



EXPLORING THE WISDOM OF NATURE HERBAL AGENTS FOR SKIN REPAIR AND PROTECTION

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Abstract : Ethnopharmacology, derived from the Greek words "ethno" (people, nation, tribe) and "pharmacology" (study of drugs), examines how human societies utilize natural resources such as plants, fungi, animals, and minerals for medicinal purposes. This field bridges traditional herbal knowledge with modern pharmacological science, aiming to integrate ancient wisdom with contemporary research methods. Ethnopharmacology seeks to document potential pharmaceuticals from these sources. It emphasises ethical use, fair rewards for communities, and integration with modern healthcare. Ethnopharmacology is the scientific study of traditional knowledge and the use of medicinal plants by various ethnic communities for the treatment of diseases. It bridges the gap between traditional medicine and modern pharmacological research, helping in the discovery of new and effective drugs. The present study focuses on documenting and understanding the ethnopharmacological importance of medicinal plants used by local communities. Data were collected through literature review and traditional healers' interviews to record plant names, parts used, methods of preparation, and therapeutic applications.

IndexTerms - Ethnopharmacology, phytochemicals, anti-aging herbs, herbal formulation, free radical-scavenging activity, radiation therapy.

I. INTRODUCTION

Ethnopharmacology is a highly diversified approach for drug discovery which involves the observation, description and experimental investigation of indigenous drugs and their biologic activities that is based on botany, chemistry, biochemistry, pharmacology, and other disciplines (anthropology, archaeology, history, and linguistics) contributing to the discovery of natural products with biologic activity. WHO defines -Traditional medicine is the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness. Traditional medicine covers a wide variety of therapies and practices which vary from country to country and region to region. In some countries, it is referred to as "alternative" or "complementary" medicine (CAM). In developed countries, 70% and 80% population have used CAM because they believe that this type of treatment is more "natural" and therefore "risk-free", or as an adjunct to treatment for a chronic, debilitating or incurable disease. India has a rich ancient heritage in traditional medicine. Indian Materia medica provides abundant information on ethnic folklore practices and traditional aspects of therapeutically important natural products.

II. LITERATURE REVIEW

1.Rajeev K. Singla et al.,(2019):-Explains how ethnopharmacology bridges traditional medicinal knowledge with modern scientific validation. after rigorous scientific validation, ethnopharmacology provides credible evidence supporting the therapeutic value of traditional remedies.

2.Aymen Owais et.al (2022):-Reported that neem possesses significant therapeutic properties, including anticancer, anti-inflammatory, and immunomodulatory activities, due to its rich phytochemical profile. Subsequent studies further demonstrated its ability to modulate key signaling pathways such as p53, NF-κB, and PI3K/Akt, contributing to antitumor effects

3.Giulia Pastorino et al.(2018):- highlighted the extensive pharmacological potential of Glycyrrhiza glabra, emphasizing its strong antioxidant and anti-inflammatory properties derived mainly from phenolic compounds and glycyrrhizin.

4. Neelu Gupta et al. (2002) :-provided one of the early comprehensive evaluations of Ocimum sanctum Linn., highlighting its therapeutic potential rooted in traditional medicine and noting its significant role in managing respiratory, gastrointestinal, and inflammatory disorders

5.Umer Hayat et al.(2015):- reported that Eucalyptus globulus possesses a rich phytochemical profile dominated by 1,8-cineole and various terpenes responsible for its broad therapeutic activities. Studies consistently highlight its strong antimicrobial, anti-inflammatory, antiviral, and antioxidant properties attributed to leaf and bud essential oils

6.Rakesh Kumar Joshi et al.(2017):- reported that *Ocimum sanctum* (Tulsi) contains bioactive compounds like eugenol and ursolic acid, contributing to its medicinal value. Studies highlight its pharmacological activities, including antioxidant, anti-inflammatory, antimicrobial, antidiabetic, and immunomodulatory effects.

III. RESEARCH METHODOLOGY

ALOE VERA:

Botanical name: *Aloe barbadensis miller*

Biological source: The biological source of aloe vera is the dried latex from the leaves of the plant, botanically known as *Aloe barbadensis miller*

Family: Asphodelaceae

Aloe vera is a herb with succulent leaves that are arranged in a rosette. The leaves are grey to green and sometimes have white spots on their surfaces. They have sharp, pinkish spines along their edges and are the source of the colourless gel found in many commercial and medicinal products. Aloe was used in ancient Greece, Rome, Babylonia, and China. Historically, it was used for skin conditions and was thought to prevent premature graying of hair and promote wound healing. Aloe is used topically (applied to the skin) and orally. Topical use of aloe is promoted for acne, psoriasis, lichen planus (a very itchy rash on the skin or in the mouth), oral submucous fibrosis (a disease that causes scars and tissue fibrosis and can involve a burning sensation in the mouth), burns, and skin damage from radiation therapy. Oral use of aloe is promoted for weight loss, diabetes, and inflammatory bowel disease (a group of conditions caused by gut inflammation that includes Crohn's disease and ulcerative colitis).

