals, and prayer were the most commonly used therapies. Multivariable analysis showed that prior TCM/CAM use (p < 0.001), having received conventional treatment(s) (p = 0.029), and being less acculturated (p = 0.028) were associated with TCM/CAM use.

Conclusions Prevalence and type of use were found to vary as a function of the degree of acculturation. Health care practitioners would be well advised to discuss TCM/CAM use with their patients, especially those who are less acculturated to Western society, since they are the most
likely users of TCM/CAM.

**Grifola frondosa**

**ALSO KNOWN AS:** Maitake, hen of the woods, dancing mushroom

**USES:** Maitake is a medicinal mushroom used to treat diabetes and hypertension, as an immunostimulant, and to treat and prevent cancer.

**BACKGROUND:** Maitake is an edible mushroom of the class Basidiomycetes. It is consumed as food in Asia and also used medicinally as an immunostimulant in Japan and elsewhere in Asia. Maitake extracts are commercially available as dietary supplements. Along with other medicinal mushroom supplements, they are used to “enhance immune function” and to treat HIV and cancer. The active constituent is thought to be a protein-bound beta-glucan.

**RESEARCH:** In vitro studies show that the beta-1,6-glucan fraction extracted from maitake enhances bone marrow colony formation, reduces doxorubicin toxicity,[1] induces hematopoietic stem cell proliferation[2] and inhibits tumor metastasis.[3] It is thought to exert these effects by activating various effector cells, such as macrophages, natural killer cells, T cells, interleukin-1, and superoxide anions.[4]

In a small noncontrolled human study, tumor regression or significant symptom improvement was observed in half of the subjects using maitake extract.[5]

Maitake also demonstrated hypoglycemic activity in mice[6] and in patients with type 2 diabetes.[7]

DR. CASSILETH: Maitake beta-glucan extract obtained from the fruiting bodies of maitake mushroom, or Grifola frondosa, is widely used in Asia as a cancer treatment, typically adjunctively. Research to determine the mechanisms that underlie maitake’s anticancer effects is ongoing, as detailed at [http://www.mskcc.org/AboutHerbs](http://www.mskcc.org/AboutHerbs).

Maitake mushroom is an edible perennial fungus that grows in clusters at the foot of large trees, especially oak. The whole mushroom, which can grow as large as 60 cm, can be fried or boiled. Extracts and supplements are sold as immune stimulants for patients with HIV or cancer.

Beta-1,6-glucan, a protein-bound polysaccharide, is the active component of the maitake mushroom. This compound has been shown to exert anticancer effects in vitro by stimulating various subsets of the immune system. A small study of maitake extract in cancer patients found the substance to be beneficial. Additional investigations are underway to determine optimal dosing and to fully assess maitake’s anticancer potential.

Adverse effects are rare from medicinal mushrooms. However, because
maitake may interfere with immunosuppressants and may also have hypoglycaemic effects, patients should use caution and consult their physicians before taking maitake supplements.

References: