

A REVIEW ON YASTIMADHU (GLYCYRRHIZA GLABRA LINN): AN OVERVIEW

Premlata^{1*}, B. Ram¹, Shubham Khandekar² and Anurag Gangwar²^{1*}Senior Resident, Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India, 221005.¹Professor, Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India, 221005,²Junior Resident, Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India, 221005.***Corresponding Author: Premlata**

Senior Resident, Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India, 221005.

Article Received on 21/01/2025

Article Revised on 10/02/2025

Article Accepted on 02/03/2025

ABSTRACT

Glycyrrhiza glabra, a plant with a rich history of medicinal use, has emerged as a promising candidate for the development of novel herbal medicines. For centuries, plants have been a cornerstone of traditional medicine, offering a wealth of health benefits. Glycyrrhiza glabra, in particular, has been used globally for its ethno-pharmacological value in treating various ailments, from simple coughs to complex conditions like hepatitis, SARS, and cancer. Glycyrrhiza glabra exhibits a broad spectrum of pharmacological activities, including: Anti-inflammatory, Antioxidant, Antibiotic, Antiviral, Anti-ulcer, Anti-tussives, Estrogenic, Anti-diuretic, Hypolipidemic. Glycyrrhiza glabra contains an array of important phytoconstituents, including: Glycyrrhizin, Glycyrrhizinic acid, Glabrin A & B, Triterpene sterols, Saponin, Isoflavones. This review aims to highlight the key pharmacological properties and phytoconstituents of Glycyrrhiza glabra, underscoring its potential as a versatile plant for the future.

KEYWORDS: Glycyrrhiza glabra, Ayurveda, Yastimadhu, Liquorice.**1. INTRODUCTION**

Medicinal plants have been a cornerstone of human health for centuries, offering a wealth of benefits to individuals and communities. The medicinal value of these plants lies in their bioactive constituents, which produce a definite physiological action on the human body. Some of the most important bioactive constituents of plants include: Triterpenoid saponins, Flavonoids, Tannins, Alkaloids, Phenolic compounds.^[1] Many indigenous medicinal plants are used as spices, food plants, and even added to foods for pregnant and nursing mothers for medicinal purposes. One such plant is Glycyrrhiza glabra, commonly known as licorice or mulaithi in north India.^[2,3] Glycyrrhiza glabra is native to the Mediterranean and certain areas of Asia. It belongs to the genus Glycyrrhiza and has been used in traditional medicine for various pathological conditions, including: Coughs, Colds, Painful swellings, Diuretic, Choleric, Insecticide. Traditional healers have long claimed the efficacy of Glycyrrhiza species, and its medicinal properties continue to be explored and validated by modern science.^[4]

2. SCIENTIFIC CLASSIFICATION

Kingdom: Plantae
Division: Angiospermae
Class: Dicotyledoneae
Order: Rosales Family: Leguminosae
Genus: Glycyrrhiza
Species: glabra Linn
Binomial Name: Glycyrrhiza glabra L.

3. MORPHOLOGY OF YASTIMADHU

Glycyrrhiza glabra Linn is a perennial shrub, attaining a height upto 2.5 m. The leaves are compound, imparipinnate, alternate, having 4-7 pairs of oblong, elliptical or lanceolate leaflets. The flowers are narrow, typically papilionaceous, borne in axillary spikes, lavender to violet in color. The calyx is short, campanulate, with lanceolate tips and bearing glandular hairs. The fruit is a compressed legume or pod, upto 1.5 cm long, erect, glabrous, somewhat reticulately pitted, and usually contains, 3- 5 brown, reniform seeds. The taproot is approximately 1.5 cm long and subdivides into subsidiary roots, about 1.25 cm long, from which the horizontal woody stolons arise. They may reach 8 m and when dried and cut, together with the root, constitute

commercial licorice. It may be found peeled or unpeeled. The pieces of root break with a fibrous fracture, revealing the yellowish interior with a characteristic odor and sweet taste. Licorice enjoys fertile, sandy or clay soil near a river or stream where enough water is available for the plant to flourish in the wild, or under cultivation where it can be irrigated.^[5]

