SUNTEXT REVIEWS

SunText Review of Pharmaceutical Sciences
ISSN: 2766-5232

Open Access
Research Article
Volume 2:1

Multiple used Medicinal Plant: *Glycyrrhiza Glabra*

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Received date: 30 June 2021; **Accepted date:** 28 July 2021; **Published date:** 03 August 2021

Citation: Mukim M, Sharma P, Mohsina FP, Faheem IP, Kukkar R, Patel R, et al. (2021). Multiple Used Medicinal Plant: *Glycyrrhiza Glabra* – Review. SunText Rev Pharm Sci 2(1): 111.

DOI: https://doi.org/10.51737/2766-5232.2021.011

Abstract

Liquorice (*Glycyrizza glabra*), the eternal tree of multiple used of medicine, belongs to the Leguminosae family. Liquorice is one of the most valuable and important used by people all over across the world. It is used to soothe gastrointestinal issues in many systems of medicines including Unani, Ayurveda, Homeopathy, Chinese and Siddha Liquorice. It provides the treatment of stomach ulcers, and heartburn, licorice root extract can suddenly repair of stomach lining and restore balance. This is due to the anti-inflammatory and immune-boosting properties of glycyrrhizic acid, anti-diabetic, anti-cancer, antimicrobial, lipid-lowering, and cardiovascular-disease-lowering compound, Hair growing, analgesic, Antitumor, Ant diuretic, menopause, Liquorice has also been reported to have activities against neurological disorders, such as Parkinson's and Alzheimer's diseases. This review illustrates the pharmacological prospective of Liquorice and Some people take Liquorice by mouth for sore throat, bronchitis, cough, and infections caused by bacteria or viruses.

Keywords: Glycyrrhizin; Glycyrrhizinic acid; Glabridin; Liquorice

Introduction

Glycyrrhiza Glabra (Family Leguminoseae) is commonly known as Liquorice or sweet root. It is small perennial herbs which possess some nutritive values and wide range of application in medicinal benefits. Ayurvedic system of healthcare has perfected efficient methods that enhanced its significance and is becoming prevalent. It is an extensive system of medicine with historical roots in the Indian subcontinent and healthcare that originated in India. It dealing with the effectiveness and adverse reactions that confers less harm as compared to the synthetic chemicals. Liquorices is grown in numerous parts of world native to the Mediterranean regions and certain region of Asia. Finds here several researchers had given their contributions for out of sight therapeutic potentials of many Ayurvedic drugs, but still number of plants need a unique study on them. Therefore, the present study aims on one such very effective and potent multiple used herb- Glycyrrhiza glabra [1]. The treasure of Ayurveda states abundant of plants to cure varieties of ailments and for the management of several diseases. Among many variety of genus glycyrrhiza, Glycyrrhiza glabra Linn is one of the most broadly used medicinal herb and flavoring spice from ancient time and utilize preclinical and clinically. The word Glycyrrhiza is derived from the Greek world, term is used glykos (meaning sweet) and rhiza (meaning root. Vernacular names for Glycyrrhiza glabra are Liquorice (British English), Licorice (American English), Malhatti and Jothi-mad (Hindi), Boisdoux (France), Jeshthamadh (Marathi), Yashtimadhu, Madhuka (Sanskrit), Aslussia (Arab), Jashtimadhu, Jaishbomodhu (Bengali), Atimadhuram, Yashtimadhukam (Telugu), Jethimadhu (Gujarati) and Atimadhuram (Tamil), Boisdoux (France), Aslussia (Arab), Lakritze (German), Alcazuz (Spanish), Liquirizia (Italy), Lakritsrot (Swedish) [2-4] (Table 1).

