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BIOLOGICAL EVALUATION OF HOMOEOPATHIC *GLYCYRRHIZA GLABRA* IN CUTANEOUS WOUND HEALING

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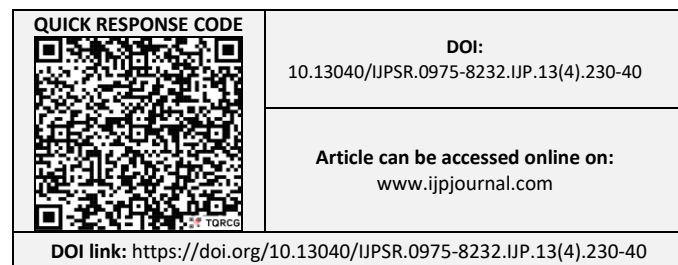
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ABSTRACT: Cutaneous wound healing is a complex biological process involving inflammation, tissue repair, and remodeling. *Glycyrrhiza glabra* (licorice), a medicinal plant long valued in traditional systems, contains diverse phytochemicals such as glycyrrhizin, flavonoids, saponins, and coumarins that exhibit anti-inflammatory, antioxidant, antimicrobial, and tissue-protective properties. While these actions are well documented in pharmacological studies, their dynamic influence in homoeopathic potencies remains underexplored. According to the homoeopathic approach, medicines act on the vital force to stimulate the organism's inherent reparative capacity rather than suppressing symptoms. Evaluating *Glycyrrhiza glabra* in this context provides insight into how its phytochemicals when potentised, can modulate excessive inflammation, enhance microcirculation, and promote orderly granulation and epithelialization. The role of *Glycyrrhiza glabra* in wound healing thus extends beyond material pharmacology to dynamic regulation of the healing response, consistent with Hahnemann's principles in the Organon of Medicine. This study is necessary to establish scientific evidence for the homoeopathic application of *Glycyrrhiza glabra* in cutaneous wounds, bridging traditional knowledge with modern biological evaluation. By demonstrating its capacity to harmonize immune signaling and sustain long-term tissue integrity, the research underscores the relevance of homoeopathy in contemporary wound management and highlights *Glycyrrhiza glabra* as a safe, non-toxic therapeutic option for acute and chronic cutaneous healing.

INTRODUCTION: Wound is the outlined as loss of cellular and anatomical tissue as well as stability of living tissue ¹. Wound is created when the integrity of the skin, mucosal surface or the body tissue is compromised due to some stimulus may be external or internal ². Cutaneous wound healing is any loss occurred at skin level due to any external or internal stimulus.

Skin is the major vital organ which act as a primary barrier against environmental hazards, pathogens and UV rays; also help to regulate the body temperature, enable the sensation, synthesis Vit. D, store fat and excrete waste products.

Thus the cutaneous wound healing is necessary to achieve all these functions. Cutaneous wound healing is the physiological process that begins after tissue injury and having three phases like inflammation, proliferation and maturation ³. The process of wound healing, keratinocytes, macrophages, platelets, and endothelial cells, some growth factors such as EGF, FGF, cytokines (IL-1 β , IL-6, IL-8, IL-10, TNF- α , IFN- γ) and chemokines are require to control subsequent



stages of wound healing^{4,5}. *Glycyrrhiza glabra* is medicinal plant widely used as anti-inflammatory, anti-oxidant, and antimicrobial and tissue protective property⁶. *Glycyrrhiza glabra* accelerates wound healing through potent anti-inflammatory, antioxidant, and tissue-regenerative mechanisms, notably by inhibiting pi3k/akt and nf-kb pathways. Active compounds like glycyrrhizin and glabridin stimulate collagen deposition, angiogenesis via rapid epithelialization, resulting in faster wound closure and improved scar appearance⁷.