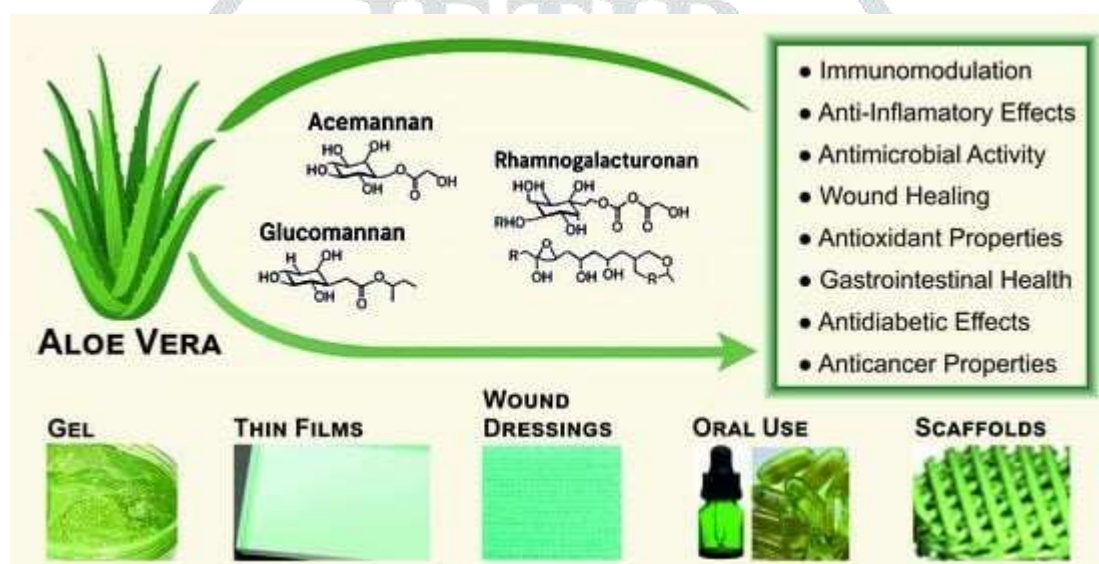


Fig 1: Aloe vera

Mechanism of Action: Aloe vera's mechanism of action is based on its bioactive compounds, which have anti-inflammatory (by inhibiting COX and reducing prostaglandins), antioxidant (scavenging free radicals), and wound-healing properties (stimulating fibroblast proliferation and collagen synthesis). Its effects on the skin include moisturization by binding moisture and an anti-aging effect by increasing skin elasticity. Other mechanisms include immunomodulatory effects, antimicrobial activity, and laxative properties from anthraquinones in the plant's latex. Anti-inflammatory and antioxidant effects Anti-inflammatory: Aloe vera contains compounds like salicylic acid and anthraquinones that inhibit the cyclooxygenase (COX) pathway, reducing the production of inflammatory mediators like prostaglandin (E_2) . Antioxidant: Polysaccharides and other components of aloe vera have free radical-scavenging activity and protect against oxidative stress. Wound healing and skin benefits Stimulates collagen: Glucomannan and gibberellin stimulate fibroblasts to produce more collagen and elastin, which increases skin strength and promotes the migration of leukocytes and fibroblasts, which are crucial for the early stages of wound healing. Moisturisers Mucopolysaccharides bind moisture to the skin, while amino acids and zinc work to soften and tighten the skin, respectively. Aloe vera exhibits several important pharmacological actions due to bioactive compounds such as polysaccharides (acemannan), vitamins, minerals, enzymes, and anthraquinones. The key pharmacological actions are anti-inflammatory, antimicrobial, wound-healing, antioxidant, immunomodulatory, antidiabetic, and gastroprotective. Aloe vera contains bradykinin, salicylic acid, and chromones, which help reduce inflammation, swelling, and redness by inhibiting inflammatory mediators. Some of the advantages of aloe vera in facial skincare for hair include reducing dandruff and promoting hair growth.

TURMERIC:

Botanical name: *Curcuma longa*

Biological source: The biological source of turmeric is the dried rhizome of the *Curcuma longa* plant

Family: Zingiberaceae.

Turmeric, a plant in the ginger family, is grown commercially in Southeast Asia and India. Its rhizome (underground stem) has been used for culinary and cosmetic purposes, among others. Curcumin, a major component of turmeric, gives the spice its yellow color. The health activities of turmeric are commonly attributed to curcuminoids, which include curcumin.

Mechanism of action: Primarily driven by its active compound curcumin, which exhibits strong anti-inflammatory, antioxidant, and antimicrobial activities. Curcumin inhibits key inflammatory pathways such as NF- κ B, COX-2, and LOX, reducing the production of inflammatory cytokines. Its antioxidant action comes from scavenging harmful free radicals and boosting the activity of endogenous antioxidant enzymes like glutathione peroxidase and superoxide dismutase, which help protect cells from oxidative damage. Additionally, curcumin modulates various signaling pathways involved in apoptosis, cell proliferation, and immune responses, contributing to its anticancer, wound-healing, and protective effects in various tissues.

Pharmacological actions: Curcumin shows multiple pharmacological activities, mainly due to its anti-inflammatory and antioxidant properties. It inhibits COX-2, LOX, and NF- κ B pathways, reducing inflammation and tissue damage. As a strong antioxidant, it scavenges free radicals and enhances protective enzymes like SOD and catalase. Curcumin also exhibits anticancer, antimicrobial, hepatoprotective, cardioprotective, antidiabetic, and neuroprotective effects by regulating various cellular signaling pathways and reducing oxidative stress.

Turmeric is a commonly used spice in Indian and Middle Eastern cooking and has been used for centuries for both culinary and medicinal purposes. It is widely used in cooking, spice blends, and as a natural food coloring. Medicinally, turmeric contains curcumin, which has anti-inflammatory and antioxidant properties and helps in digestion. It is also known for its gastroprotective action, as it protects the stomach lining and helps prevent ulcers. Additionally, turmeric is used for joint pain relief, skin care, cold and flu remedies, and in cosmetics and natural dyes.

