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Licorice: A Medicine with Multifunctional Activity

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ABSTRACT

A well-known medicinal plant with significant pharmacological value is licorice, or Glycyrrhiza glabra L. Glycyrrhizin, glabridin, liquiritigenin, and isoliquiritin are the primary bioactive components that contribute to its wide range of biological activities, including antioxidant, antimicrobial, anti-inflammatory, anticancer, antiviral, hepatoprotective, and antidiabetic effects. It has been demonstrated that glycyrrhizin, a triterpenoid saponin that gives licorice roots their distinctive sweetness, is effective against hepatitis, HIV, and skin conditions. In the food and pharmaceutical industries, it is utilized as a natural sweetener and therapeutic agent. Extracts of Glycyrrhiza glabra have been shown in pharmacological studies to control how the immune system works, stop tumor growth, protect the liver from damage, and stop bacterial and fungal infections. As a natural remedy, its traditional uses include treating respiratory conditions, gastric ulcers, inflammation, and hormonal disorders. Recent advances in extraction and phytochemical enrichment techniques have enhanced the yield of glycyrrhizin and flavonoids, reinforcing Glycyrrhiza glabra's role as a major candidate in modern pharmacognosy and drug discovery.

KEYWORDS: Glycyrrhiza Glabra, Licorice, Glycyrrhizin, Phytochemicals, Pharmacological Activity, Medicinal Plant.

1. INTRODUCTION

Plants have long served as a major source of medicine, and the demand for herbal products continues to rise globally. Glycyrrhiza glabra (licorice), commonly known as Mulethi, is a well-known medicinal herb native to the Mediterranean and parts of Asia, and is cultivated worldwide including in Europe, the USA, China, and India. (1)

Licorice root has been used since ancient times for both therapeutic and flavoring purposes and remains important in modern herbal medicine. The plant contains several bioactive compounds, such as saponins, flavonoids, tannins, alkaloids, and phenolics, which contribute to its medicinal value. Botanically, it is a small perennial shrub with pinnate leaves, purple-violet flowers, and stolon-forming roots used commercially. Traditionally used across Egyptian, Greek, Chinese, Indian, and Roman cultures, licorice continues to be applied in pharmaceuticals, food supplements, cosmetics, and cough preparations as a flavoring and expectorant agent. (2)

Pharmacognostic Description

Macroscopic

The plant is an herbaceous perennial that grows up to 1 meter in height. Its leaves are pinnate, measuring 7-15 cm long with 9-17 oblong to ovate leaflets. The plant produces purple to pale whitish-blue flowers in loose inflorescences, which develop into oblong pods containing several seeds. The root system consists of a main taproot with numerous runners, characterized by a cylindrical, woody, and tough structure. The roots have a bright yellow interior, a sweet taste, and a slight aromatic odor. The surface of young roots is relatively smooth with longitudinal cracks, while mature roots have a rough, warty, corky, and flaky exterior with transverse cracks. These characteristics are consistent with licorice (Glycyrrhiza glabra), a plant known for its medicinal properties and culinary uses. (3)

Microscopic

The plant's root and leaf anatomy reveal distinctive features. The root has a corky, flaky outer surface and a woody, cylindrical structure. Internally, a thin silver-colored ring lines the bark, and the central region consists of a light brown woody part with pores and creamish radiating rays. Microscopically, the root exhibits multiple layers of reddish-brown cork cells, phelloderm, phloem fibers, xylem fibers, and parenchyma cells containing starch grains and calcium oxalate crystals. The leaf anatomy shows stomata that release salt crystals, and typical vascular bundles with xylem, phloem, and epidermal cells. These specialized structures suggest the plant's adaptations for water conduction, nutrient transport, and structural support. Overall, the plant's anatomy highlights its unique characteristics and functional adaptations. (4)