Traditional uses

Liquorice root is used in Unani medicines, Greco-Arab as well as in the traditional medicines of Japan, Pakistan, Vietnam, Korea,

India and other nations. Its Arabic name is 'Asal-as-Soos' and it is referred as 'Mulethi' in India. The Perso-Arabic system (Unani) Medicine recommend its oral use after removal of external layer from mulethi to avoid side effects, People with heart conditions or high blood pressure should avoid ingesting surplus amounts of liquorice, as it causes intensive blood pressure and lead to stroke [5,6]. It is employed in respiratory infections, bronchitis, dry cough, tuberculosis, epilepsy, genitourinary diseases, urinary tract infections (UTI), abdominal pain, gastric and duodenal ulcers, inflamed stomach, and mouth ulcer and in catarrh of the upper respiratory tract.

Table 1: *Scientific classification kingdom [5].*

1.	Kingdom	Plantae
2.	Family	Leguminosae
3.	Division	Angiospermae
4.	Genus	Glycyrrhiza
5.	Class	Dicotyledoneae
6.	Species	Glabra Linn
7.	Order	Rosales

Also used for adrenocorticoid insufficiency. It is useful as a general tonic in debility and as a rejuvenator. It is used in treating of peptic ulcer and warm sensation on mucus membrane; also have spasmolytic antiulcer properties, so useful in, hypo and hyper acidity, and peptic ulcer, gastric ulcer. It is used to make (suffering, deficiency, or a problem) less severe oral inflammations, irritable condition of bronchial tubes, hoarseness, dry coughs, bronchitis, asthma, sore throats and in viral infections and also used for allaying coughs and catarrhal affections. Liquorices extract is a constituent of cough syrups, it is useful in clears and sooths sore throat and it resolves infection of respiratory tract as an expectorant. It provides protection of skin and hairs from oxidative damage and useful in falling and graying of hair [7]. This traditional plant has been used as prevention for gastric, duodenal ulcers and in dyspepsia as an anti-inflammatory agent during allergenic reactions. In folk medicine, it was used as a laxative, emmenagogue, anti-asthmatic drug and antiviral agent [8].

Figure 1: *Glycyrrhiza glabra Stem Part.*

It is useful in anemia, gout, flatulence, sexual debility, hyperdypsia, fever, coughs, skin diseases, sore throat, tonsillitis, swellings, acidity, leucorrhoea, bleeding, jaundice, hiccough, hoarseness, bronchitis, vitiated conditions of vatadosha, gastralgia etc. Liquorice in combination with other herbs treat eczema and prostate cancer. It is an important ingredient in medicinal oils for the paralysis, epilepsy, rheumatism, hemorrhagic diseases and also used in the treatment of diarrhea, anuria, fever with delirium. It is metabolized in the gut; glycyrrhizin deploy an anti-inflammatory action similar to hydrocortisone and other corticosteroid hormones. It gives stimulatory action on the adrenal glands and inhibits the breakdown of steroids by the liver and kidneys. Glycyrrhizin is primary remedy for peptic ulcer but also proved effective in the treatment of chronic hepatitis and liver cirrhosis. Liquorice seems to remove the irritating effects of acids in a better way than alkalis and relieve pain and discomfort. *Glycyrrhiza glabra* was considered as one of the best remedies widely used around the world It was used by practitioners of the indigenous systems as tonic, as a demulcent [9] (Figure 1).