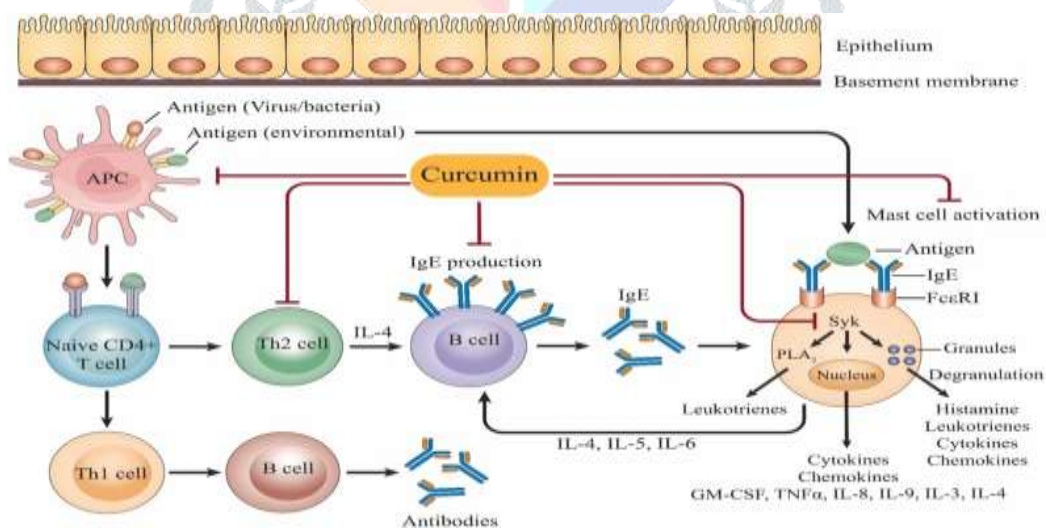


Fig 2: Turmeric

NEEM:

Botanical name: *Azadirachta indica*

Biological source: Neem is obtained from the plant *Azadirachta indica* A. Juss., commonly known as Neem or Indian Lilac.

Family: Meliaceae

Azadirachta indica, commonly known as neem, is a fast-growing evergreen tree from the mahogany family native to the Indian subcontinent, valued for its medicinal properties, use in organic pesticides, and timber. It is a tall tree with a rounded crown, thick furrowed bark, and compound leaves with toothed leaflets. Its small, fragrant white flowers bloom twice a year, followed by smooth, yellow-green fruits called nimboli. Neem (*Azadirachta indica*) is a tall evergreen tree reaching 15–30 m in height, with a rounded crown, thick furrowed bark, compound toothed leaves, small fragrant white flowers borne in clusters, and smooth yellow-green drupe fruits with sweet pulp. Neem (*Azadirachta indica*) acts through bioactive

compounds such as azadirachtin, nimbidin, and quercetin, producing antimicrobial, anti-inflammatory, antioxidant, and immunomodulatory effects. It inhibits the growth of bacteria and fungi, reduces inflammation by blocking COX and LOX pathways, neutralizes free radicals, and enhances immune responses, thereby promoting tissue protection, wound healing, and overall therapeutic benefits.

Pharmacological actions: Neem exhibits antimicrobial, anti-inflammatory, antioxidant, anticancer, and immunomodulatory activities, supporting its traditional and therapeutic uses. Almost all parts of the neem tree are used for medicinal and cosmetic purposes due to their antibacterial and antifungal properties. Neem is commonly found in shampoos for dandruff, soaps and creams for skin disorders, and in toothpastes and mouthwashes, while neem twigs are used as natural toothbrushes. Neem leaves are traditionally used to help manage diabetes, though neem oil, bark, and leaves should be avoided during pregnancy as they may cause miscarriage.



Fig 3: Neem

CALENDULA:

Botanical name: *Calendula officinalis*

Biological source: calendula is the flower of the plant *Calendula officinalis*.

Family: Asteraceae

Physical Description: An annual or short-lived perennial herbaceous plant, typically growing 30-60 cm tall, with simple, alternate leaves and bright yellow or orange daisy-like flower heads. *Calendula officinalis* is an annual herb in the daisy family (Asteraceae) originating from southern Europe and the Eastern Mediterranean area. It has long been cultivated and is a widespread garden escapee in cool, temperate climates. It has been used for many centuries for a range of culinary and medicinal purposes



Fig 4: calendula

Mechanism of action:

Calendula's mechanism of action primarily involves anti-inflammatory, wound healing, and antioxidant properties. It works by inhibiting pro-inflammatory cytokines and enzymes like COX-2, promoting blood flow to aid tissue repair, and scavenging free radicals. Its effects are due to bioactive compounds like flavonoids, triterpenoids, and carotenoids.

Anti-inflammatory effects

Inhibits inflammatory markers: Calendula extracts reduce the production of pro-inflammatory cytokines such as IL-1 β , IL-6, TNF- α , and IFN- γ .

Reduces enzyme activity: It may inhibit cyclooxygenase-2 (COX-2), which decreases the synthesis of prostaglandins, compounds that contribute to inflammation.

Suppresses oxidative stress: It reduces the production of reactive oxygen species (ROS) and nitric oxide (NO), further decreasing inflammation.

Wound healing and tissue regeneration

Increases blood flow: It enhances blood flow to the wound area, delivering necessary oxygen and nutrients for tissue repair.

Promotes cell growth: It stimulates the formation of granulation tissue and increases collagen production, which are crucial for wound closure and strength.

Protects collagen: Extracts can inhibit collagenase activity, helping to preserve collagen for new tissue formation.

Antioxidant activity

Scavenges free radicals: Calendula contains a high concentration of antioxidants that combat harmful reactive oxygen species (ROS) generated during injury and inflammation. Protects against oxidative damage: Its antioxidant properties help protect against cellular damage in various tissues.

Pharmacological actions: Calendula exhibits anti-inflammatory, antimicrobial, wound-healing, antioxidant, and antiviral activities, helping reduce inflammation, prevent infections, promote tissue repair, and protect the skin from oxidative damage. Due to these properties, calendula is widely used in wound care, treatment of skin conditions such as eczema, acne, and dermatitis, and in skincare and cosmetic products to soothe and heal irritated skin.

TEA TREE:

Botanical name: *Melaleuca alternifolia*

Biological source: Tea Tree oil is obtained from the leaves and terminal branches of *Melaleuca alternifolia* (Maiden & Betche) Cheel.

Family; Myrtaceae

Tea tree (*Melaleuca alternifolia*) is a plant native to Australia. Its essential oil is extracted from the leaves and has been used for centuries in traditional medicine. Tea tree oil is known for its antimicrobial, antifungal, and anti-inflammatory properties, making it a popular ingredient in skincare products, natural remedies, and aromatherapy. It's often used to treat acne, wounds, and skin infections, as well as to promote overall skin health.



