International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 12 | Dec - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Licorice (Glycyrrhiza glabra): A Comprehensive Overview of its Medicinal and Therapeutic Properties

Takeshwar Kumar[1], Md Amaan[1], Khileshwar Sahu[1], Denees Sinha[1], Purnanand[1]
Dewanjali Rathore[2], Harish Sharma[3], Gyanesh Kumar Sahu[2]*
[1]Rungta Institute of Pharmaceutical Sciences
[2]Rungta Institute of Pharmaceutical Sciences and Research
[3]School of Pharmacy, Anjaneya University, Raipur

Corresponding Author:
Ms. Dewanjali Rathore
Asst Professor
Rungta Institute of Pharmaceutical Sciences & Research, Bhilai

ABSTRACT

Glycyrrhiza glabra, commonly known as licorice, is a medicinal plant widely used in traditional medicine for its therapeutic properties. Native to regions of the Mediterranean, Central Asia, and South Asia, this perennial herb is particularly valued for its roots, which contain bioactive compounds such as glycyrrhizin, Alkaloids, glycosides, carbohydrates, starches, phenolic chemicals, flavonoids, proteins, pectin, mucilage, saponins, lipids, tannins and sterols. These compounds contribute to its diverse pharmacological activities, including memory improvement, antidepressant, antibacterial, anticancer, antioxidant, protective, anti-inflammatory, antiulcer, antidiabetic, and hypolipidemic properties Licorice root has been traditionally employed in the treatment of respiratory ailments, gastrointestinal disorders, and skin conditions. It is also utilized in modern pharmaceutical and cosmetic formulations, particularly for its soothing and anti-aging properties. In hair care, licorice is known to promote scalp health and reduce dandruff, owing to its antifungal and hydrating effects. With growing interest in herbal medicine, Glycyrrhiza glabra remains a subject of extensive research, aiming to better understand its pharmacological potential, optimize its applications, and ensure its safe use in therapeutic and cosmetic practices.

Keywords: licorice, glycyrrhizin, antioxidant

INTRODUCTION

Since the dawn of human civilization, one of the major sources of medicines has been plants. The market for pharmaceuticals, food supplements, health products, and plant-based medications is expanding. Both individual and community health greatly depends on medicinal plants. These plants have therapeutic potential because of certain chemicals that have a specific physiological effect on people. Triterpenoid, saponin, flavonoids, tannins, alkaloids, and phenolic chemicals are the most significant of these bioactive plant components [1]. Glabra Glycyrrhiza One of the most widely utilized therapeutic herbs in Ayurveda's long medical history is linn. It's also used as a herb for seasoning. The Greek words glykos, which means sweet, and rhiza, which means root, are the origins of the word glycyrrhiza. Commonly referred to as "liquorice" and "sweet wood," Glycyrrhiza glabra Linn is a member of the Leguminosae family. Jeshthamadh (Marathi), Jothi-madh (Hindi), Yashtimadhu, Madhuka (Sanskrit), Jashtimadhu, Jaishbomodhu (Bengali), Atimadhuram, Yashtimadhukam (Telugu), Jethimadhu (Gujarati), and Atimadhuram (Tamil) are some of the colloquial terms for liquorice [2]. As a diuretic, choleretic, insecticide, and traditional medicine remedy for coughs, colds, and uncomfortable swellings, some traditional healers have asserted the effectiveness of Glycyrrhiza species for a range of pathological disorders [3].

Scientific Classification of Glycyrrhiza glabra

Kingdom	**Plantae**
Divisio	Angiospermae
Class	Dicotyledoneae
Order	Rosales
Family	Leguminosae
Genu	Glycyrrhiza
Species	glabra Linn

ORIGIN

Glycyrrhiza glabra is indigenous to the Mediterranean region, central and south-western Asia, and Eurasia (Plate 2). G. glabra is found in South Europe (Spain, Italy), Turkey, Iran, Iraq, Central Asia, and the northwest region of China, according to Hayashi (2009) and Hayashi and Sudo (2009). G. uralensis is found in Central Asia, Mongolia, and the northwest and northeastern regions of China, while G. infl ata is only found in the northeastern region, the Xinjiang Uygur Autonomous Region of China. According to Hayashi and Sudo (2009), G. glabra is classified into two types: G. glabra var. glandulifera Glycyrrhiza glabra (Russian licorice) and G. glabra var. typica (Spanish licorice). There are three known varieties of G. glabra: Russian licorice, which is classified as G. glabra var. glandulifer a; Persian and Turkish licorice, which is classified as G. glabra var. violace a; and Spanish and Italian licorice, which is attributed to G. glabra var. typica (Nomura et al. 2002).
Iran, Afghanistan, the People's Republic of China, Pakistan, Iraq, Azerbaijan, Uzbekistan, Turkmenistan, and Turkey are among the nations that produce liquorice. The three species mentioned above are used to make commercial licorice in China.