Chemical constituents

Mulethi roots contained glycyrrhizin, a triterpenoidal saponin glycoside which was 60 times sweeter than cane sugar [10]. glycyrrhetic acid, glycyrrhizin can exist in the 18α and 18β stereoisomers [11]. Chalones, Flavanoid, Isoflavones in liquorice root are reported are liquirtin, isoliquirtin, liquiritigenin, neoliquiritin, chalones isoliquiritin, rhamnoliquirilin, glabrolide, licoflavonol, glucoliquiritinapioside,shinflavanone, prenyllicoflavone-A, shinpterocarpin and 1-methoxyphaseolin, glychionide A and B. It also constituted licopyranocoumarin, licoarylcoumaringlisoflavone and new coumarin-GU-12 and various isoflavones are glabridin, glabrone, galbrene, shinpterocarpin, glyzarin, licoisoflavones A and B, 3-hydroxy-4-O-methlyglabridin, hispaglabridin A and B [12,13]. isoprenoid-substituted phenolic constituents – semilicoisoflavone B, 1-methoxyficifolinol, isoangustone A, licoriphenone and new prenylatedisoflavan derivative, kanzonol R was also included pentanolhexanol, linalool oxide A and B, tetramethylpyrazine terpinen-4-ol, α-terpineol, geraniol, propionic acid, 2,3-butanediol, furfuraldehyde, furfurylformate, 1-methyl-2-formylpyrrole trimethylpyrazie. Carbenoxolone (18-β glycyrrhetinic acid hydrogen succinate), an analog of glycyrrhetic acid, used for curing ulcerative conditions (peptic ulcers) [14,15]. Glycyrrhiza Glabra roots were contain some heavy metal residues are arsenic, cadmium, lead, and mercury [16]. Trace elements in its roots were potassium, calcium, iron, sulphur, aluminum, phosphorus, silicon, magnesium, and sodium [17].

Pharmacokinetic study

Glycyrrhizic acid is hydrolyzed to glycyrrhetic acid by intestinal bacteria possessing a specialized ß-glucuronidase [18,19]. Glycyrrhetic acid is 200-1,000 times more potent an inhibitor of 11-ß-hydroxysteroid dehydrogenase than glycyrrhizic acid [20]. The study on glycyrrhetic acid has found that it was absorbed and transported to the liver, it is metabolized to glucuronide and sulfate conjugates, which were subsequently rehydrolyzed to glycyrrhetic acid and reabsorbed, resulting in a significant delay notify in terminal clearance from plasma. In healthy volunteer's administration of 100 mg glycyrrhizin, glycyrrhetic acid was found at < 200 ng/mL in plasma, and after 24-hour it was found in the urine [21].

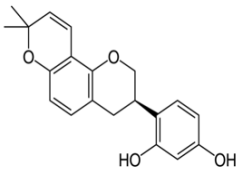
Mechanism of action

The usual physiology for sodium-water retention is maximum influenced by the expression of mineralocorticoids. While aldosterone is regarded as the main hormone binding to mineralocorticoid receptors involved in the maintenance of sodium reabsorption and potassium excretion in the distal renal tubules of the kidney, cortisol also binds to receptor with the same binding affinity as aldosterone. Interestingly, even though cortisol concentrations of blood tend to be Maximum aldosterone concentrations, the effect of aldosterone dominates in terms of regulating sodium and water reabsorption and blood volume [22].

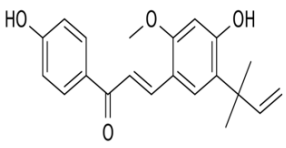
Pharmacological Activity of Liquorice

Anti-Oxidant activity

Maximum number of Phenolic components in Liquorice's ethanolic extract (Glycyrrhiza glabra L) shows powerful antioxidant activity by means of free radical hydrogen-, donating scavenging, anti-lipid per oxidative and reducing abilities, metal ion chelating. Antioxidant activity of liquorice flavonoids was found to be over 100 times stronger than that of vitamin E. An effective dose of 2.58 mg/ml liquorice flavonoids can scavenge more free radicals (20.6% scavenging) than 258 mg/ml of vitamin E (11.2% scavenging). Flavonoids from liquorice are currently the strongest natural antioxidants known [23]. Thus, Liquorice extract can be used in competent way to formulate herbal and cosmetic products for the protection of skin and hair [24].



Licochalcone A



Glabridin

Anti-Inflammatory activities

Root's extract has been used in many experimental animal models as well as clinical trials. Action resembles that of phenylbutazone, hydrocortisones, Glycyrrhizinic acid as well as its aglyconglycyrrhetic acid are clearly the active agents, and this has been seen in several methods of animal models (formaldehyde-cotton pledget- induced granulation, induced paw swelling etc. albino rats). The flavonoid quiritin and its geninliquiritigenin also show anti-inflammatory mode of action of Liquorice [25].