4. MEDICINAL USES OF YASTIMADHU

In traditional medicine, licorice has been valued for its therapeutic properties, particularly in: Gastrointestinal Health. Licorice has been recommended as a prophylactic agent to prevent: Gastric ulcers and duodenal ulcers. Licorice is also employed in: to alleviate digestive discomfort and as an anti-inflammatory agent to reduce inflammation and alleviate symptoms.^[6] It is used as a contraceptive, laxative, anti-asthmatic, emmenagogue, galactagogue, antiviral agent in folk therapy.^[7] Glycyrrhiza roots are useful for treating cough because of its demulcent and expectorant property.^[8] It is also effective against anemia, gout, sore throat, tonsillitis, flatulence, sexual debility, hyperdyspsia, fever, skin diseases, swellings. Liquorice is effectively used in acidity, leucorrhoea, bleeding, jaundice, hiccup, hoarseness, bronchitis, vitiated conditions of Vata dosha, gastralgia, diarrhea, fever with delirium and anuria.^[9,10]

5. CLASSICAL USES OF YASTIMADHU^[11]

1. A decoction of Yastimadhu powder with honey in anemia.
2. Yastimadhu mixed with cow's milk for promoting lactation.
3. 10g Yastimadhu powder mixed with 10g sugar, pounded with rice water was prescribed in menometrorrhagia.
4. A confection of rice milk, prepared with Yashtimadhu, in hoarseness of voice.
5. In Charaka Samhita 10gm Yastimadhu powder mixed with honey, followed by intake of milk, as an aphrodisiac and as an intellect tonic.
6. According to Charaka, paste of licorice and Picirrhiza kurroa with sugar water used as cardi tonic.
7. According to Charaka Yashtimadhu and Santalum album, powdered with milk in haematemesis.
8. Sushruta Samhita, the paste of Yashti madhu 10g in intrinsic hemorrhage.
9. In edema, paste of licorice and Sesamum indicum, milk mixed with butter is used.
10. Warm clarified butter mixed with licorice, was applied topically on wounds, bruises and burns.
11. A decoction of Yastimadhu was applied on erysipelas.
12. A decoction of the root is a good wash for falling and graying of hair.
13. Yashtimadhu is an important ingredient in Narikelanjana eye drops, prescribed in both acute & chronic conjunctivitis.

6. PHYTOCHEMISTRY

The roots of *Glycyrrhiza glabra* Linn. contain glycyrrhizin, which is a saponin that is 60 times sweeter than cane sugar; Flavonoid rich fractions include liquiritin, isoliquirtin liquiritigenin and rhamnoliquiritin and five new flavonoids glucoliquiritin apioside, prenyllicoflavone A, shinflavanone, shinpterocarpin and 1-methoxyphaseolin isolated from dried roots. Isolation and structure determination of licopyranocoumarin, licoaryl coumarin, glisoflavone and new coumarin GU-12 also isolated. Four new isoprenoid-substituted phenolic constituents – semilicoisoflavone B, 1-methoxyficifolinol, isoangustone A, and licoriphenone isolated from roots. A new prenylated isoflavan derivative, kanzonol R was also isolated. The presence of many volatile components such as pentanol, hexanol, linalool oxide A and B, tetramethyl pyrazine, terpinen-4-ol, α -terpineol, geraniol and others in the roots is reported. Presence of propionic acid, benzoic acid, ethyl linoleate, methyl ethyl ketone, 2, 3-butanediol, furfuraldehyde, furfuryl formate, 1-methyl 1,2-formylpyrrole, trimethylpyrazine, maltol and any other compounds is also isolated from the essential oil.^[12] The Indian roots show various 2-methyliso-flavones, and an unusual coumarin, C liquocoumarin, 6-acetyl-5-hydroxy-4-methyl coumarin. Asparagine is also found. Glycyrrhizin (glycyrrhizic acid; glycyrrhizinate) constitutes 10–25% of licorice root extract and is considered the primary active ingredient. Glycyrrhizin is a saponin compound comprised of a triterpenoid aglycone, glycyrrhetic acid (glycyrrhetic acid; enoxolone) conjugated to a disaccharide of glucuronic acid. Both glycyrrhizin and glycyrrhetic acid can exist in the 18 α and 18 β stereoisomers. As a tribasic acid, glycyrrhizin can form a variety of salts and occurs naturally in licorice root as the calcium and potassium salts. The ammoniated salt of glycyrrhizin, which is manufactured from licorice extracts, is used as a food flavoring agent and specifications for this salt form have been established in the Food Chemicals Codex. Carbenoxolone (18- β -glycyrrhetic acid hydrogen succinate), an analog of glycyrrhetic acid, is used in the treatment of some alimentary tract ulcerative conditions, such as peptic ulcers.^[13,14]