There are many species of *Glycyrrhiza* genus extensively spread worldwide⁸. Licorice is scientifically known as *Glycyrrhiza glabra* and is from Leguminosae family⁹. This species is found in the world from 50° W to 100° E longitude and 20° - 50° N latitude. It's abundant production noted in Western China, parts of Asia Minor, Persia, Asian Republics of erstwhile U.S.S.R. and Afghanistan. It is also cultivated in Punjab & Sub Himalayan tracts in India¹⁰. It is grown commercially in many countries. *Glycyrrhiza glabra* is termed as an "essential herbal medication." In Traditional Chinese Medicine, licorice is included in nearly 90% of herbal formulations. It is highly valued for its ability to reduce toxicity and enhance the therapeutic effects of other herbs. It is also use as natural sweetener because it is a "medicine food homology" herbal medication¹¹. It is reported in many journals as *Glycyrrhiza glabra* contains amino acids, proteins, simple sugars, polysaccharides, mineral salts, pectin, starches, sterols, gums, and resins¹². It was one of the important plants mentioned in Assyrian herbal (2000 BC). Hippocrates (400 BC), mentioned its use as a remedy of ulcers and quenching of thirsts. In traditional system of medicine, Liquorice is used as a demulcent, expectorant, anti-tussive, and laxative¹³.

The Phytochemical screening of *Glycyrrhiza glabra* root contains alkaloids, phenolic compounds, pectin, carbohydrate, starch, glycosides, lipids, mucilage, proteins, sterols and steroids^{14,15}.

Glycyrrhiza glabra used as a flavoring and sweetening agent used in beverages⁹. Also having effective involvement in skin cosmetics¹⁰.

Pharmaceutical therapeutic properties such as antiviral and anti tumoral¹³, antioxidant¹⁵, antiulcer¹⁶, antifungal¹¹, antibacterial¹⁴, antimicrobial¹² has been reported in many articles.

Study shows *Glycyrrhiza glabra* having capacity of wound healing at oral site, mucosal ulcer²¹ Gastric site²⁰, and intestinal site²⁰ also burning wound²². But still there is no study available which shows the Homoeopathic dilutions of *Glycyrrhiza glabra* having cutaneous wound. This medicinal review more highlight on role of *Glycyrrhiza glabra* in cutaneous wound healing in homoeopathic point of view.

Botanical Sources and Chemical Composition^{27, 28, 29}:

Kingdom: Plantae

Family: Leguminosae

Division: Angiospermae

Genus: Glycyrrhiza

Class: Dicotyledoneae

Species: *Glabra* Linn.

Order: Rosales

Botanical Name: *Glycyrrhiza glabra* Linn.

Synonyms: *Glycyrrhiza glandulifera*

Regional Names:

Sanskrit: Yashti-madhu, madhuka Persia: Ausareha mahaka Bengali: Jashtimadhu, jaishbomodhu	Telugu: Atimadhuranu, yastimadhukam Hindi: Jothimadh, mulaithi Malayalam: Iratimadhuram
<i>Glycyrrhiza glabra</i>	
Arab: Aslussiesa Oriya: Jatimadhu Famce : Boisdoux	Marathi: Jeshthimadh Gujarat: Jethimadhu Kannada: Yastimadhuka, atimaddhura

Morphology and Distribution^{10, 29}: The autumn is the good season for collection of roots of *Glycyrrhiza glabra* season. It plant having favorable climate for its growth in India, Spain, Iran, Russia, China and Italy. This plant needs

fertile, sandy, and clay soil for cultivation where enough water is available.

Glycyrrhiza glabra is perennial herb, with 1 m height, about 7-15 cm long pinnate leaves and 9-17 leaflets. The colour of the flowers is purple to pale whitish blue, 0.8-1.2 cm long, with soft flower cluster. 2-3 cm long fruit containing many seeds. The *Glycyrrhiza* belongs to pea family having

extensive root system with a main taproot and numerous runners. The main taproot, which is use for medicine.

Medicinal Parts Used: Roots and Rhizome in the form of powder/ teas/ tonic/ extracts/ tinctures/decoction are used to prepare medicine ^{27, 29}.



FIG. 1: PARTS OF GLYCYRRHIZA GLABRA

Medicinal Properties & Uses: The roots of medicine are sweet in taste, are used as emetic, tonic, diuretic, demulcent, mild laxative, aphrodisiac, trichogenous, expectorant emmenagogue, alexipharmic, alterant and intellect promoting. They are useful in hyper dipsia ³⁰, cough & bronchitis ³¹, gastralgia ³², cephalalgia ³³, fever ³⁰, skin diseases ³¹, ophthalmopathy ³¹ and pharyngodynia ³⁴. An extract of the root is good for

throat infections. A decoction of the root is a good wash for falling and greying of hair ³⁵. Externally the root is applied for cuts and wounds ³⁶. Plant is reported for to possess antioxidant activity and numerous pathological conditions including management of PCOS, arthritis ^{46, 47, 48}. Also, there are attempts to standardize by using molecular markers ⁴⁹.