Anti Dyslipidaemic activity

HFD induces hepatic stress response resulting in cholesterol and lipid dysregulation. The results obtained reveal that serum cholesterol, triglycerides, and LDL-C become significantly higher in the HFD fed hamsters compared to those in normal diet fed hamsters. The continuous treatment with the root extract of *Glycyrrhiza glabra* significantly brought down the above lipid parameters in the high fructose diet fed hamsters. Serum HDL-C levels were significantly lowered in HFD fed hamsters which upon treatment with ethanolic extract increased by 14.8% that is comparable to increase brought by fenofibrate (19.5%). Besides the above VLDL was significantly elevated in the HFD fed hamsters as compared to normal diet control hamsters. Different fractions of ethanolic extract were studied for their antidyslipidaemic activity in HFD fed hamsters at 50 mg/kg dose. The TG lowering activity was distributed into ethyl acetate fraction, aqueous fraction and hexane fraction as 37.2, 41.2 and 28.9%. Aqueous fraction showed maximum cholesterol lowering effect (39%) followed by ethyl acetate After 30 days of study, the body weight of the HFD fed control animals increased significantly when compared to normal diet fed group ($P < 0.01$). Treatment with standard drugs (fenofibrate) as well as ethanolic extract (100 mg/kg) and its fractions appreciably decreased the gain in the body weight [26]. The oral administration of G. glabra root extract at three different doses, 0.2, 0.7 and 1 mg mL to the animals for one month show significant decrease in total cholesterol and triglyceride concentration and increase in HDL-c concentration when compared with the untreated group. Very low density and low-density lipoprotein was markedly reduced in the treated group in comparison with the untreated [27].

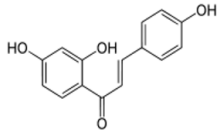
Memory enhancing activity

This activity of liquorice was detected in mice. To investigate memory and learning capability Elevated plus-maze and passive avoidance paradigm were used. Three doses of aqueous extract of liquorice were administered [75, 150 and 300 mg/kg p.o.] in separate groups of animals for 7 successive days. Memory and learning capacity of mice was reported at the dose of 150 mg/kg for having significant advancement. But, the exact mechanism of action is unrevealed and needs further investigation. The effect of

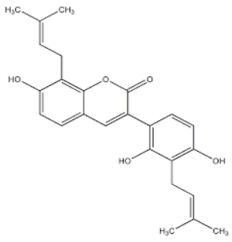
glabridin isolated from the roots of Glycyrrhiza glabra was investigated on Memory enhance activity in mice [28] (Table 2).

Anti-diabetic activity

The present study indicates that ethanolic root extract of liquorice shows prominent antioxidant and anti-diabetic activity. Reduction in disaccharide hydrolysis by inhibition of α-glucosidase and α-amylase enzyme activity shows preferable effects on glycemic index control in diabetic patients and can reduce the incidence of post prandial hyperglycemia. As the plant extract was reported for having anti-diabetic activity in vivo, its activity was evaluated in vitro [29].