Medicinal Parts Used Powder, teas, tonics, extracts, tinctures, and decoctions made from roots and rhizomes.

TRADITIONAL USES

Liquorice has been suggested as a preventative measure for duodenal and stomach ulcers in traditional medicine. It is used as an anti-inflammatory treatment for dyspepsia during allergic responses. [6]. In folk medicine, it is used as a laxative, antiviral, emmenagogue, galactagogue, anti-asthmatic, and contraceptive [7]. Because glycyrrhiza roots have expectorant and demulcent properties, they can be used to treat cough [8]. Additionally, it works effectively for sexual debility, anemia, gout, sore throats, tonsillitis, flatulence, hyperdypsia, fever, skin conditions, and swellings. Acidity, leucorrhea, hemorrhage, jaundice, hiccough, hoarseness, bronchitis, vitiated Vata dosha conditions, gastralgia, diarrhea, fever with delirium, and anuria can all be efficiently treated with liquorice [9, 10]. It is an essential component of therapeutic oils used to treat paralysis, epilepsy, hemorrhagic illnesses, and rheumatism [10].

PHYTOCHEMISTY

Glycyrrhiza glabra roots have yielded several components, including a water-soluble, physiologically active compound that makes up 40–50% of the dry material weight. Triterpene, saponin, flavonoids, polysaccharides, pectins, simple sugars, amino acids, mineral salts, asparagines, bitters, essential oil, fat, protein, gums, mucilage (rhizome), resins, starches, sterols, volatile oils, tannins, glycosides, and other materials make up this complex [12,13]. The triterpenoid component glycyrrhizin (Fig. 1) is responsible for the sweet flavor of licorice root. This substance is a combination of glycyrrhizic acid potassium, calcium, and magnesium salts that ranges from 2 to 25%. Glycyrrhizic acid is a naturally occurring saponin that is made up of two glucuronic acid molecules, a hydrophilic portion, and a hydrophobic portion called glycyrrhetic acid.[2] [14]. Liquiritin (Fig. 3), isoliquiritin (Fig. 4), a chalcone, and other chemicals are among the flavonoids that give licorice its yellow hue [15]. Both glabridin and glabrene exhibit estrogen-like activity [3], and the isoflavones, glabridin (Fig. 5) and hispaglabridins A and B have strong antioxidant activity [16].

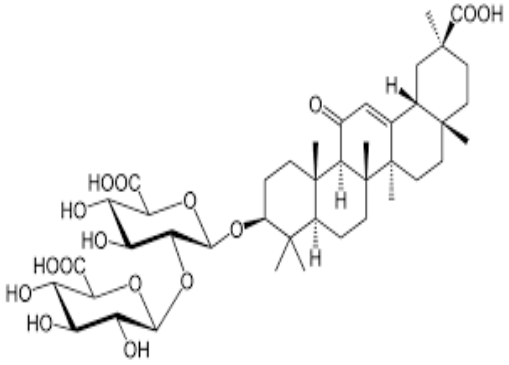
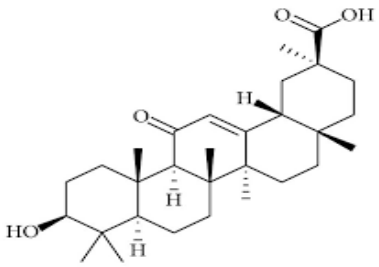