Fig 5: Tea tree

Mechanism of action:

Tea tree oil works by disrupting the cell membranes of bacteria and fungi, exhibiting antimicrobial activity, while also reducing inflammation and neutralizing free radicals through its antioxidant properties.

Pharmacological actions:

Tea tree oil is a natural essential oil widely valued for its therapeutic properties, especially in skin care. It exhibits strong antimicrobial activity, helping to control the growth of bacteria responsible for acne and other skin infections. Its anti-inflammatory effect reduces redness, swelling, and irritation, while its antifungal property makes it useful in managing conditions such as athlete's foot, ringworm, and nail infections. Tea tree oil also shows antiviral potential against certain viruses and contains antioxidant

compounds that protect the skin from oxidative damage. Because of these actions, it is commonly used in acne treatment, wound care, relief of minor skin irritations, and in antiseptic and aromatherapy applications. For safe use on the skin, it should always be diluted with a suitable carrier oil.

LAVENDER:

Botanical name: *Lavandula officinalis*

Biological source: Lavender consists of the dried flowers and essential oil obtained from the plant *Lavandula angustifolia*.

Family: Lamiaceae

Lavender is an aromatic flowering plant from the mint family, *Lavandula* genus, native to the Mediterranean region. Valued for its fragrant purple flowers and essential oils, it is widely used in perfumes, cosmetics, aromatherapy, and traditional medicine. Lavender also serves as a popular ornamental garden plant known for its silvery-green leaves and ability to attract pollinators.



Fig 6: lavender

Mechanism of action:

Lavender's mechanism of action is largely attributed to its essential oil components, especially linalool and linalyl acetate, which exert calming, anti-inflammatory, analgesic, and antimicrobial effects. These compounds interact with the GABAergic system in the brain, enhancing inhibitory neurotransmission and producing anxiolytic and sedative effects. Lavender also reduces inflammation by inhibiting pro-inflammatory mediators and helps relieve pain through modulation of nociceptor activity. Additionally, its antimicrobial properties act against various bacteria and fungi, supporting wound healing and skin protection. Through these combined pathways, lavender promotes relaxation, reduces stress and pain, and supports overall skin and nervous system health.

Pharmacological actions:

Lavender is well known for its calming and mood-enhancing effects, mainly due to its action on the nervous system. It produces anxiolytic, sedative, and antidepressant effects by influencing neurotransmitter pathways, particularly through modulation of GABA receptors and serotonin transport mechanisms. The essential oil components, especially linalool and linalyl acetate, are responsible for these effects and also contribute to its anti-inflammatory, antioxidant, and antimicrobial properties. Lavender helps reduce stress, anxiety, and sleep disturbances and is widely used in aromatherapy to promote relaxation and mental well-being. In medicinal use, it acts as a mild sedative, provides relief from headaches and migraines, and helps reduce pain and inflammation. Additionally, its antimicrobial and soothing properties make it valuable in skincare for treating acne, minor burns, insect bites, and small wounds.

SANDALWOOD:

Botanical name: *Santalum album* L.

Biological source: Sandalwood consists of the heartwood of the tree *Santalum album*, belonging to the family Santalaceae.

Family: Santalaceae.

Sandalwood, scientifically known as *Santalum album*, is a small, fragrant, evergreen tree highly valued for its aromatic heartwood and essential oil used in perfumery, religious ceremonies, and traditional medicine. It is a slow-growing tree that is native to tropical regions of India, Indonesia, and Australia. Its unique ability to retain fragrance for a long time has made it one of the most expensive woods in the world, leading to over-harvesting and endangerment of some species.



Fig 7: Sandalwood

Mechanism of action:

Sandalwood's mechanism of action is primarily attributed to its main components, α -santalol and β -santalol, which have sedative, anti-inflammatory, and antimicrobial effects. The santalols have a direct neuroleptic effect on the central nervous system, which reduces anxiety and promotes sleep. For skin benefits, they work by modulating inflammation and disrupting bacterial cell walls, while other components also provide antioxidant and astringent properties.

Pharmacological actions:

Sandalwood is valued for its broad range of therapeutic properties and has been used in traditional medicine for centuries. It exhibits strong antioxidant and anti-inflammatory activities, helping protect tissues from oxidative stress and reducing inflammation in various conditions. Sandalwood also shows antimicrobial effects against bacteria, fungi, and some viruses, making it useful in managing acne, skin infections, and minor wounds. Emerging studies suggest it may possess anticancer potential by interfering with abnormal cell growth and promoting programmed cell death. In addition, sandalwood has a mild sedative effect that helps ease anxiety, stress, and sleep disturbances. Because of its cooling, soothing, and antiseptic nature, it is widely used in dermatological and cosmetic preparations to improve skin texture, reduce pigmentation, and relieve irritation. Its pleasant, calming aroma has also made sandalwood oil an important component of aromatherapy, perfumery, and various household and industrial products.

MANJISTHA:

Botanical name: *Rubia cordifolia* Linn.

Biological Source:

Manjistha consists of the dried roots and stolons of *Rubia cordifolia*.

Family: Rubiaceae.

Manjistha, also known as Indian madder, is a climbing plant with the scientific name *Rubia cordifolia*. Revered in Ayurveda, its red roots are used for medicinal purposes, particularly as a blood purifier and detoxifier, and it is also known for its use as a natural dye. It is used to address various skin conditions, support liver function, and balance certain bodily energies (doshas).

Mechanism of action:

Manjistha works by inhibiting the enzyme tyrosinase to reduce melanin production, which is key for its skin-whitening effects. It also has anti-inflammatory and antioxidant properties that protect skin from damage and reduce inflammation. Other mechanisms include its antibacterial, anti-diarrheal, and blood-purifying actions, which come from compounds like anthraquinones and flavonoids.