Isoliquiritigenin



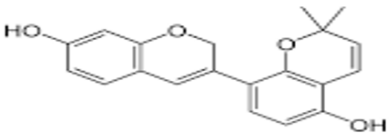
Licocoumarin

Table 2: *Chemical compound activity response.*

S. No.	Activity	Chemical constituents	Reference
1.	Anti-inflammatory	Glycyrrhetic acid, liquiritoside, Licochalcone	25
2.	Memory enhancing activity	Glabridin	28
3.	Anti-Diabetic Activity	18-β-glycyrrhetinic acid, glycyrrhizin	29
4.	Menopause	Glabridin, glabrene	30,31
5.	Hair growth activity	Glycyrrhizic acid	36
6.	Anticancer effect	Glycyrrhetic acid, Glycyrrhizin	42,47
7.	Anticonvulsant Activity	Glycyrrhetinic acid	76
8.	Analgesic action	Isoliquiritigenin	53
9.	Antidiuretic activity	Glycyrrhizin	52
10.	Antifungal activity	Glabridin	54
11.	Neurological Disorder	Glabridin rich extracts	58
12.	Chronic fatigue	----------	-----
13.	Hepatoprotective activity	Glycyrrhizin,Glyccyrrhizi acid and Glycyrrhetic acid	70
14.	Oral lichen planus	Glycyrrhizin	75
15.	Antidyslipidaemic activity	Licochalcone, glabridin, isoliquiritigenin, licocoumarin	26

Menopause

Glycyrrhiza glabra consumption and exercise program were effective in controlling the symptoms of menopause behavior of menopausal woman. Therefore, it may refer as one of the main strategies for health and education interventions. Women's attitudes toward menopause can help to improve their performance and reduce the severity of its complications. The effect of Glycyrrhiza glabra plant and exercise on the attitude of menopause [30, 31].

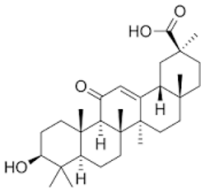


Glabrene

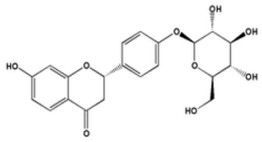
Hair growth activity

2.5%, 5%, and 10% concentration of ethanolic extract of Licorise had hair growth activity similar to that of the positive control (minoxidil) according to the hair length and hair thickness parameters. The 5% and 10% licorice ethanol extract hair tonic solutions had better hair weight and density than that of the positive control [32]. The concentration of glycyrrhizic acid contained in the licorice ethanol extract used as an active ingredient in the hair tonic solutions was 1456.65 mg/g or 5.665%. The hair tonic solutions containing 2.5%, 5%, and 10% licorice ethanol extract showed physical and chemical stability when stored at low (4±2 °C), room (28±2°C), and high (40±2°C) temperatures for 12 weeks. 10% licorice ethanol extract hair tonic solution was safe for topical use the HET-CAM and patch safety test give evidence of it. However, the 2.5% licorice ethanol extract hair tonic solution was irritative to the eye [33,34]. This study used male New Zealand rabbits from Balai Penelitian Hewan Ternak, Ciawi that weighed 2-2.5 kg. Modification was used to measure hair growth [35]. The chemical compound responsible for the hair growth activity of

licorice ethanol extract might be glyceric acid and its derivatives and glycyrrhizic acid and its derivatives, which are suspected to have anti-hair loss effects resulting from the inhibition of the production of DHT through suppression of 5-alpha-reductase activity [36-38].