Figure 1:- GLYCYRRHIZA GLABRA PLANT

Figure 2:- GLYCYRRHIZA GLABRA ROOT

Taxonomical Classification

Kingdom: Pantae

Sub-kingdom: Tracheobionta

Division: Angiospermae

Class: Dicotyledoneae

Order: Rosales

Family: Fabaceae (Leguminosae)

Genus: Glycyrrhiza

Species: glabra Linn

Vernacular Names

Sanskrit: Yashti-madhu, Madhuka

Bengali: Jashtimadhu, Jaishbomodhu

Persia: Ausareha mahaka

Gujarati: Jethimadhu

Kannada: Yashtimadhu, Atimaddhura

Malayalam: Iratimadhuram

Marathi: Jeshtamadha

Oriya: Jatimadhu

Tamil: Atimaduram

Telugu: Atimadhuranu, Yashtimadhukam

English: Licorice, Liquorice, Sweet wood

Hindi: Jothi-madh or Mulhatti

Arab: Aslussiesa

France: Boisdoux

Geographical Distribution

Glycyrrhiza glabra has a wide geographical distribution, primarily native to Eurasia, but is also found in regions of northern Africa and Western Asia. The species is indigenous to central and southwestern Asia and the Mediterranean region. It is notably found in countries such as Spain, Italy, Turkey, Iran, Iraq, Central Asia, and northwestern China. In Africa, its presence is recorded mainly in Libya. In south Asia, it occurs in India and Pakistan. In India Glycyrrhiza glabra is primarily found and cultivated in northern states such as Punjab, Haryana, and in the Sub-Himalayan areas, it is also cultivated in parts of Haryana (Hisar) and West Bengal where it is recognized as an important medicinal plant. (4-5)

Phytochemical Constituents

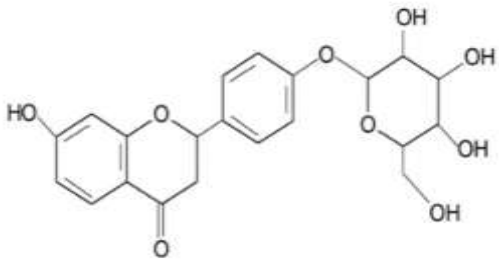
Glycyrrhizin, a saponin 60 times sweeter than cane sugar, is found in the roots of Glycyrrhiza glabra Linn. Among the flavonoid-rich fractions are liquidin, isoliquertin, liquidigenin, rhamnoliquirilin, and others. Five novel flavonoids were also extracted from dried roots that are glucoliquiritin apioside, prenylliciflavone A, shinflavanone, shinpterocarpin, and xyphaseolin. Licopyranocoumarin, licoarylcoumarin, glisoflavone, and the novel coumarin-GU-12 were also isolated and their structures determined. Semilicoisoflavone B, 1-methoxyficifolinol, and isoangustone A, and licoriphenone are four novel isoprenoid-substituted phenolic components that were extracted from roots.

Licorice roots contain various bioactive and volatile compounds, including kanzonol R, geraniol, terpinen-4-ol, α-terpineol, and linalool oxides. The essential oil has propionic acid, benzoic acid, ethyl linoleate, and

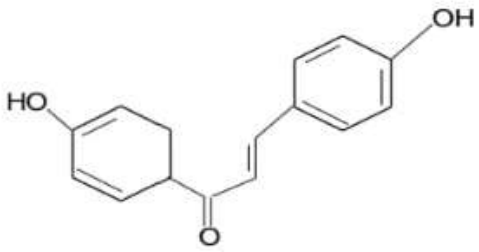
other aromatic compounds. Indian roots also contain 2-methylisoflavones, liquocoumarin, 6-acetyl-5-hydroxy-4-methyl coumarin, and asparagine. The main active component, glycyrrhizin (10–25%), is a saponin composed of glycyrrhetic acid and glucuronic acid, existing in 18α and 18β forms, and occurs naturally as calcium and potassium salts. (6)

The Food Chemicals Codex has established specifications for the ammoniated salt of glycyrrhizin, which is made from licorice extracts and is used as a food flavoring agent. Carbenoxolone, an along of glycyrrhetic acid, is used in the treatment of some alimentary tract ulcerative conditions, such as peptic ulcers. (7-8)