Fig 8: Manjistha

Pharmacological actions:

Manjistha (*Rubia cordifolia*) is an important medicinal herb known for its detoxifying and healing properties. It exhibits strong anti-inflammatory, antioxidant, and antimicrobial activities, which help reduce inflammation, protect cells from oxidative damage, and control the growth of acne-causing and other harmful microorganisms. Traditionally regarded as a blood purifier, Manjistha supports healthy circulation and lymphatic function while aiding in the removal of toxins from the body. It also shows hepatoprotective effects, making it useful in liver disorders such as jaundice. The herb promotes wound healing by enhancing collagen formation and protecting tissues from infection. In addition, Manjistha contributes to immune support, helps regulate blood sugar levels, and may assist in hormonal balance and menstrual discomfort. Owing to these combined actions, it is widely used for skin disorders, inflammatory conditions, metabolic imbalances, and overall systemic health.

LICORICE:

Botanical name: Glycyrrhiza glabra

Biological Source:

Licorice consists of the dried roots and stolons of *Glycyrrhiza glabra*.

Family: Fabaceae (Leguminosae).

Licorice is the common name for the perennial herb *Glycyrrhiza glabra*, prized for its sweet roots used in food flavoring, traditional medicine, and other products. Its botanical name comes from the Greek words for "sweet root" because its main active compound, glycyrrhizin, is many times sweeter than sugar. Licorice has a long history of use across many cultures, dating back to ancient civilizations in Mesopotamia, Greece, and Egypt.



Fig 9: Licorice

Mechanism of action:

Liquorice exerts its mechanism of action mainly through its key bioactive compound glycyrrhizin, along with flavonoids such as liquiritin and glabridin. Glycyrrhizin is metabolized into glycyrrhetic acid, which inhibits the enzyme 11β -hydroxysteroid dehydrogenase, allowing cortisol to exert prolonged anti-inflammatory effects. This contributes to liquorice's strong anti-inflammatory and anti-ulcer properties. Its flavonoids provide potent antioxidant action by scavenging free radicals and protecting tissues from oxidative stress. Liquorice also shows antimicrobial activity against various bacteria and viruses and supports skin healing by reducing irritation and promoting hydration. Together, these mechanisms make liquorice effective in soothing inflammation, protecting mucous membranes, and enhancing skin and respiratory health.

Pharmacological actions:

Licorice (*Glycyrrhiza glabra*) is a widely used medicinal plant with diverse pharmacological activities mainly attributed to its bioactive constituents, glycyrrhizin and glycyrrhetic acid. It exhibits strong anti-inflammatory, antioxidant, antiviral, and antimicrobial effects, helping to protect tissues from inflammation and oxidative damage while inhibiting the growth of harmful microorganisms. Licorice is well known for its gastrointestinal benefits, as it enhances protective mucus secretion in the stomach, supports ulcer healing, and soothes sore throats by acting as a mild expectorant. It also shows hepatoprotective activity, making it useful in supporting liver health. Emerging evidence suggests that licorice may aid in regulating blood glucose levels and possesses anticancer potential by suppressing abnormal cell growth and inducing programmed cell death. Beyond its medicinal value, licorice is commonly used as a natural flavoring agent in foods, beverages, pharmaceuticals, and cosmetics, where it is valued for its soothing, antioxidant, and skin-brightening properties.

ROSEMARY:

Botanical name: *Salvia rosmarinus*, although it was formerly known as *Rosmarinus officinalis*.

Biological Source: Leaves of the *Salvia rosmarinus* plant.

Family: Lamiaceae

Rosemary scientific name is *Rosmarinus Officinallis*, it has long been regarded as the herb for remembrance. Mystically, it symbolizes loyalty, love, and immortality, and it was once believed to strengthen the heart as well as memory. The Greeks and Romans prepared fragrant distilled water from the flowers and inhaled the odor so that the evils were destroyed from the mind and the memory no longer played tricks. In ancient Greece, students prepare for examinations with threaded sprigs of rosemary in their locks to induce clear thinking and a good memory.

It is a sweet-scented evergreen shrub that grows up to two meters high, its leaves are narrow and resemble curved pine needles, and the small pale blue flowers grow in little clusters on the stems. It belongs to the mint family. It is an evergreen aromatic shrub. Dried leaves of rosemary are used for commercial purposes. The dried herb is brownish-green in color, and the leaves have a tea-like fragrance. Crushed rosemary has a spicy camphoraceous aroma and a pungent, bitter taste.

Mechanism of action:

Rosemary's mechanism of action is multifaceted, involving antioxidant, anti-inflammatory, antimicrobial, and neuroactive effects. Its main active compounds, such as carnosic acid, carnosol, and rosmarinic acid, work by scavenging free radicals, inhibiting inflammation-related pathways like NF- κ B, disrupting microbial cell membranes, and modulating neurotransmitter levels in the brain by inhibiting cholinesterase enzymes. Antioxidant activity Directly neutralizes free radicals: Compounds like carnosic acid act as a chemical quencher for reactive oxygen species (ROS). Carnosol can prevent the oxidation of lipids in cell membranes through a mechanism that doesn't rely on scavenging ROS. Anti-inflammatory and cellular signaling Modulates inflammatory pathways: Rosemary diterpenes inhibit key inflammatory pathways such as NF- κ B and MAPK, which reduces the production of pro-inflammatory cytokines. Reduces inflammatory mediators: It can decrease the production of substances like leukotriene (B_4) and inhibit the complement system. Neuroactive effects Inhibits cholinesterase enzymes: Compounds in rosemary can inhibit cholinesterase enzymes, which increases acetylcholine levels in the brain. This is similar to how some Alzheimer's drugs work and contributes to anxiolytic and antidepressant-like effects. Affects neurotransmitter systems: It interacts with noradrenergic, dopaminergic, and serotonergic systems, which are critical for mood regulation.