Glycyrrhetic acid



Liquiritin

Anticancer effect

Glycyrrhizaaspera ethanolic extract exhibits antimutagenic activity against N-methyl-N-nitrosourea [MNU]. The inhibitory activity of glabridin and licochalcone was more effective than that of liquiritigenin. Thus, Glycyrrhiza contains antimutagenic components against DNA alkylating, direct-acting carcinogens [39]. It was determined by mechanism HEGU and its active component, isoangustone A, inhibited 4T1 mouse breast cancer cells and cell cycle progression in DU145 human prostate. The addition of HEGU to drinking water significantly suppressed the orthotropic growth of 4T1 allografts and the expression of the proliferating nuclear cell antigen, CDK2 and CDK4 proteins in the tumor tissues. These results demonstrate the potential of HEGU containing isoangustone A as an antitumor agent [40]. The cytotoxicity of the selected compounds and their aglycones were evaluated against HeLa and MCF-7 cancer cell lines, and the preliminary structure-activity relationship was also elucidated. Four new triterpene glucuronides, namely Ural saponins C-F an artificial product, namely the methyl ester of glycyrrhizin, as well as six known triterpene glucuronides was isolated [41-43]. Licorice root extract for effects on Bcl-2 to identify novel cytotoxic derivatives was assessed. The result demonstrated that licorice root contains beta-hydroxy-DHP, which induced Bcl-2 phosphorylation, apoptosis, and G2/M cell cycle arrest, in breast and prostate tumor cells, similarly to the action of more antimicrotubular agents used clinically [44]. The in vitro immunomodulatory and antitumor potential of Glycyrrhizauralensis polysaccharides fractions of high molecular weight [fraction A], low molecular weight and crude extract was investigated. The result indicates that G. uralensis polysaccharides especially those of low molecular weight have a potential as anticancer agents. is the ability of the polysaccharides to up-regulate anticancer cytokine IL-7, which is important in proliferation and maturation of immune cells and it is associated with better prognosis in cancer [45]. It was examined whether HEGU and licoricidin inhibit metastasis using the 4T1 mammary cancer model. The result demonstrates that the licoricidin in HEGU inhibits lung metastasis of 4T1 mammary carcinoma cells, which may be mediated via inhibition of cancer cell migration, tumor angiogenesis, and lymph angiogenesis [46]. The effects of an ethanol extract Glycyrrhiza glabra on the expression of HSP90, growth and apoptosis in the HT-29 colon cancer cell line was evaluated. Results showed that Glycyrrhiza glabra inhibited proliferation of the HT-29 cell line at a concentration of 200 µg/ml and this was confirmed by the highest rate of cell death as measured by trypan blue and MTT assays [47]. The three authenticated medicinal species of licorice Glycyrrhiza glabra, Glycyrrhizauralensis, and G. inflata [GI] tested, the results suggest that, of the three licorice species that are used in botanical supplements, GI represents the most promising chemo preventive licorice extract for women's health. Additionally, the differential effects of the Glycyrrhiza species on estrogen metabolism emphasize the importance of standardization of botanical supplements to species-specific bioactive compounds [48]. Isoflavonoidcalycosin showed the best potency against human T-cell leukemia cells MT-4. Pterocarpansmedicarpin and homopterocarpin exhibit anticancer activity in micro molar range with selectivity on the human monocyte cells U-937. The isoflavan [3R]-vestitol was highly selective on the lymphoblastic leukemia cells CEM-13 and was more active than the drug doxorubicin [49-50]. Treatment with LigC alone did not induce NQO1 in vivo most likely due to its conversion to LigF, extensive metabolism, and its low bioavailability in vivo. These data show the chemopreventive potential of licorice species in vitro could be due to LigC and LicA and emphasize the importance of chemical and biological standardization of botanicals used as dietary supplements. It must be emphasized that menopausal women take these supplements for extended periods of time and long-term beneficial effects are quite possible [51,52].

Analgesic activity

A Chinese herbal medicinal formula consisting of licorice has been used for the treatment of dysmenorrhea for thousands of years. The purpose of the present study was to demonstrate the analgesic and uterine relaxant effects of isoliquiritigenin (ISL). In vitro, isoliquiritigenin caused concentration-dependent inhibition of spontaneous contraction of isolated rat uterus, such as acetylcholine (Ach, 10 mM), KCl (40 mM) and oxytocin (1 mU/mL). The uterine contractile response to cumulative concentrations of $CaCl_2$ was blocked by 0.1 and 1 mM of isoliquiritigenin. The isoliquiritigenin-induced relaxation was partly inhibited by the nitric oxide synthase (NOS) inhibitor Nv-nitro-L-arginine methylester (L-NAME, 100 mM) and the COX-1/COX-2 inhibitor indomethacin (10mM). In vivo, isoliquiritigenin could cause a significant reduction in the acetic acid-induced writhing response and hot-plate test at the high dose.