Fig. 1 Glycyrrhizin



Glycyrrhetinic acid $C_{30}H_{46}O_4$

Fig. 2 Glycyrrhetic acid

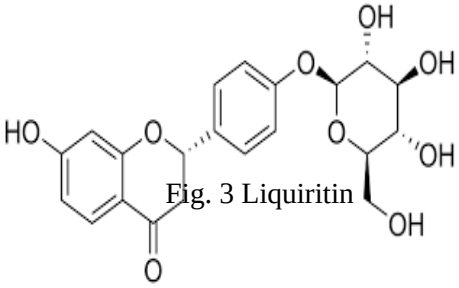
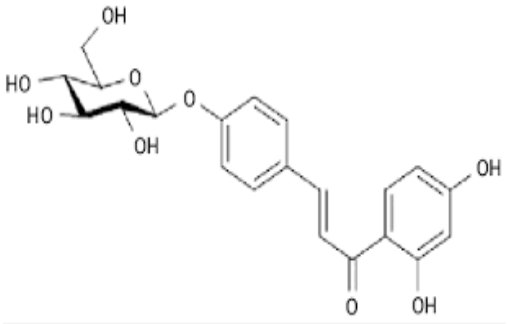


Fig. 3 Liquiritin



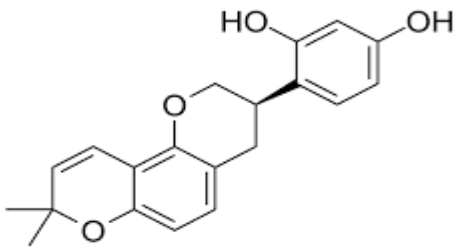


Fig. 5 Glabridin

PHARMACOLOGICAL ACTIVITY

The plant may be a source of new medications, and therapeutic compounds for the treatment of a variety of diseases and afflictions could be made, according to the numerous research on its bioactivities conducted by ethnobotanists, phytochemists, and experimental pharmacologists. Here is a report on a variety of activities.

Anticoagulant activity

Glycyrrhizin, a well-known anti-inflammatory substance, has also been discovered to be the first thrombin inhibitor derived from plants. It increased the duration of plasma recalcification and prolonged the thrombin and fibrinogen clotting times. Glycyrrhizin was reported to decrease thrombin-induced platelet aggregation, but it had no effect on collagen-induced agglutination or Platelet Aggregating Factor (PAF) [17, 18].

Anti-Fungal activity

There have been reports of fungicidal activity of licorice methanolic extract against Arthrinium sacchari M001 and Chaetomium funicola M002. It was discovered that the active ingredient with antifungal activity was glacibridin [19]. Mycobacterium smegmatis and Candida albicans are inhibited in vivo by isoflavonoids such glabridin, glabrol, and its derivatives [20]. Therefore, the use of licorice extract in the creation of cosmetics with antibacterial properties is quite promising.

Antitussive and Expectorant

It was discovered that licorice extract and powder were effective in treating bronchial catarrh, cough, and sore throat. Because it speeds up tracheal mucus secretion, it helps clear congestion in the upper respiratory tract and possesses antitussive, demulcent, and expectorant-loosening properties that may be attributed to the presence of glycyrrhizin [14]. Liquiritin apioside, an active ingredient in the methanolic extract of liquorice, was discovered lately. The substance prevents coughing brought on by capsaicin [15].

Anti hyperglycemic activity

In albino mice, the impact of liquorice extract on liver enzymes and serum lipid profiles was investigated. At modest dosages, it was discovered that Glycyrrhiza glabra root extract exhibited anti-lipidemic and anti-hyperglycemic properties [21].

Hair growth stimulatory activity

The licorice hydro-alcoholic extract shown good hair growth-promoting properties. A comparison of the usual medication, 2% Minoxidil, and licorice extract revealed that the latter had less effective hair growth stimulatory activity than the former. Liquorice has a considerable hair growth activity and can be used safely in herbal formulations to treat different kinds of alopecia, according to efficacy and safety studies [22].

Antiviral activity

Glycyrrhizin exhibits strong antiviral properties because it prevents the virus from attaching to cells. It has been identified as the yellow fever virus, Japanese encephalitis virus, and HIV-1. In a recent evaluation of the antiviral properties of ribavirin, 6-azauridine, pyraziofurin, mycophenolic acid, and glycyrrhizin against two clinical isolates of the SARS (severe acute respiratory syndrome) virus (FFM-1 and FFM-2) from SARS patients admitted to Frankfurt University's clinical center in Germany, it was found that glycyrrhizin was the most effective in preventing viral replication and could be used as a preventative measure. Glycyrrhizin has been used in the past to treat patients with HIV-1 and chronic hepatitis C virus [23,24,25].