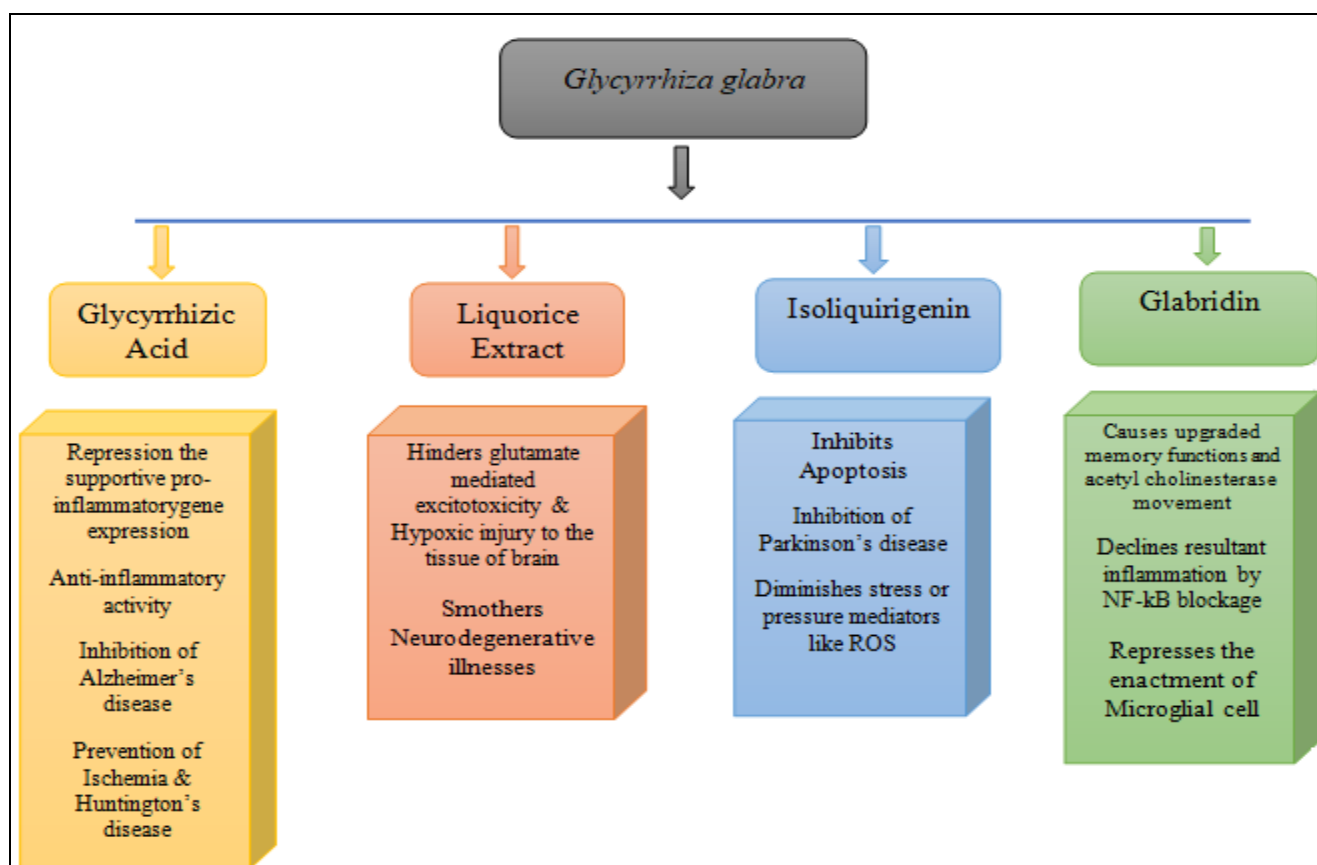


FIG. 2: GLYCYRRHIZA GLABRA AS ANTI-INFLAMMATORY, ANTIVIRALS AND IMMUNOMODULATORS ^{41, 42}

TABLE 1: SOME CLINICAL STUDIES OF *GLYCYRRHIZA GLABRA* ENLISTED WHICH HELP TO UNDERSTAND THE ACTION OF THE DRUG ON LIVING CELL