Fig 10: Rosemary

Pharmacological actions:

Rosemary is a medicinal herb known for its wide range of therapeutic actions and long history of traditional use. It possesses strong antioxidant and anti-inflammatory properties due to compounds such as rosmarinic acid and carnosol, which help reduce oxidative stress and suppress inflammatory mediators. Rosemary also shows antimicrobial activity against several bacteria and fungi, supporting its use in skin and wound care. Its neuroprotective effects contribute to improved cognitive function, as inhalation of rosemary essential oil has been associated with enhanced concentration, memory, and reduced mental fatigue. Additionally, rosemary acts as a mild analgesic and vasodilator, which helps relieve muscle pain and supports hair growth by improving blood circulation to the scalp. It is also used to aid digestion, promote wound healing, and support overall vitality, making it a valuable herb in both traditional and modern herbal medicine.

TULSI:

Botanical name: *Ocimum tenuiflorum* L. (syn. *Ocimum sanctum* L.)

Biological Source: The plant is an aromatic, branched shrub, and the whole plant, including the leaves, seeds, and roots, is used for its medicinal properties.

Family: Lamiaceae.

Tulsi, or Holy Basil, is an aromatic plant with a deep spiritual and medicinal significance in India, belonging to the mint family. It is revered in Hindu culture, frequently grown in homes and temples, and is known for its antimicrobial properties that help purify the air and are used in traditional Ayurvedic medicine to treat ailments like fevers, coughs, and digestive issues. The plant has various chemical constituents, such as eugenol, and parts like the leaves, seeds, and roots are used for various medicinal purposes.



Fig 11: Tulsi

Mechanism of action:

Tulsi's mechanism of action is multifaceted, driven by its rich compounds like eugenol, ursolic acid, and flavonoids, which provide antioxidant, anti-inflammatory, and adaptogenic effects. It works by neutralizing free radicals, reducing inflammation through mechanisms like inhibiting pro-inflammatory cytokines and COX enzymes, and protecting against oxidative and metabolic stress. Additionally, it may enhance detoxification, modulate stress hormones like cortisol, and induce apoptosis in cancer cells.

Pharmacological actions:

Tulsi (*Ocimum sanctum*) is a highly valued medicinal herb known for its broad spectrum of pharmacological activities. It possesses strong anti-inflammatory, antioxidant, and immunomodulatory effects due to bioactive compounds such as eugenol, ursolic acid, rosmarinic acid, and carvacrol, which help reduce oxidative stress, suppress inflammatory mediators, and strengthen both innate and adaptive immune responses. Tulsi also exhibits antimicrobial activity against bacteria, fungi, and viruses, making it useful in the prevention of infections. Its adaptogenic nature helps the body manage physical and mental stress, while antidiabetic and cardioprotective actions support blood glucose control, cholesterol balance, and healthy blood pressure. In addition, Tulsi shows hepatoprotective, analgesic, and anti-ulcer properties. Traditionally, it is widely used to improve respiratory health, enhance digestion, promote skin health, and support overall immunity, highlighting its importance in both traditional and modern healthcare systems.

HIBISCUS:

Botanical name: Hibiscus rosa-sinensis

Biological source: The plant is from the Malvaceae family, which includes several hundred species of flowering plants.

Family: Malvaceae

Hibiscus is a genus of flowering plants in the Malvaceae family, known for their large, showy, trumpet-shaped flowers. With over 300 species, they are found in tropical, subtropical, and warm temperate climates and are used ornamentally, culinarily, and medicinally. The flowers come in various colors, and the plants can be herbs, shrubs, or trees.



Fig 12: Hibiscus

Mechanism of action:

Hibiscus exerts its mechanism of action through a rich blend of bioactive compounds, mainly anthocyanins, flavonoids, organic acids (such as hibiscus acid and citric acid), and vitamin C. Its antioxidant activity comes from anthocyanins, which neutralize free radicals and protect cells from oxidative stress. Hibiscus also shows strong anti-inflammatory effects by inhibiting pro-inflammatory mediators and enzymes, helping reduce tissue damage and swelling. The organic acids contribute to antimicrobial and astringent actions, promoting skin tightening and reducing bacterial growth. Additionally, hibiscus enhances wound healing and supports skin regeneration by boosting collagen production and improving cell turnover. Collectively, these mechanisms make hibiscus beneficial for skin protection, cardiovascular support, and overall antioxidant defense.

Pharmacological actions:

Hibiscus is a medicinal plant valued for its powerful antioxidant, anti-inflammatory, and cardioprotective properties. It contains high levels of anthocyanins, flavonoids, and organic acids that help neutralize free radicals, reduce oxidative stress, and protect body tissues from damage. These bioactive compounds also support cardiovascular health by improving lipid profiles, lowering LDL cholesterol, and promoting relaxation of blood vessels, which aids in the regulation of blood pressure. Hibiscus additionally exhibits diuretic, hepatoprotective, antimicrobial, and antidiabetic activities, helping support kidney and liver function while assisting in blood glucose control through improved insulin sensitivity. Owing to its digestive, anti-obesity, and skin-supportive effects, hibiscus is widely used in herbal therapy, skincare preparations, and functional foods. It is also popular in teas and culinary products, as well as in traditional remedies for heart health, metabolic balance, and skin nourishment.

SAFFRON:

Botanical Name: *Crocus sativus* L.

Biological Source: The dried stigmas (female reproductive part) and styles of the *Crocus sativus* flower.

Family: Iridaceae (Iris family).

Saffron is the world's most expensive spice, derived from the dried red stigmas of the *Crocus sativus* flower, prized for its intense color, distinct flavor, and aroma in culinary, medicinal, and dyeing uses, obtained through delicate hand-harvesting from a plant native to Southwest Asia.