Anti-bacterial & Anti-oxidant activity

The crude hydro-methanolic root extract of Glycyrrhiza glabra included a variety of beneficial secondary metabolites, including flavonoids, alkaloids, saponins, and others. The extract demonstrated strong antibacterial and antioxidant properties as a result of these constituents. It can scavenge hydroxyl radicals and combat bacterial infections. It might be a useful medication for scavenging hydroxyl radicals produced during carcinogenesis and preventing bacterial infections [26].

Antiulcer activity

Since the early 1970s, licorice has been utilized as an antiulcer drug. Deglycyrrhizinated licorice (DGL), which contains extracted glycyrrhizin, is typically used to cure ulcers. By preventing the release of gastrin, carbenoxolon from licorice roots has an anti-ulcerogenic action [27]. It has been observed that licorice has an anti-pepsin action and extends the life of stomach surface cells. It can also increase the concentration of prostaglandins in the digestive tract, which encourage the stomach to secrete mucus [28].

Anti-tumor activity

The aqueous extract of G. glabra suppresses angiogenesis in peritoneal and choreoallantonic membrane assays, as well as in vitro and in vivo proliferation or Ehrlich ascites tumor cells.Additionally, in MCF-7 human breast cancer cells, the ethanol extract of G. uralensis root caused G1 cell cycle arrest and death. However, several in vitro and in vivo studies have examined the anti-cancer properties of various derivatives of its constituents. By causing a mitochondrial permeability transition, glycyrrhetic acid may also activate the pro-apoptotic pathway, which could be helpful in causing tumor cells to undergo apoptosis.

When compared to the well-known anticancer agents, lichochalcone A and isoliquiritigenin, lichochalcone E, a novel retrochalcone derived from the roots of G. inflate, recently demonstrated the strongest cytotoxic impact [33].

Immunostimulatory effects

Studies conducted in vitro demonstrated that Glycyrrhiza glabra had immunostimulatory effects at a dose of 100µg/ml. It causes human granulocytes to produce more TCD69 lymphocytes and macrophages. In vivo research has shown that liquorice root extract inhibits the increase in immune complexes linked to autoimmune conditions such as systemic lupus erythematosus [20].

Hepatoprotective activity

Glycyrrhizin effectively suppresses the CCl4- induced release of AST and LDH at doses of 25–200 µg/ml. The activity may be caused by glycyrrhizin altering the fluidity of the membrane or by inhibiting CCl4-induced membrane lipid peroxidation. By preventing the production of free radicals and lipid peroxidation, 18β-glycyrrhetic acid, an aglycone of glycyrrhizic acid, exhibits hepatoprotective action [34]. Acetaminophen-induced hepatotoxicity can be effectively treated with glycyrrhizin [35]. It has been demonstrated that liquorice extract exhibits hepatoprotective effect against rats' hepatotoxicity caused by diclofenac [36].

Anti-malarial activity

It has been claimed that licorice contains a chalcone called licochalcone A, which has very strong antimalarial properties. This chemical can be isolated from all Glycyrrhiza species and is present in varying levels. It has been demonstrated that oral dosages of 1000 mg kg-1 against P. yoelii in mice totally remove the malarial parasite. Furthermore, no toxicity was noted [35].

Anti-inflammatory activity

Extract from liquorice root (Glycyrrhiza) aids in the recovery of oral and stomach ulcers. The information was known for more than two millennia. However, the 1950s saw the start of scientific research to determine a potential mechanism. According to reports, the anti-inflammatory effects of glycyrrhetinic acid in liquorice extract are comparable to those of glucocorticoids and mineralocorticoids. In vitro research indicates that glycyrrhizic acid suppresses every element that causes inflammation. It prevents the production of prostaglandins, particularly prostaglandin E2, and cyclooxygenase activity. Additionally, it is in charge of indirectly preventing platelet aggregation. It has been observed that the glycyrrhetinic acid analog carbenoxolone (Biogastron) increases prostaglandin levels by inhibiting two enzymes crucial to prostaglandin metabolism: Δ13 prostaglandin and 15-hydroxyprostaglandin dehydrogenase. Prostaglandins promote cell division and mucus secretion. Consequently, ulcer healing is encouraged [34].