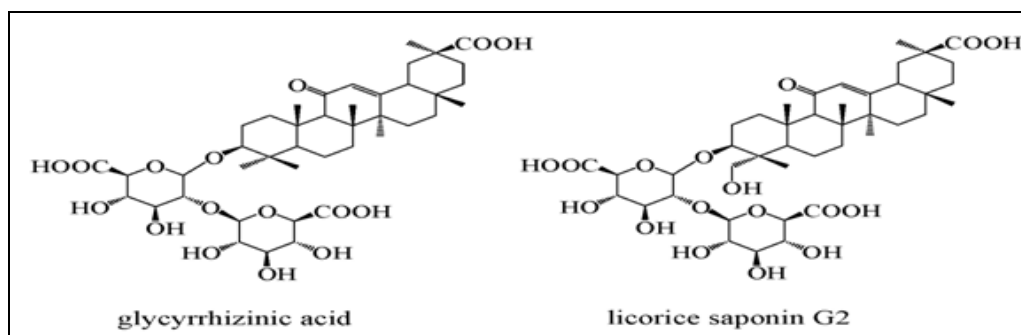
Sr. no.	Study done by	Subjects on which study conducted	Type of medicine used	Pathological condition	Key findings after study	Reference
1	Tarazi et al. (2023)	Rats (burn wound model)	<i>G. glabra</i> hydrogel	Burn wound healing	Accelerated wound closure, reduced inflammation, enhanced collagen deposition	Gels, Vol. 11, Issue 10
2	Zangeneh et al. (2019)	Sprague Dawley rats	Aqueous extract ointment	Wound healing	Enhanced wound shrinkage, re-epithelialization, improved tensile strength	Comparative Clinical Pathology
3	CSIR Multi-centre Trial (India, 2021)	Mild–moderate COVID-19 patients	Yashtimadhu tablets (250 mg bid)	COVID-19 adjunct therapy	Improved recovery rates, reduced inflammatory markers, safe as add-on	Clinical Trials Database CSIR-Indian Institute of Integrative Medicine Int. J.
4	Ammar et al. (2012)	Patients with plaque-induced gingivitis	Licorice extract mouthwash	Oral health	Significant reduction in gingival inflammation and plaque scores	Phytomedicineijp.ajournals.org
5	Takahashi et al. (2010)	Patients with chronic hepatitis C	Glycyrrhizin IV	Hepatitis C	Reduced ALT levels, improved liver function	Journal of Gastroenterology
6	Armanini et al. (2003)	Healthy volunteers	Licorice tablets	Hormonal regulation	Mineralocorticoid-like effects (blood pressure increase, sodium retention)	Journal of Endocrinological Investigation
7	Shibata et al. (2000)	Patients with gastric ulcers	Licorice extract	Gastrointestinal	Accelerated ulcer healing, reduced gastric irritation	Yakugaku Zasshi

Phytochemicals of *Glycyrrhiza glabra*:

Pharmaceutical preparations and Phytochemical analysis of licorice root extract exhibited that it contained flavonoids like isoflavonoids, formononetin, and Liquiritin, saponins triterpene⁴¹ and some other constituents such as sugars, coumarins, amino acids, starch, tannins, phytosterols, choline, and vitamins (e.g., ascorbic acid)³⁷. The yellow colour of the licorice is due to presence of some flavonoid components such as hispaglabridins and Glabridin. The dried aqueous extracts of licorice contain approximately 4-25% glycyrrhizinic acid⁴⁰. The main active principle of licorice are Liquiritin, isoliquiritigenin, liquiritigenin, and glycyrrhetic acid³⁸,

Glycyrrhiza polysaccharide. This herb is rich in flavonoids and syringic, abscisic, trans-ferrulic, and pharmacological activities are contributed to by glycyrrhizin, 18β-glycyrrhetic acid, glabrin A and B, and isoflavones of *Glycyrrhiza glabra* Linn⁵⁰.

Total of 27 flavonoids are present in the roots, 3 were characterized as liquiritigenin, liquiritin and isoliquiritigenin. A new flavonoid glycoside licuraside from plant. A new flavonone glycoside Rhamnoliquiritin from plant. Isolation of liquoric acid from plant. Isolation of two triterpenoid acids: 11-deoxyglycyrrhetic acid and liquiritic acid from plant³⁹.