7. Pharmacological activities

7.1 Pharmacological activities reported in *glycyrrhiza glabra*.

S.R.	Activity	Plant/ Extract	Animal Model and Cell lines
1.	Immunomodulatory activity	Aqueous extract	In vivo phagocytosis, determination of cellular immune response haemagglutination antibody titre & plaque forming cell assay using sheep RBCs ^[15]
2.	Anti tussive activity	Ethanol extract	SO ₂ gas induced cough in experimental animals. Mice showed an inhibition of 35.62% in cough on treatment with <i>G.glabra</i> extract ^[16]
3.	Anti-inflammatory activity	Hydro alcoholic extract	Carrageenan induced rat paw oedema at dose levels of 100,200,300 mg/Kg. The extract showed a maximum of 46.86% inhibitory action ^[17]
4.	Chronic fatigue stress	Hydro alcoholic extract	The extract showed the protective effect on mice on exposure to chronic fatigue stress ^[18]
5.	Anti nociceptive activity	Ethanol extract	Different pain models in Swiss albino mice. Activity was evaluated at 50-200 mg/Kg ip in mice using various pain models like acetic acid induced abdominal constrictions, formalin induced hyperalgesia & tail flick method ^[19]
6.	Antiulcer activity	Aqueous, acetone, ethanolic extracts of leaves	Micro-organism used: <i>Helicobacter pylori</i> by agar well diffusion method ^[20]
7.	Hepatoprotective activity	Aqueous extract of roots	PCM induced rats hepatocytes damage in vivo. Rabbit models with acute liver injury induced by CCl ₄ ^[21]
8.	Memory enhancing activity	Aqueous extract of roots	Three month old Wistar albino rats. Elevated - plus maze and Morris water –maze test were conducted ^[22]
9.	Anti convulsant activity	Hexane, ethanol, methanol extract of leaves	Fractions were evaluated intraperitoneally in mice using maximal electroshock (MES) & pentylenetetrazol (PTZ) seizure tests ^[23]
10.	Anti stress activity	Alcoholic & aqueous extract	Reduce stress in <i>Drosophila melanogaster</i> induced by Methotrexate at different conc. ^[24]
11.	Antioxidant activity	Methanol extract	The method based on scavenging activity & reduction capability of 1,1-diphenyl-2-picrylhydrazyl radical; Also against nitric oxide & superoxide radicals ^[25]
12.	Testicular toxicity	Aqueous extract	Carbendazim induced testicular toxicity in albino rats ^[26]
13.	Cytotoxic activity	CHCl ₃ , methanol & aqueous extract	In vitro cytotoxic activity using two different cell lines MCFT-cancerous & Vero-normal cell line ^[27]
14.	Enzyme inhibiting activity	Methanolic extract	In-vitro inhibition of tyrosinase enzyme ^[28]
15.	Anti hyperglycemic activity	-	Male albino rats of Wistar strain ^[29]
16.	Anti malarial activity	Alcoholic extract	Micro-organism used: <i>Plasmodium falciparum</i> ; <i>Plasmodium yoelii</i> ^[30]
17.	Anti viral activity	Aqueous extract	Herpes simplex 1 & vesicular stomatitis virus ^[31]
18.	Anti cancer activity	Licorice extract	Ames test, Trp-p-1, Trp-p-2 in <i>S.typhimurium</i> TA 98 revertants ^[32]
19.	Estrogenic activity	Alcoholic extract	Mouse
20.	Anti Myco bacterial activity	Methanolic extract	Micro-organisms used: <i>Mycobacterium tuberculosis</i> H37Ra & H37Rv strain
21.	Anti dyslipidaemic activity	Ethanol extract	Fractions significantly brought down LDL and VLDL in the HFD fed hamsters to various degrees
22.	Anti microbial activity	Ether, Chloroform, acetone	Micro-organisms used: <i>E. coli</i> , <i>B. subtilis</i> , <i>P. aerogenosa</i> , <i>S. aureus</i> ^[33]

7.2 Chemical constituents

Table 2: Chemical constituents reported in *glycyrrhiza glabra*.