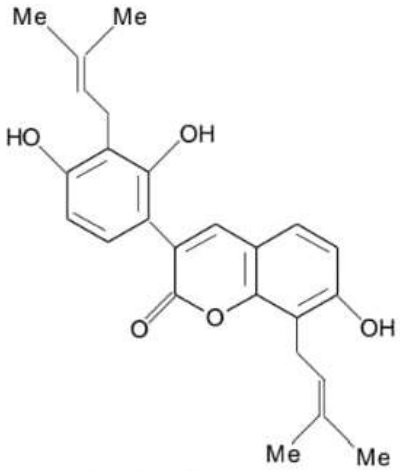
Chemical Structures



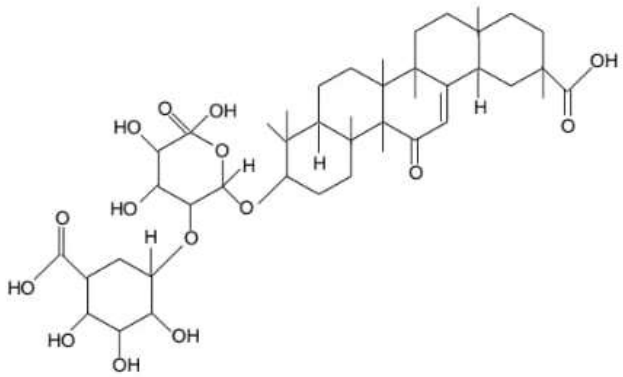
LIQUIRITIN



ISOLIQUIRITIGENIN



LICOCAUMARIN



GLYCYRRHIZIN

Adverse effect

Excess licorice use can cause serious side effects such as low potassium (hypokalemia), high blood pressure, fluid retention, and heart problems. It may also affect hormones, worsen kidney issues, and interact with certain medications. Other possible effects include fatigue, muscle pain, and metabolic imbalances. Elderly individuals, women, and those with certain health conditions are at higher risk, with rare severe outcomes like stroke or preterm birth.

Dose

The recommended dose of Glycyrrhiza glabra (licorice) varies depending on the form and health condition being treated. For powdered root, typical doses are 1 to 4 grams taken three times daily. For deglycyrrhizinated licorice (DGL), commonly used for digestive health and ulcers, the usual dose is two to four 380 mg chewable tablets taken between or 20 minutes before meals, continued for 8 to 16 weeks. In general, glycyrrhizin intake, the active component responsible for effects and side effects, should be limited to no more than 100 mg per day to avoid toxicity. For children and adolescents, doses are lower and adjusted by age.

Mechanism of action

Numerous tools are to blame for the beneficial effects of licorice. Various RNA and DNA infections, including hepatitis A and C, herpes zoster, HIV, herpes simplex, and CMV, have been shown to be repressed in their development and cytopathology by glycyrrhizin and glycyrrhizic corrosive. The well-known pseudo-aldosterone disorder is caused by glycyrrhizin and its metabolites suppressing aldosterone digestion in the liver and inhibiting 5-(beta)-reductase. The mineralocorticoid and glucocorticoid effects of glycyrrhizin corrosive can be seen in its structure, which is comparable to that of hormones discharged by the adrenal cortex. (9)

Traditional Uses (10)

- Yashtimadhu prepared rice milk confection was prescribed in hoarseness. Of speech.
- Charaka advised taking 10 grams of madhuka powder mixed with honey.
- 10 grams of sugar and 10 grams of madhuka powder. Was mashed with rice water and prescribed for men with hemorrhage.
- In cases of intrinsic hemorrhage, sushrata prescribed 10 grams of yashti madhu paste.
- Santalum album, a milk-powdered powder, and yashtimadhu were also prescribed by charaka in haemoglobinemia.
- It was recommended to mix yashti with cow's milk to encourage lactation.
- Anemia was treated with honey and a decoction or powder of madhuka.
- Licorice and warm clarified butter were applied topically to wounds, burns and bruising.
- Butter milk paste made from licorice and sesamum indicum is used to treat oedema.
- Additionally, charaka advised mixing sugar water a paste of licorice and picirrhiza kurroa as a heart-tonic.