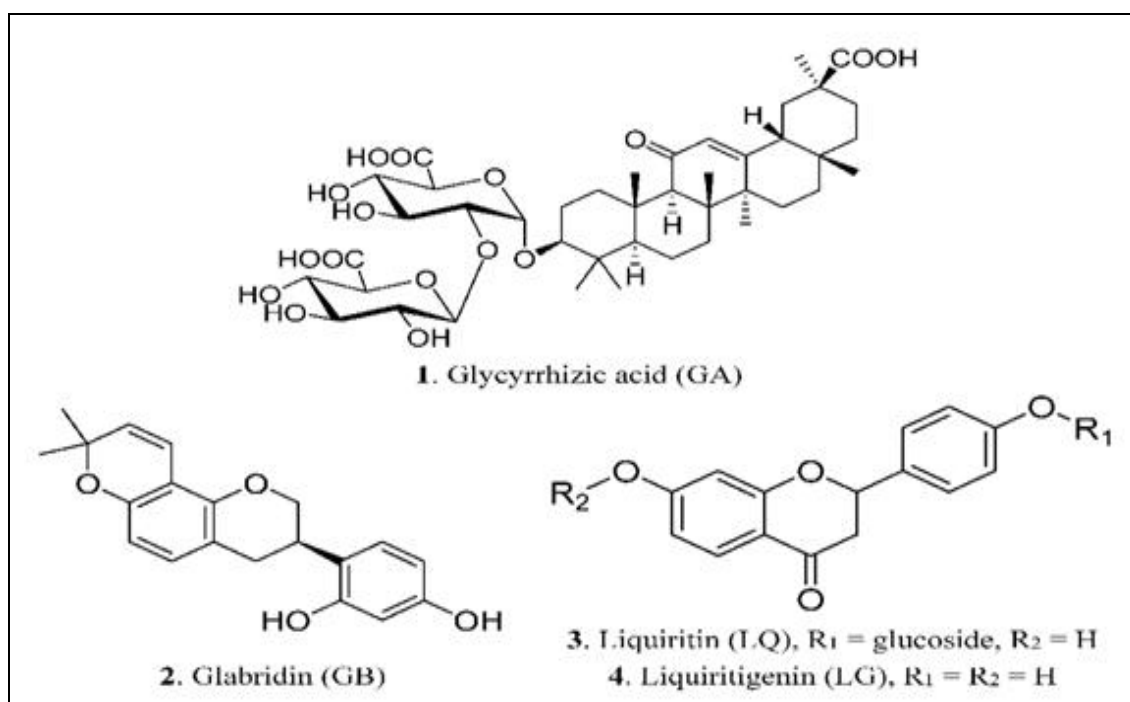


FIG. 3: CHEMICAL STRUCTURE OF PHYTOCHEMICALS OF *GLYCYRRHIZA GLABRA*^{39, 51}

TABLE 2: PHYTOCHEMICALS AND THEIR PHARMACOLOGICAL ACTIONS

Sr. no.	Phytochemical	Class	Pharmacological Action	Reference
1	Glycyrrhizin	Triterpene saponin	Anti-inflammatory, antiviral, hepatoprotective, immunomodulatory	39
2	18β-Glycyrrhetic acid	Triterpenoid	Anti-inflammatory, cytoprotective, wound healing	38
3	Liquiritin	Flavonoid glycoside	Antioxidant, anti-inflammatory, skin protective	41
4	Liquiritigenin	Flavonoid	Estrogenic activity, antioxidant, neuroprotective	37
5	Isoliquiritigenin	Flavonoid	Antioxidant, anticancer, anti-inflammatory	38
6	Glabridin	Isoflavonoid	Antioxidant, skin whitening, anti-atherogenic	40
7	Hispaglabridins	Flavonoid	Antioxidant, pigmentation regulation	41
8	Licuraside	Flavonoid glycoside	Antioxidant, anti-inflammatory	39
9	Rhamnoliquritin	Flavonoid glycoside	Antioxidant, cytoprotective	39
10	Liquiritic acid	Triterpenoid acid	Anti-inflammatory, hepatoprotective	38
11	11-Deoxyglycyrrhetic acid	Triterpenoid acid	Anti-inflammatory, wound healing	40
12	Glabrolide / Deoxoglabrolide / Isoglabrolide	Lactones	Antimicrobial, cytoprotective	39
13	Glabranine	Flavonoid	Antioxidant, anti-inflammatory	37
14	Pinocembrine	Flavonoid	Antioxidant, neuroprotective	38
15	Prunetin	Isoflavone	Anti-inflammatory, estrogenic	41
16	Formononetin	Isoflavone	Antioxidant, estrogenic, anticancer	37
17	Coumarins	Phenolic compounds	Anticoagulant, antimicrobial	40
18	Phytosterols	Sterols	Cholesterol-lowering, anti-inflammatory	38
19	Syringic acid	Phenolic acid	Antioxidant, anti-inflammatory	37
20	Abscisic acid	Plant hormone	Immunomodulatory, stress response	41
21	Trans-ferulic acid	Phenolic acid	Antioxidant, wound healing	38
22	Salicylic acid	Phenolic acid	Anti-inflammatory, analgesic	40
23	Choline	Nutrient	Neuroprotective, hepatoprotective	40
24	Ascorbic acid (Vitamin C)	Vitamin	Antioxidant, collagen synthesis	38

“Each major phytochemical of *Glycyrrhiza glabra* has listed its biological activity, which supports the observed experimental outcomes.” Following are

list of Phytochemical of *G. glabra* showing different actions on living body.

TABLE 3: ACTION OF PHYTOCHEMICAL OF *GLYCYRRHIZA* ON LIVING CELL

Sr. no.	Phytochemical	Chemical	Action on living body	Clinical significance	Reference
1	Liquiritin	Flavonoid glycoside	Antioxidant, anti-inflammatory, cytoprotective	Reduces oxidative stress; protects fibroblasts and keratinocytes during repair	15, 52