Fig 13: Saffron

Mechanism of action:

Saffron's mechanism of action involves its potent antioxidants (crocin, crocetin, safranal) neutralizing free radicals and reducing oxidative stress, alongside anti-inflammatory effects by inhibiting pathways like NF- κ B and COX enzymes, while also modulating neurotransmitters (serotonin, dopamine) and protecting neurons from apoptosis (programmed cell death), making it beneficial for mood, neurodegeneration, and various systemic disorders. Antioxidant Activity (Crocin, Crocetin): Scavenges Reactive Oxygen Species (ROS), increases antioxidant enzymes (SOD, CAT, GPx), and reduces lipid peroxidation, protecting cells from damage. Anti-inflammatory Effects (Crocin, Safranal): Inhibits pro-inflammatory pathways (like NF- κ B) and enzymes (COX-1/COX-2), reducing cytokine production and inflammation. Neurotransmitter Modulation (Safranal, Crocin): Influences serotonin, dopamine, and glutamate systems, helping to balance brain chemistry, crucial for mood regulation. Neuroprotection & Anti-apoptosis (Crocin): Activates pathways like BDNF/TrkB, reduces c-Fos expression, and inhibits neuronal cell death. Enzyme Inhibition: Inhibits Acetylcholinesterase (AChE) (relevant for Alzheimer's) and pancreatic lipase (relevant for obesity).

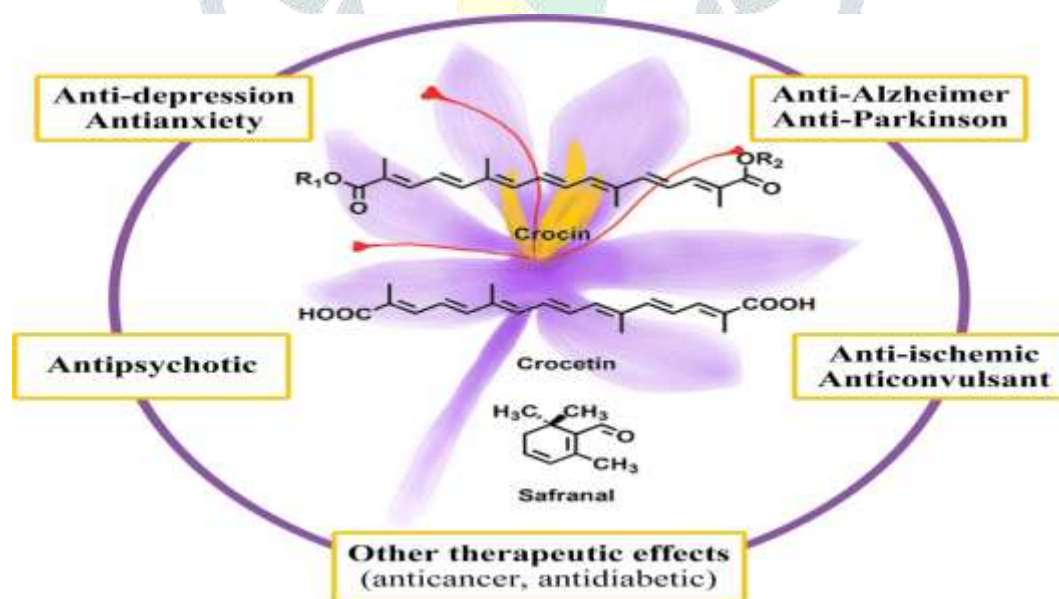


Fig 14: saffron

Pharmacological actions:

Saffron (*Crocus sativus*) is a highly valued medicinal spice known for its wide spectrum of pharmacological activities, mainly attributed to its bioactive compounds such as crocin, safranal, and picrocrocin. It exhibits strong antioxidant and anti-inflammatory effects by neutralizing free radicals and modulating inflammatory pathways, thereby protecting tissues from oxidative damage. Saffron is especially recognized for its antidepressant and mood-enhancing properties, as it helps increase serotonin levels in the brain and improve symptoms of mild to moderate depression and premenstrual discomfort. Its

neuroprotective action supports cognitive function, memory, and learning, and shows promise in neurodegenerative conditions. Additionally, saffron promotes cardiovascular health by improving lipid profiles, lowering blood pressure, and reducing atherosclerotic risk, while also aiding in blood sugar regulation through improved insulin sensitivity. Owing to its anticancer, vision-protective, digestive, and skin-enhancing effects, saffron is widely used in traditional and modern medicine for overall physical and mental well-being.

AMLA:

Botanical Name: *Phyllanthus emblica*

Biological Source: The dried or fresh fruits of the *Phyllanthus emblica* tree.

Family: Phyllanthaceae (or Euphorbiaceae).

Amla, or Indian Gooseberry (*Phyllanthus emblica*), is a highly nutritious, tangy fruit central to Ayurvedic medicine, prized for its immense Vitamin C content (20x oranges!) and antioxidants, used for centuries in remedies, tonics (like Chyawanprash), juices, and culinary dishes for rejuvenation, immunity, hair health, and digestive support, considered a divine "nectar fruit" for overall vitality.



Fig 15: Amla

Mechanism of action:

Amla exerts its effects mainly through its rich antioxidant content, especially vitamin C, polyphenols, tannins, and flavonoids, which neutralize free radicals and reduce oxidative stress in tissues. It also shows anti-inflammatory action by inhibiting pro-inflammatory mediators like TNF- α , IL-6, and NF- κ B pathways. Amla enhances immune function by boosting macrophage activity and supporting antibody production. Its hypolipidemic and hypoglycemic effects are attributed to improved insulin sensitivity, decreased lipid peroxidation, and modulation of glucose-metabolizing enzymes. Additionally, amla protects the liver by stabilizing cell membranes and enhancing detoxifying enzymes, contributing to its overall rejuvenating and protective pharmacological actions.

Pharmacological actions:

This medicinal plant is valued for its wide range of health-promoting effects, largely due to its high content of vitamin C, tannins, and other bioactive compounds. It exhibits strong antioxidant and anti-inflammatory activity, helping to reduce oxidative stress and protect tissues from damage. The plant also shows anticancer and chemopreventive potential through its anti-mutagenic properties. It supports cardiovascular health by improving lipid balance and lowering cholesterol, while its gastroprotective action helps safeguard the stomach lining and relieve acidity and ulcers. Neuroprotective effects contribute to better brain function and memory, and its immunomodulatory nature strengthens the body's defense mechanisms. Additionally, it protects liver function, aids detoxification, and helps regulate blood sugar levels. Widely used as a rejuvenative and anti-aging agent, it promotes digestion, enhances skin and hair health, supports vitality in conditions like anemia and weakness, and contributes to overall wellness.

