Ganoderma lucidum and its pharmacologically active compounds.


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Ganoderma lucidum is a wood-degrading basidiomycete with numerous pharmacological effects. Since the mushroom is very rare in nature, artificial cultivation of fruiting bodies has been known on wood logs and on sawdust in plastic bags or bottles. Biotechnological cultivation of G. lucidum mycelia in bioreactors has also been established, both on solid substrates and in liquid media by submerged cultivation of fungal biomass. The most important pharmacologically active constituents of G. lucidum are triterpenoids and polysaccharides. Triterpenoids have been reported to possess hepatoprotective, anti-hypertensive, hypocholesterolemic and anti-histaminic effects, anti-tumor and anti-angiogenic activity, effects on platelet aggregation and complement inhibition. Polysaccharides, especially beta-d-glucans, have been known to possess anti-tumor effects through immunomodulation and anti-angiogenesis. In addition, polysaccharides have a protective effect against free radicals and reduce cell damage caused by mutagens.

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Ganoderma lucidum: a potent pharmacological macrofungus.

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Ganoderma lucidum (Ling Zhi) is a basidiomycete white rot macrofungus which has been used extensively as "the mushroom of immortality" in China, Japan, Korea and other Asian countries for 2000 years. A great deal of work has been carried out on the therapeutic potential of Ganoderma lucidum. The basidiocarp, mycelia and spores of Ganoderma lucidum contain approximately 400 different bioactive components, which mainly include triterpenoids, polysaccharides, nucleotides, sterols, steroids, fatty acids, proteins/peptides and trace elements which has been reported to have a number of pharmacological effects including immunomodulation, anti-atherosclerotic, anti-inflammatory, analgesic, chemo-preventive, antitumor, chemotherapeutic, sleep promoting, antibacterial, antiviral (including anti-HIV), hypolipidemic, anti-fibrotic, hepatoprotective, estrogenic activity and anti-ulcer properties. Ganoderma lucidum has now become recognized as an alternative adjuvant in the treatment of leukemia, carcinoma, hepatitis and diabetes. The macrofungus is very rare in nature rather not sufficient for commercial exploitation for vital therapeutic emergencies, therefore, the cultivation on solid substrates, stationary liquid medium or by submerged cultivation has become an essential aspect to meet the driving force towards the increasing demands in the international market. Present review focuses on the pharmacological aspects, cultivation methods and bioactive metabolites playing a significant role in various therapeutic applications.

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Ganoderma - a therapeutic fungal biofactory.


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Ganoderma is a basidiomycete white rot fungus which has been used for medicinal purposes for centuries particularly in China, Japan and Korea. A great deal of work has been carried out on Ganoderma lucidum. The common names for preparations include Lingzhi, Munnertake, Sachitake, Reishi and Youngzhi. This review collates the publications detailing activities and compounds by representative species whilst considering the most valid claims of effectiveness. The biological activities reported of preparations from Ganoderma are remarkable and give most emphasis herein as distinct from structure/activity information. The metabolites consist of mainly polysaccharides and terpenoids. Many are activities against the major diseases of our time and so the present review is of great importance. The list of effects is huge ranging from anti-cancer to relieving blockages of the bladder. However, the reports have not all been tested scientifically with the convincing evidence is reserved for assays of pure compounds. It is a prime example of an ancient remedy being of great relevance to the modern era. There does appear to be an assumption that the therapeutic effects attributed to the fungus have been proven. The next step is to produce some effective medicines which may be hampered by problems of mass production.

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Comparative studies of various ganoderma species and their different parts with regard to their antitumor and immunomodulating activities in vitro.

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OBJECTIVES: Ganoderma lucidum (Lingzhi or Reishi) has been commonly suggested in East Asia as a potential candidate for prevention and treatment of different diseases, including cancer. Ganoderma extracts, in particular Ganoderma lucidum (extracts or isolated components), have previously been shown to possess antitumor activities. The present study aimed at comparing three different species of Ganoderma, widely grown versus cultivated, as well as the different parts of the fruiting body (whole fruiting body, mycelia and spores), with regard to their antitumor effects in human breast cancer cells and immunomodulatory activities in mouse splenic lymphocytes in vitro. METHODS: The aqueous extracts (12.5-400 microg/mL) of G. lucidum, G. sinense, and G. tsugae were examined for their antiproliferative activities in human breast cancer cell lines, MCF-7 and MDA-MB-231, as well as in normal human mammary epithelial cells (primary culture). The immunomodulatory effects of the extracts were evaluated in mouse splenic lymphocytes. The proliferative responses of the mentioned cell types were determined by MTT [3-(4,5-dimethylthiazolyl)-2,5-diphenyl-tetrazolium
bromide] assay. RESULTS: The present results demonstrated that the extracts of all tested Ganoderma samples could significantly inhibit cell proliferation in human breast cancer cell lines MCF-7 and MDA-MB-231, with G. tsugae being the most potent. The extracts, however, did not exert any significant cytotoxic effect on human normal mammary epithelial cells. Within the species G. sinense, the inhibitory effects of wildly grown samples were not significantly different from those of the cultivated samples, except at 400 microg/mL. Most of the tested extracts of Ganoderma stimulated mouse splenic lymphocytes proliferation. The extracts from the stipes of the G. tsugae and wildly grown G. sinense showed much stronger inhibitory effects than the other parts of the fruiting body in both cancer cell lines, whereas the extracts from the stipes of G. lucidum and wildly grown G. sinense showed stronger immunopotentiating activities in mouse splenic lymphocytes. CONCLUSIONS: These results indicate that the aqueous extracts of these commonly available Ganoderma fruiting bodies, G. lucidum, G. sinense, and G. tsugae have antitumor activities in human breast cancer cells and immunomodulatory activities in murine lymphocytes. In addition, the present findings also suggest that the stipes of fruiting bodies of Ganoderma species should be included in the preparation of extract of these fungi in order to obtain the most comprehensive active ingredients. To the best of the authors' knowledge, this is the first detailed comparison among the different parts of the fruiting bodies of Ganoderma.

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