2	Isoliquiritigenin	Chalcone (flavonoid)	Anti-inflammatory, antimicrobial, antioxidant	Inhibits NF- κ B signaling; reduces inflammatory mediators and microbial load in wounds	55, 60
3	Glabridin	Isoflavan	Antimicrobial, antioxidant, skin-protective	Active against <i>Staphylococcus</i> and <i>Candida</i> ; protects skin from oxidative damage	15, 56,57,58,59
4	Licoflavanone	Flavanone	Anti-inflammatory, antioxidant	Suppresses NF- κ B & MAPK pathways; reduces inflammatory cell infiltration	55, 60
5	Saponins (general)	Glycosides	Immunomodulatory, angiogenic	Promote granulation tissue formation and neovascularization	15, 53, 54
6	Coumarins	Phenolic compounds	Anti-inflammatory, microcirculation-enhancing	Improves local circulation and tissue oxygenation	15, 54
7	Phenolic acids	Polyphenols	Antioxidant, antimicrobial	Reduce oxidative damage and prevent microbial growth at wound site	15, 52, 57
8	Polysaccharides	Complex carbohydrates	Immunomodulatory, tissue-protective	Support innate immunity and extracellular matrix formation	53,54

Research related to the pharmacological action of the drug on wound healing was done by many people. Wound healing require proper blood supply to the affected area, oxygenation so that collagen synthesis and angiogenesis accors, proper immune response i.e. macrophage activity and lastly the hormonal balancing so that growth factors promotes the cell proliferation and tissue repair. Healing of any wound is depend upon on 4 basic things, hemostasis, inflammation, proliferation and remodeling^{61, 62, 63, 64}. *Glycyrrhiza glabra* having potential to accelerate the healing, as it suppresses the pro-inflammatory cytokines such as TNF- α and IL-6 in LPS- stimulates macrophages. The anti-inflammatory effect was mediated through inhibition of JKA/STAT signal pathway which clearly indicate regulatory action on intracellular inflammatory cascade rather than nonspecific suppuration. This finding by⁶⁵ Perri establish strong molecular basis for the anti-inflammatory potential of *Glycyrrhiza glabra*. He also stated⁶⁶ during his experimental studies on animal, homoeopathic potencies of *Glycyrrhiza glabra* reduce inflammatory markers in LPS- induced inflammation. Homoeopathic dilutions with their dynamic action support the hypothesis of dose dependent regulatory action. This study bridges molecular inflammation research with homoeopathic experiments¹⁵. Asl & Hosseinzadeh