Medicinal Uses

The biological effect of this plant species such as its anti-inflammatory and expectorant properties, its ability to control coughing, and its effects on hormones have been documented in the literature. It is used internally to treat addition's disease, asthma, bronchitis, and peptic ulcer. It detoxifies and protects the liver Arthritis, Allergic complaints and steroid therapy. (11)

It is said to have antiviral, anticancer, anti-ulcer, anti-diabetic, anti-oxidant, anti-thromatic, anti-malarial, anti-fungal, anti-bacterial, immune-stimulant, antithrombotic, anticonvulsant, anti-allergenic, and expectorant properties. It is also said to have anti-inflammatory and anti-inflammatory properties. It was also shown that the roots had antidepressant, hypotensive, hepatoprotective, spasmolytic, and memory-enhancing properties. Because of its demulcent properties, licorice roots are used.

It can also help with gout, asthma, tonsillitis, flatulence, sexual dysfunction, epilepsy, hyperdypsia, fever, cough, skin diseases, swellings, acidity, leucorrhoea, bleeding, jaundice, hiccough, hoarseness, and vitiated vata dosha conditions like gastralgia, cephalalgia, ophthalmopathy, and pharyngod. (12)

2. PHARMACOLOGICAL ACTIVITY

1. Anti-ulcer activity

Licorice's main ingredient, glycyrrhizinic acid, raises the stomach's local concentration of prostaglandins, which encourage mucous secretion and cell proliferation. Glycyrrhizic acid, glycyrrhetinic acid, and a novel lipophilic derivative of glycyrrhetinic acid monoglucuronide (GAMG), acetylated GAMG (GAMG), were found to be effective against 29 strains of Helicobacter pylori in a previous study of Extractum liquiritiae (EL). Glycyrrhizic acid's beneficial effect on peptic ulcers is concluded by its strong in vitro activity against H. pylori. (13)

2. Immunostimulatory activity

A studies proved that Glycyrrhiza glabra at 100µg/ml concentration, possess immunostimulatory effects. Human granulocyte production of TCD69 lymphocytes and macrophages is boosted as a result. Liquorice root extract was found in a previous study to prevent an increase in immune complexes linked to autoimmune diseases like systemic lupus erythematosus.

3. Anti-fungal activity

Glycyrrhiza glabra has strong antifungal properties. The oil-based extract of licorice, or OEL, was found to have a high fungicidal effect on Arthrinium sacchari M001 and Chaetomium funicola M002, and its active compound was identified as glabridin, in a previous study of screening for antifungal compounds from various plant materials. As a result, liquorice extracts inclusion in the formulation of cosmetics with antiseptic properties could be very beneficial. (14)

4. Anti-malarial activity

Licochalcone A, a chalcone found in liquorice, has antimalarial properties. In a previous study, oral doses of 1000mg kg-1 of P. yoelii were found to completely eradicate the malaria parasite in mice.

5. Antioxidant activity

Antioxidant properties Glycyrrhiza have a significant effect on quenching free radicals. Flavonoids found in liquorice have a particularly potent antioxidant effect. The antioxidant capacity of liquorice flavonoids was found to be over one hundred times greater than that of vitamin E. As a result, liquorice extract can be effectively incorporated into cosmetic products to safeguard hair and skin from oxidative damage. (15)

6. Anti-tussive and Antidemulcent activity

The liquorice extract and powder were used to treat cough, bronchial catarrh, and a sore throat. It has been demonstrated that licorice and codeine both have the same effect on sore throats. It soothes irritation and has expectorant effects. Glycyrrhiza derived semi-synthetic compound carbenoxolone stimulates gastric mucus

secretion. Liquorice's demulcent action is due to glycyrrhizin. Liquiritin apioside, an active ingredient in liquorice's methanolic extract that prevents cough caused by capsaicin, can be found in liquorice. (16)