Dose, Side Effects, and Contraindications

Licorice root has been used to treat gastritis and ulcers at documented daily dosages of 1 to 15 g. Higher dosages given over an extended length of time, however, may raise the risk of hyperkalemia, result in significant blood pressure increases, and appear to cause an excess of mineralocorticoids. Furthermore, Isbrucker et al. proposed that 0.015–0.229 mg/kg body weight/day is the tolerable daily consumption of glycyrrhizin based on the in vivo and clinical data. The half-maximal lethal concentrations (LD50) of glycyrrhizin in rats and mice were recorded by Vispute and Khopade as follows: The LD50 values for the oral route of administration were 14.2-18.0 g/kg, the intraperitoneal method of administration was 1.42-1.70 g/kg, and the subcutaneous route of administration was 4-4.4 g/kg.

Furthermore, Omar et al. found that licorice and glycyrrhizin intoxication is more common in those with cardiac or kidney problems. Glycyrrhizin is contraindicated during pregnancy and causes pseudohyperaldosteronism, which makes a person hypersensitive to adrenal cortex hormones and causes a number of negative side effects, including headaches, heart attacks, high blood pressure, exhaustion, and water retention, which results in leg swelling and other issues. Furthermore, licorice exhibited abortifacient activity together with an estrogenic effect. Glycyrrhizin should not be taken with hydrocortisone, prednisolone, or oral contraceptives.

Thus, more study is required to determine the ideal dosage to avoid the negative effects of plants and to uncover novel compounds with strong pharmacological effects. [35]

CONCLUSION

A plant with a long ethnobotanical history is Glycyrrhiza glabra (GG), also known as licorice (Fabaceae/Papilionaceae). In both eastern and European nations, the roots are utilized as a traditional remedy. The primary constituents are glycyrrhizin and glycyrrhetic acid, triterpene saponins, which are thought to be partially in charge of the plant's anti-inflammatory, anti-ulcer, anti-diuretic, anti-epileptic, antiallergic, and antioxidant qualities as well as its capacity to "fight" low blood pressure. Additionally, it has been demonstrated that GG extracts contain antidepssant properties, such as memory-enhancing and antithrombotic actions.

REFERENCES

1. Hill AF (1952) Economic botany: a textbook of useful plants and plant products, 2nd edn. McGarw Hill, New York.
2. Chopra RN, Nayar SL, and Chopra IC, (2002). Glossary of Indian Medicinal Plants. New Delhi: NISCAIR, CSIR.
3. Tamir S, Eizenberg M, Somjen D, Izrael S, Vaya J (2001) Estrogen like activity of glabrene and other constituents isolated from licorice root. J Steroid Biochem Mol Biol 78:291–29.
4. Sharma V, Agrawal RC (2013) Glycyrrhiza glabra: a plant for the future. Mintage J Pharm Med Sci 2(3):15–20.
5. Okwu DE, (2001). Evaluation of the chemical composition of indigenous spices and flavouring Agents. Global J. Pure Appl. Sci. 7(3): 455-459.
6. Ammosov S, Litvinenko VI. Triterpenoids of Plants of Glycyrrhiza L. and Meristotropis Fisch. Et Mey Genuses, Pharm Chem J 2003; 37:83-94.
7.Saxena S. Glycyrrhiza glabra: Medicine over the millennium, Natural product radiance 2005; 4(5):358- 367.
8. Glycyrrhiza final. http://openmed.nic.in/3195/01/. 10 May 2014.
9. Sheth A. The Herbs of India. Edn 1, Vol 2, Hi Scan Pvt Ltd, Gujrat, 2005, 566.
10. Kaur R, Kaur, Dhinds AS. Glycyrrhiza glabra: a phytopharmacological review, IJPSR 2013; 4(7):2470- 2477.
11. Damle, M. (2014). Glycyrrhiza glabra (Liquorice)-a potent medicinal herb. International journal of herbal medicine, 2(2), 132-136.
12. Bradley PR (ed) (1992) British herbal compendium, vol 1. BHMA, Bournemouth.
13. Hoffmann D (1990) The new holistic herbal, 2nd edn. Element, Shaftesbury.
14. Obolentseva GV, Litvinenko VI, Ammosov AS, Popova TP, Sampiev AM (1999) Pharmacological and therapeutic properties of licorice preparations (a review). Pharm Chem J 33:24–31.
15. Yamamura Y, Kawakami J, Santa T, Kotaki H, Uchino K, Sawada Y, Tanaka N, Iga T (1992) Pharmacokinetic profile of glycerrhizin in healthy volunteers by a new high-performance liquid chromatographic method. J Pharm Sci 81(10):1042–1046.
16. Vaya J, Belinky PA, Aviram M (1997) Antioxidant constituents from licorice roots: isolation, structure elucidation and antioxidative capacity toward LDL oxidation. Free Radic Biol Med 23:302–313.
17. Mauricio I, Francischett B, Monterio RQ and Guimaraeas JA, (1997). Identification of Glycyrrhizin as thrombin inhibitor. Biochim Biophys Res Commun. 235: 259-263.
18. Mendes-Silva W, Assafim M, Ruta B, Monteiro RQ, Guimaraes JA, Zingali RB, (2003). Antithrombotic effect of Glycyrrhizin, a plant-derived thrombin inhibitor. Thromb Res. 112:93-98.
19. Hojo H, Sato J. Antifungal Activity of Licorice (Glycyrrhiza glabra Linn) and Potential Applications in Beverage Foods. J Food Ingredients Japan, 2002; 203.
20. Alonso J. Tratado de Fitofármacos y Nutracéuticos. www.fitoterapia.net. Barcelona: Corpus, 2004; 905-911.