These results indicate that isoliquiritigenin, not only has a spasmolytic effect on uterine contraction, which is in relation to Ca^{2+} channels, NOS and COX, that mean is an effective in reducing pain [53].

Antidiuretic activity

Glycyrrhetinic acid and its salts had antidiuretic effect. Antidiuretic activity of Glycyrrhizin was confirmed wherein the reduction of sodium excretion was accompanied by a mild decrease in potassium excretion. These effects were observed in adrenalectomized rats and it suggested that the antidiuretic action of glycyrrhizin was mediated by adrenocortical hormones. Some author reported that the herb could increase the renal tubular reabsorption of sodium and chloride. The mode of action of the herb was different from that of deoxycorticosterone in that it probably acted directly on the renal tubules [52].

Antifungal activity

The activity was identified in crude ethanol extracts and further in the ethyl acetate fraction. Glycyrriza Glabra's specific chemical compound of glabridin was isolated through bioactivity guided fractionation of the licorice root extract. Glabridinwas identified as an antifungal agent while hispaglabridin B was inactive. Glabridin was found to be most potent against amphotericin B resistant C. albicans. The structures of the compounds were established with the aid of NMR and MS spectroscopic techniques [53,54]. Antifungal susceptibility testing was determined by disc diffusion and micro broth dilution [55,56]. The disc diffusion assay was performed as described. The result was obtained by measuring the zone of fungal growth inhibition (diameter in mm) around the disc of test compound. The minimum inhibitory concentrations of the tested compounds were determined by a two-fold broth dilution assay. The MIC end point was defined as the lowest concentration of test compounds exhibiting 80% (or greater) reduction in optical density compared with the growth in the control well. Antifungal activities of the extracts were examined against growth of the fungi using the agar well method on MEA plates and tube having minimum extract shows no turbidity [57].

Neurological disorder

Acetyl cholinesterase levels in brain gets reduce by *Glycyrrhiza glabra*, thus suggesting the anti-cholinesterase activity of Aqueous liquorice extract (400mg/kg p.o) and Glabridin rich extracts (5mg/kg and 10mg/kg p.o) might be the probably active constituent for Neurological Disorder. In the regulation of cognitive functions, neurotransmitter Acetylcholine is considered as the most important. Acetylcholine hydrolysis terminate cholinergic transmission via enzyme Acetyl cholinesterase (AChE). Extract of liquorice and Glabridin inhibit AChE activity significantly in the brain. Data suggest that the ameliorating effects on memory could be explained by their inhibition on AChE activity within the brain [58].

Chronic fatigue

Hydro alcoholic extract of Glycyrrhiza glabra and fluoxetine narrowing various behavioral alterations due to chronic fatigue which is induced by daily exposures of mice to forced swim [59,60]. Animals were made to swim daily for 6 min over a total period of 15 days. These chronically fatigued animals showed an increased anxiety response in mirror chamber, increased pain sensation (hyperalgesia response), memory dysfunctions and increased immobility period and reduced muscle co-ordination. Repeated experiences to forced swim are known to increase immobility as compared with unstressed rats Cognitive problems are another most disruptive and disabling symptoms of chronic fatigue. A similar result was observed in stressed mice as compared to unstressed group of mice and the effect was attenuated by the daily administration with Glycyrrhiza glabra and fluoxetine, thereby confirming the anti-stress as well as antidepressant effect. In the present study, chronically fatigued mice show memory impairment and the daily treatment with liquorice extract prevented the memory impairment in mice. Previous studies have demonstrated that various stress conditions induce hyper algesia to thermal, chemical and mechanical stimuli [61,62]. The dysfunction of the hypothalamo-pituitary adrenocortical axis and multiple neurotransmitter systems in the central nervous system including endogenous opioid, serotonergic and noradrenergic systems, has been reported [63]. Antidepressants have been known to induce a dose-dependent ant nociceptive effect in mice [64]. Since chronically stressed animals present a hyperalgesicresponse [65]. Forced swimming stress has also been reported to induce 2-3-fold rise of plasma cortisol level increased cortisol level has been linked with anxiety behavior and painful response in humans [66,67]. Glycyrrhiza glabra and fluoxetine produced antianxiety effect possibly by decreasing plasma cortisol levels. The present study revealed that Glycyrrhiza glabra is effective in reversing chronic fatigue induced memory dysfunction, immobility, hyperalgesia, anxiety and muscle in co-ordination in mice [68].