7. Anti-bacterial Activity

The hydro-methanolic root extract of Glycyrrhiza glabra contains secondary metabolites with potent antibacterial activity against Staphylococcus aureus, such as saponins, alkaloids, and flavonoids. Moreover various studies on aqueous and ethanolic extracts of liquorice proved its inhibitory activity on cultures of Staphylococcus aureus and Streptococcus pyogenes.

8. Anti-viral effects

Herpes simplex, Varicella zoster, Japanese encephalitis, the influenza virus, vesicular stomatitis virus, and type an influenza virus are all thought to be inhibited in growth by liquorice extract. Glycyrrhizin does not allow the virus cell binding. As a result, it is discovered to have significant antiviral activity. (17)

9. Antithrombotic effect

Glycyrrhiza glabra extract's in-vivo effects, when combined with Vitamin K and Heparin, were examined in Sprague Dawley rats in a previous study. When administered at doses of 180 mg/kg and 360 mg/kg, it was discovered that extract of G glabra prolonged bleeding. The absorbance at 540 nm was used to measure blood loss 60 minutes later because the solution contained hemoglobin. Overall, the data show that Glycyrrhiza glabra is a good anti-thrombotic.

10. Hair growth stimulation

Liquorice can be safely used in herbal formulations to treat a variety of alopecias and has a significant effect on hair growth. Hydro-alcoholic liquorice extract had positive effects on hair growth in a previous study. Liquorice extract at a concentration of 2% performed better than Minoxidil at a concentration of 2% to stimulate hair growth when compared to the standard drug used (Minoxidil 2%). (18)

11. Skin lightening activity

Liquorice extract has been reported to effectively lighten pigments. In cultured B16 murine melanoma cells, glabridin in the hydrophobic fraction of liquorice extract inhibits tyrosinase activity. Additionally, tyrosinase activity is inhibited by liquorice extract active compounds such as isoliquiritin, glabrene, and licochalcone A. The liquiditine in liquorice extract lightens the skin by dispersing melanin.

12. Anti-inflammatory activity

Liquorice root (Glycyrrhiza) extract is said to have an anti-inflammatory effect similar to that of glucocorticoids and mineralocorticoids. The fact that liquorice root (Glycyrrhiza) extract aids in the healing of mouth and stomach ulcers has been known for more than two thousand years. Glycyrrhizic acid, according to studies, inhibits all factors that cause inflammation. It inhibits cyclooxygenase activity and prostaglandin formation. It is also indirectly inhibiting platelet responsible aggregation, for indirectly inhibiting platelet responsible aggregation.

13. Anti-diabetic activity

In a previous study Kuroda M et al., reported that ethyl acetate extract of licorice exhibited a significant PPARY (peroxisome proliferator-activated receptors) function as transcription factors regulating the expression of genes involved in glucose and lipid metabolism binding activity. Finally reduces the blood glucose level in knockout diabetic mice. (19)

3. CONCLUSION

Glycyrrhiza glabra L is extensively used and a potent therapeutic herb used in many problems with other systems. It serves as both a single treatment and the primary content. Many medicinal preparations like lozenges, syrups etc. It is highly sought after. Internationally as remedial and nutritious supplement. Since then, this herb has been used centuries for asthma, bronchitis, ulcers, and an anti-inflammatory, according to

contain oil, alkaloids, flavonoids, and essential coumarins. Extract of root can be found in different herbal preparations that are in market today. The pharmacological and clinical the studies in this review demonstrate that Glycyrrhiza has medicinal value. L. glabra it is a significant source of different types of compounds with varied chemical structures and pharmacological properties as well. Existence of such a wide range of chemical compounds shows that the plant could serve as a lead for the development of new drugs that work well for different disorders. In the years to come. (20)

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