S.R.	Activity	Chemical constituent
1.	Antiulcer activity	Glabridin, glabrene, glycyrrhizinic acid
2.	Anti mycrobacterial Activity	Flavonoid
3.	Analgesic & uterine relaxant	Flavonoid
4.	Antioxidant activity	Chalcone, flavonoid
5.	Memory enhancer	Flavonoid
6.	Corticosteroid activity	Triterpenoid saponin glycoside
7.	Anti allergic activity	Triterpenoid saponin glycoside, flavanone
8.	Hepatoprotective activity	Triterpenoid saponin glycoside
9.	Anti-inflammatory activity	Chalcone
10.	Anti cancer activity	Triterpenoid saponin glycoside
11.	Anti malarial activity	Chalcone
12.	Antiviral activity	Triterpenoid, saponin glycoside
13.	Anti hyperglycemic activity	Triterpenoid, saponin glycoside
14.	Hepato cellular carcinoma	Triterpenoid, saponin glycoside
15.	Anti tussive activity	Triterpenoid, saponin glycoside
16.	Antithrombin activity	Triterpenoid, saponin glycoside, flavonoid
17.	Immunostimulating	Triterpenoid
18.	Anti HIV	Triterpenoid saponin glycoside
19.	Chronic hepatitis C	Triterpenoid saponin glycoside
20.	Spasmolytic	Flavonoid

8. CONCLUSION

The increasing demand for phytopharmaceuticals worldwide can be attributed to the growing concern over the side effects of allopathic drugs. This trend underscores the need for exploring plant-based alternatives, making *Glycyrrhiza glabra* an attractive candidate for further research. Pharmacological and clinical studies confirm the therapeutic potential of *Glycyrrhiza glabra*. The presence of bioactive compounds suggests that this plant could serve as a "lead" for developing novel agents to treat various disorders. To fully harness the medicinal potential of *Glycyrrhiza glabra*, further studies are necessary to explore its: Disease prevention and treatment capabilities and phytochemical and pharmacological properties. This review provides a roadmap for future investigators to develop medicinally important drugs from *Glycyrrhiza glabra*, ultimately contributing to the discovery of novel, plant-based therapies.

REFERENCES

- Hill AF, (1952). Economic Botany. A textbook of useful plants and plant products. 2nd edn. McGraw-Hill Book Company Inc, New-York.
- Okwu DE, (1999). Flavouring properties of spices on cassava Fufu. Afr.J. Roots Tuber Crops, 3(2): 19-21.
- Okwu DE, (2001). Evaluation of the chemical composition of indigenous spices and flavouring Agents. Global J. Pure Appl. Sci., 7(3): 455-459.
- Chopra RN, Nayar SL, and Chopra IC, (2002). Glossary of Indian Medicinal Plants. New Delhi: NISCAIR, CSIR.
- Lakshmi T., Geetha RV., *Glycyrrhiza glabra* commonly known as licorice- a therapeutic review. International Journal of Pharmaceutics & Pharmaceutical Sciences, 2011; 3: 20-25.
- Saxena S. *Glycyrrhiza glabra*: Medicine over the millennium, Natural product radiance, 2005; 4(5): 358- 367.
- Glycyrrhiza* final. <http://openmed.nic.in/3195/01/>. 10 May 2014.
- Sheth A. The Herbs of India. Edn 1, Vol 2, Hi Scan Pvt Ltd, Gujrat, 2005; 566.
- Kaur R, Kaur, Dhinds AS. *Glycyrrhiza glabra*: a phytopharmacological review, IJPSR., 2013; 4(7): 2470- 2477.
- Khare CP. Encyclopedia of Indian Medicinal Plants. Springer-Verlag, New York, 2004; 233-5.
- Kumar A, Dora J. Review on *Glycyrrhiza glabra*: licorice. Journal of Pharmaceutical & Scientific Innovations, 2012; 1: 1-4.
- The wealth of India, A Dictionary of Indian Raw Materials and Industrial Products, First supplement series, published by National Institute of Sciences Communication and Information Resources, CSIR, New Delhi, 2005; 3(1): 195-198.
- Washington DC, Food Chemicals Codex, fifth ed. National Academy Press, 2003; 25.
- Isbrucker RA., Burdock GA. Regulatory Toxicology and Pharmacology, 2006; 46: 167-192.
- Mazumdar PM., Patnayak SP., Parwani H. Evaluation of immunomodulatory activity of *Glycyrrhiza glabra* roots in combination with zinc. Asian pacific Journal of Tropic Medicine, 2012; S15-S20.
- Jahan Y., Siddique HH. Study of antitussive potential of *Glycyrrhiza glabra* & *Adhatoda vasica* using a cough model induced by SO₂ gas in mice.