21. Revers FE. Clinical and pharmacological investigations on extract of licorice. Acta Medica Scandinavica 1956; 154:749-751.
22. Roy SD, Karmakar PR, Dash S, Chakraborty J, Das B. Hair growth stimulating effect and phytochemical evaluation of hydro-alcoholic extract of Glycyrrhiza glabra, Global J res Med Plants & Indigen Med 2014; 3(2):40-47.
23. De Clercq E, (2000). Current lead natural products for the chemotherapy of human immunodeficiency virus (HIV) infection. Med Res Rev. 20: 323-349.
24. Badam L, (1997). In vitro antiviral activity of indigenous glycyrrhizin, licorice and Glycyrrhizic acid (Sigma) on Japanese Encephalitis Virus. J Commun Dis. 29: 91-99.
25. Badam L, (1994). In vitro studies on the effect of glycyrrhizin from Glycyrrhizin glabra on some RNA and DNA viruses. Indian J Pharmacol. 26: 194-199.
26. Sharma V, Agrawal RC, Pandey S, (2013). Phytochemical screening and determination of anti-bacterial and antioxidant potential of Glycyrrhiza glabra root extracts. J. Environ. Res. Develop., 7(4A): 1552-1558.
27. Masoomeh MJ, Kiarash G, (2007). In vitro susceptibility of Helicobacter pylori to licorice extract. Iran. J. Pharm. Res. 6:69-72.
28. Adel M, Alousi LA, Salem HA, (2005). Licorice: A possible anti-inflammatory and anti-ulcer drug. AAPS Pharm. Sci. Tech. 6:74-82.
29. Sheela ML, Ramakrishna MK, Salimath BP, (2006). Angiogenic and proliferative effects of the cytokine VEGF in Ehrlich ascites tumor cells is inhibited by Glycyrrhiza glabra. Int Immunopharmacol. 6: 494–498.
30. Jo EH, Kim SH, Ra JC, et al (2005). Chemopreventive properties of the ethanol extract of Chinese licorice (Glycyrrhiza uralensis) root: induction of apoptosis and G1 cell cycle arrest in MCF-7 human breast cancer cells. Cancer Lett. 230: 239–247.
31. Salvi M, Fiore C, Armanini D, Toninello A, (2003). Glycyrrhetinic acid-induced permeability transition in rat liver mitochondria. Biochem Pharmacol. 66: 2375–2379.
32. Fiore C, Salvi M, Palermo M, Sinigagliab G, Armaninia D, Toninello A, (2004). On the mechanism of mitochondrial permeability transition induction by glycyrrhetinic acid. Biochim Biophys Acta. 1658: 195–201.
33. Yoon G, Jung YD, Cheon SH, (2005). Cytotoxic allyl retrochalcone from the roots of Glycyrrhiza inflate. Chem Pharm Bull. 53: 694–695.
34. Baker ME. Licorice and enzymes other than 11- hydroxysteroid dehydrogenase: An evolutionary perspective, Steroids 1994; 59:136-141.
35.Isbrucker, R.A.; Burdock, G.A. Risk and safety assessment on the consumption of Licorice root (Glycyrrhiza sp.), its extract and powder as a food ingredient, with emphasis on the pharmacology and toxicology of glycyrrhizin. Regul. Toxicol. Pharmacol. 2006, 4, 167–192. [CrossRef].