summarized the clinical and experimental study by stating *Glycyrrhiza glabra* and its constituents possess potent anti-inflammatory, antioxidant, antimicrobial, and immunomodulatory activities. They identified glycyrrhizin, glycyrrhetic acid, and flavonoids as principal bioactive compounds acting via inhibition of prostaglandins, cytokines, and oxidative mediators, thereby providing a pharmacological rationale for therapeutic use in inflammatory conditions⁶⁷. Frattaruolo states licoflavanone, a flavonoid from *G. glabra* leaves, exerts strong anti-inflammatory and antioxidant effects by suppressing NF- κ B and MAPK signaling pathways. It helps in reducing inflammatory mediator release and oxidative stress markers and control the chronic inflammation and tissue injury⁶⁸. Zhou & Wink demonstrated that glycyrrhizin, 18 β -glycyrrhetic acid, and isoliquiritigenin directly inhibit NF- κ B activation and inflammatory mediator expression in macrophages⁶⁹. Kim analyzed the licorice-derived compounds in inflammatory and intestinal disorders, highlighting their ability to regulate immune balance, cytokine expression, oxidative stress, and epithelial integrity. He emphasized that licorice compounds act as inflammation modulators, not suppressors, but supporting safe long-term use in chronic inflammatory conditions⁷⁰. Li in its vitro study showed that methanolic extract of *Glycyrrhiza*

glabra significantly inhibited nitric oxide (NO), reactive oxygen species (ROS), and pro-inflammatory cytokines in LPS-stimulated

RAW264.7 macrophages. These all findings confirm that this drug having strong antioxidant-linked anti-inflammatory activity.

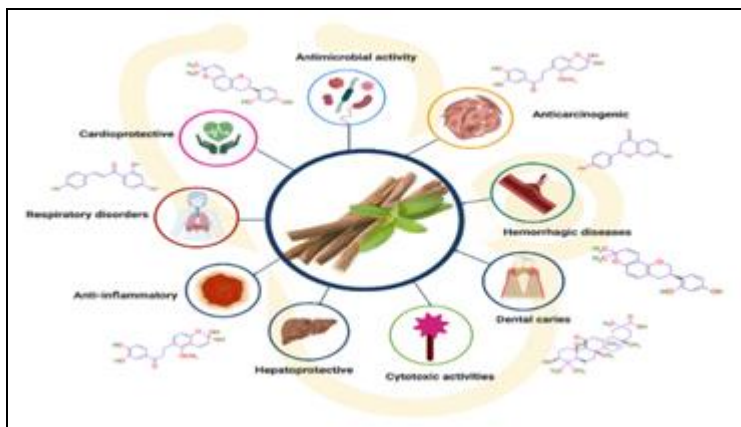


FIG. 4: GLYCYRRHIZA GLABRA (LICORICE) A MULTI-SYSTEM REGULATOR ⁷¹

Homoeopathic Approach for the Action of Phytochemicals of *Glycyrrhiza glabra*: The phytochemicals of *Glycyrrhiza glabra* gives the directions of action of the remedy and its homoeopathic preparation explains the dynamic influence on the vital force, resulting in regulation of inflammation and promotion of tissue healing ^{72, 73, 74, 75}. Phytochemicals are only direction of action of medicine, but cure in homoeopathy is the dynamic regulation of the vital force and not the chemical concentration of medicine ^{72, 76, 77}. According to Dr. Hahnemann as he mentioned in Organon of Medicine, disease is just a derangement

of vital force and cure occurs only when remedy stimulate that vital force, to react and self-heal. Phytochemicals are just material dose of medicine but homoeopathic dilutions are dynamic dose which boost vital force more vigorously ^{76, 77}.

Glycyrrhiza glabra as a homoeopathic medicine acts by calming hyper-reactive inflammation, supporting tissue regeneration, removing obstacles to cure (infection, oxidative damage), restoring harmony of the vital force, producing qualitative healing, not suppression.