ARNICA:

Botanical Name: Arnica montana L.

Biological Source: The primary biological sources of arnica for medicinal and commercial use are specific parts of the Arnica montana plant.

Family: Asteraceae (also known as the daisy or composite family)

Arnica is a genus of flowering plants in the sunflower (Asteraceae) family, most notably the species Arnica montana. It is widely used in topical creams and gels in traditional and homeopathic medicine for its purported anti-inflammatory and pain-relieving effects on bruises, sprains, and muscle aches.

Mechanism of action:

Arnica acts mainly through anti-inflammatory, antioxidant, and tissue-repair mechanisms due to sesquiterpene lactones like helenalin. It inhibits NF- κ B and reduces pro-inflammatory cytokines, while flavonoids reduce oxidative stress. Arnica also promotes healing by stimulating collagen and fibronectin formation, supporting angiogenesis, and limiting tissue breakdown, thereby reducing swelling and bruising.

Pharmacological actions:

Arnica exhibits strong anti-inflammatory, analgesic, and anti-bruising actions, helping reduce pain, swelling, and discoloration while supporting tissue healing. It is commonly used externally in creams or gels for bruises, sprains, muscle pain, joint stiffness, and post-exercise or minor injury recovery, and is not recommended for internal use.



Fig 16: Arnica

EUCALYPTUS:

Botanical name: Eucalyptus globulus.

Biological Source: Eucalyptus oil is obtained from the fresh leaves and tender branch tips of Eucalyptus globulus Labill., belonging to the family Myrtaceae.

Family: Myrtaceae.

Eucalyptus, commonly called gum trees, are fast-growing, evergreen trees/shrubs from the myrtle family (Myrtaceae), predominantly native to Australia, known for their distinctive aromatic foliage and adaptability, widely cultivated globally for timber, pulp, essential oils (like for fresh scents in soaps/perfumes), and fuelwood, with species varying greatly in size and form, from small shrubs to the world's tallest flowering plants.

Mechanism of action:

Eucalyptus acts mainly through anti-inflammatory, antimicrobial, and respiratory-relief mechanisms. It inhibits inflammatory pathways (NF- κ B, MAPK) and reduces cytokines like TNF- α and IL-6. It shows antibacterial and antiviral activity by blocking pathogen entry and growth. Eucalyptus also provides decongestant effects by acting on nasal receptors, enhances antioxidant protection by neutralizing free radicals, and supports metabolic balance by improving glucose uptake and insulin response. Overall, it modulates immunity, clears pathogens, and relieves respiratory symptoms.



Fig 17: Eucalyptus

Pharmacological actions:

Eucalyptus exhibits anti-inflammatory, antimicrobial, analgesic, antioxidant, and respiratory-supporting activities mainly due to 1,8-cineole. It helps relieve pain, reduce infections, ease cough and congestion, and protect against oxidative damage. Eucalyptus oil is commonly used for muscle and joint pain, minor wounds, mouthwashes, aromatherapy, insect repellents, and supportive herbal formulations.

FLAXSEED:

Botanical Name: *Linum usitatissimum*

Common Names: Flax, linseed, or Alsi (in Hindi)

Biological Source: Flaxseed is obtained from the ripe, dried seeds of *Linum usitatissimum*, belonging to the family Linaceae.

Family: Linaceae

Flaxseed, from the ancient *Linum usitatissimum* plant, is a tiny, nutrient-dense seed packed with omega-3s (ALA), fiber, protein, and lignans, making it a "superfood" known for improving digestion, heart health, and potentially reducing risks of certain cancers and diabetes. Available whole, ground, or as oil, grinding is best for nutrient absorption, and it's versatile in smoothies, cereals, baked goods, or as a vegan egg substitute, adding a mild, nutty flavor.

Mechanism of action:

Flaxseed's mechanism of action is due to its key components—ALA (omega-3), lignans, fiber, and bioactive peptides—which work together to provide anti-inflammatory, antioxidant, lipid-lowering, and metabolic benefits. ALA reduces inflammation and supports heart health. Lignans act as antioxidants and mild phytoestrogens, helping with hormonal balance and cancer protection. Dietary fiber improves digestion, controls blood sugar, and lowers LDL cholesterol. Peptides show ACE-inhibitory effects, helping reduce blood pressure. Overall, flaxseed supports cardiovascular health, metabolic regulation, gut health, and chronic disease prevention.



Fig 18: flaxseed

Pharmacological actions:

Flaxseed exerts its pharmacological actions mainly due to omega-3 fatty acids (ALA), dietary fiber, and lignans, providing cardioprotective, anti-inflammatory, antioxidant, anti-diabetic, and anticancer benefits. It helps lower LDL cholesterol, improves blood sugar control, supports digestion, hormonal balance, skin health, and overall well-being. Flaxseed is widely used as a nutritional supplement and functional food in products such as bakery items, cereals, and smoothies for chronic disease prevention and health promotion.

IV. CONCLUSION

V. Ethnopharmacology reveals the strong link between traditional knowledge and modern science in understanding medicinal plants used for skin health. Herbal systems such as Ayurveda, Siddha, Unani, and tribal medicine have long relied on plants like aloe vera, turmeric, neem, calendula, tulsi, hibiscus, ginseng, and saffron for their protective and healing effects on the skin. These plants contain bioactive compounds that provide anti-inflammatory, antimicrobial, antioxidant, wound-healing, and anti-aging properties, making them effective for treating common skin disorders. This study emphasizes the importance of ethnopharmacology in preserving traditional wisdom while supporting modern drug and cosmetic development. Scientific validation, sustainable use, and conservation of medicinal plants are essential as global demand for natural skincare increases. Overall, ethnopharmacology plays a vital role in integrating traditional heritage with modern research to promote safe, effective, and sustainable skin healthcare.

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