- International Journal of Pharmaceutical Sciences & Research, 2012; 3: 1668-74.
17. Mirmala P., Selvaraj T. Anti-inflammatory & antibacterial activities of Glycyrrhiza glabra. Journal of Agriculture Technology, 2011; 7: 815-23.
 18. Trivedi R., Sharma K. Hydroalcoholic extract of Glycyrrhiza glabra attenuates chronic fatigue stress induced behavioral alterations in mice. International Journal of Pharmaceutical & Biological Sciences, 2011; 2: 996-1001.
 19. Bhandage A., Shevkar K., Vaishali Undale V. Evaluation of antinociceptive activity of roots of Glycyrrhiza glabra. Journal of Pharmaceutical Research, 2009; 2: 803-7.
 20. Kalaigandhi V., Poovendran P. Antimicrobial activity of Glycyrrhiza glabra against peptic ulcer produced Helicobacter pylori. International Journal of Current Pharmaceutical Research, 2011; 3: 93-95.
 21. Al Razzuqi RAM., Al-Hussaini JA. Hepatoprotective effect of Glycyrrhiza glabra in CCl₄ induced model in acute liver injury. Journal of Physiology & Pharmacology Advances, 2012; 2: 259-63.
 22. Chakravarthi KK., Avadhani R. Effect of Glycyrrhiza glabra root extract on learning & memory in Wistar albino rats. Drug Invention Today, 2012; 4: 387-90.
 23. Yazdi A., Sardari S., Sayyah Md. Evaluation of anticonvulsant activity of leaves of Glycyrrhiza glabra grown in Iran as a possible renewable source for anticonvulsant compounds. Iranian journal of Pharmaceutical research, 2011; 10(1): 75-82.
 24. Sowmya M., Kumar S. Antistress property of Glycyrrhiza glabra on stress induced Drosophila melanogaster. Journal of Stress Physiology & Biochemistry, 2010; 6: 18-27.
 25. Latif M., Iqbal L., Fatima N. Evaluation of antioxidant & urease inhibition activity of roots of Glycyrrhiza glabra. Pakistan Journal of Pharmaceutical Sciences, 2012; 25: 99-102.
 26. Sakr S., Shalaby SY. Carbendazim induced testicular damage & oxidative stress in albino rats: Ameliorative effect of liquorice aqueous extract. Toxicol Ind Health, 2012.
 27. Rathi SG, Suthar M., Patel P. In vitro cytotoxic screening of Glycyrrhiza glabra. Pharmacology, 2009; 1: 239-43.
 28. Rastogi RP., Mehrotra BN. Compendium Indian medicinal plants published by CDRI, Lucknow & National Institute of Science & information resources. ND., 1990-94; 6: 395-98.
 29. Kalaiarasi P., Pugalendi KV. Antihyperglycemic effect of 18 beta glycyrrhetic acid, aglycone of glycyrrhizin on streptozotocin diabetic rats. European Journal of Pharmacology, 2009; 1: 269-73.
 30. Sianne S., Fanie RVH. Antimalarial activity of plant metabolites. Natural Product Report, 2002, 19: 675-92.
 31. Taro N., Toshio F., Toshiyuki A. Chemistry of phenolic compounds of licorice & their estrogenic and cytotoxic activities. Journal of Pure & Applied Chemistry, 2002; 74: 1199-1206.
 32. Lee CK., Park KK., Lim SS. Effects of licorice extracts against tumor growth & cisplatin induced toxicity in a mouse xenograft model of colon cancer. Biological Pharmaceutical Bulletin, 2007; 30: 2191-5.
 33. Nitalikar M., Munde KC, Dhore BV. Studies of antibacterial activities of Glycyrrhiza glabra root extract. International Journal of Pharmaceutical Technology & Research, 2010; 2: 899-901.