TABLE 4: RESEARCH SHOWING GLYCYRRHIZA GLABRA HAVING DYNAMIC/ HOMOEOPATHIC PRINCIPLES

Sr. no.	Phytochemical	Material action	Dynamic action	Vital / Body reaction	Reference
1	Glycyrrhizin	Anti-inflammatory, cortisol-modulating	Regulates excessive reactive state of the vital force	Restores balance in inflammatory response; reduces exaggerated tissue reaction	72 Aphorism 11-16
2	18-β-Glycyrrhetic acid	Tissue protective, epithelial supportive	Stimulates reparative response of the organism	Enhances regenerative tendency; supports orderly tissue repair	72 Aphorism 26
3	Liquiritin (flavonoids)	Antioxidant, cytoprotective	Protects vitality from destructive oxidative stress	Preserves cellular integrity; sustains healing energy in chronic wounds	72 Aphorism 28-29
4	Isoliquiritigenin	Anti-inflammatory, antimicrobial	Removes obstacles to cure caused by persistent irritation	Facilitates transition from inflammatory to reparative state	72 Aphorism 186-193
5	Glabridin	Antimicrobial, skin-protective	Clears vitality-blocking pathogenic influence	Supports defense without suppressing natural reaction	72 Aphorism 9
6	Licoflavanone	NF-κB modulation	Harmonizes disordered immune signaling	Promotes regulation rather than suppression of inflammation	72 Aphorism 63-64
7	Saponins	Angiogenic, immune-modulatory	Activates formative forces of the vital principle	Encourages granulation, nourishment, and tissue rebuilding	72 Aphorism 247

8	Coumarins	Improves microcirculation	Enhances flow of vital energy	Improves tissue oxygenation and metabolic harmony	72 Aphorism 15
9	Phenolic compounds	Antioxidant, anti-microbial	Shields vital force from degenerative influences	Prevents progressive tissue breakdown	72 Aphorism 19-20
10	Polysaccharides	Immunomodulator	Strengthens adaptive capacity of vital force	Promotes stable, long-term healing and resistance	72 Aphorism 4

Future Prospects: The present study on *Glycyrrhiza glabra* establishes a scientific foundation for further advancement of evidence-based homoeopathic research in wound healing. Future investigations may extend this work through detailed molecular and immunological studies to elucidate the regulatory pathways involved in inflammation and tissue repair. Comparative evaluation of different homoeopathic potencies and long-term assessment of healing quality, including scar formation and tensile strength, could provide deeper therapeutic insights. The development of homoeopathic topical formulations and their evaluation in standardized animal and clinical models represents another important avenue for translational research. Furthermore, well-designed clinical trials in acute and chronic wounds may help validate experimental findings and facilitate integration into routine homoeopathic practice. Collectively, these future directions have the potential to strengthen the scientific credibility of homoeopathy and contribute meaningfully to integrative wound-care strategies.

CONCLUSION: The present study was undertaken to scientifically evaluate the anti-inflammatory and wound-healing potential of *Glycyrrhiza glabra* within a homoeopathic framework using validated experimental models. A critical review of literature established that although *Glycyrrhiza glabra* is well documented for its pharmacological anti-inflammatory, antioxidant, antimicrobial, and tissue-protective properties, systematic evaluation of its homoeopathic preparations in skin injury models has been notably lacking. The phytochemical analysis of the mother tincture confirmed the presence of bioactive constituents such as glycyrrhizin, glycyrrhetic acid, flavonoids, saponins, and phenolic compounds, which provide a rational direction of action for the remedy. Experimental findings from the study demonstrated that homoeopathic *Glycyrrhiza glabra*, including its mother tincture and selected potencies,

favorably influenced the wound-healing process by modulating inflammation, accelerating wound contraction, reducing epithelialization time, and improving histopathological features of tissue repair. The observed reduction in inflammatory infiltration and enhancement of organized collagen deposition indicate that the remedy supports physiological healing rather than suppressive action. These findings align with homoeopathic principles, wherein the medicinal action is understood as a dynamic regulation of the vital force, resulting in a coordinated and qualitative healing response of the living organism. This study provides experimental evidence supporting the role of homoeopathic *Glycyrrhiza glabra* as a potential therapeutic agent in inflammatory and wound-healing conditions. By integrating phytochemical understanding, biological outcomes, and homoeopathic philosophy, this research contributes meaningfully to the growing body of evidence-based homoeopathy and establishes a foundation for future experimental and clinical investigations in homoeopathic wound management.

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