Hepatoprotective activity

Glycyrrhizic acid that is active constituent of liquorice is used in hepatoprotective formulations. Pre-treatment with GA has been reported to show protective action against carbon tetrachloride (CCl4) induced liver injury in rats, also glycyrrhizin (10.5 mg/kg) suppressed the increases in AST and ALT, inhibited iNOS mRNA expression, cell infiltration and the degeneration of hepatocytes in the liver of concanavalin A (Con A)-treated mice, glycyrrhizin reduce CCl4-induced liver injury by diminishing free radical toxic properties and inducing heme oxygenase-1 and down regulating proinflammatory mediators and show protective effect on retro

sine-induced liver damage in rats as compared with glycyrrhizin or matrine alone [69-71]. Glycyrrhizin and matrine together attenuate the development of acetaminophen-induced hepatotoxicity in mice [72]. In addition, it has a protective effect on immunosuppression without causing significant adverse effects. Saponins, triterpenes, sterols and bitter principles were identified in n-hexane extract of Lygodiumflexuosum was reported as a hepatoprotective agent against carbon tetrachloride-induced hepatotoxicity [73]. We supposed that the components (triterpene, saponins, glycyrrhizic acid) alone or in combination with other components present in the licorice extract might be responsible for the reduction of hepatotoxicity in treatment groups. On basis of experimental results reported here, we hypothesize that the components (triterpene, saponins, and glycyrrhizin acid) alone or in combination with other components present in the licorice extract might be responsible for subsequently protecting the liver against CCl4-induced damage and reduction of hepatotoxicity in treatment groups [74].

Oral Lichen planu

Oral lichen planus, a provocative infection described lymphocytic hyperkeratosis of the oral mucosa. Constant hepatitis C suffering patients frequently encounters oral lichen plant. Among nine patients, six were clinical manifestation moved forwarded for reducing redness, white papules [75].

Anti-convulsant activity

Anticonvulsant effect show the effect by the aq. Extract of Glcyrizza glabra investigated in mice. Study investigated show the anticonvulsant effects of G. glabra using the PTZ-model. Agents affecting the PTZ model can inhibit petit mal seizure. Thus, Glycyrrhitinic acid and its derivatives have been shown to inhibit gap junction channels. In the presence of bicuculline, glycyrrhetinic acid abolished seizure-like activity in vitro guinea-pig brain preparation. The succinyl ester of glycyrrhetinic acid, had anticonvulsant effects in the PTZ model and in this study glycyrrhiza extract was similarly shown to decrease the duration of seizure. The inhibitory effects of 18β-glycyrrhetinic acid on gap junction channels of arteriolar smooth muscle, endothelial cells, renal pelvis, ureter and mesenteric small arteries were established [76].

Conclusion

Glycyrrhiza glabra is an Herb with rich botanical beneficial history. This plant effectively used as medication in India also over world. It has shown its effectiveness in Hepatoprotective activity, chronic fatigue, Neurological Disorder, Antifungal activity, Antifungal activity, Eye inflammatory diseases, Menopause, Memory enhancing activity properties. Many kinds of impacts like antidiuretic, antihepatotoxic, antifungal etc. The potential use against hostile to viral activity of glycyrrhizin are obstruse; in any case, balance of the invulnerable reaction in by all accounts is demonstrated.

Declaration of Conflict Interest

The Author declares that there is no conflict of interest.

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