



THERAPEUTIC POTENTIAL OF MANGIFERA INDICA IN DERMATOLOGICAL DISORDERS: A COMPREHENSIVE REVIEW

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ABSTRACT

Herbal medicines have gained significant attention due to their multi-target therapeutic potential, improved safety profile, and widespread use in the management of dermatological disorders. The present review aims to comprehensively evaluate the therapeutic potential of *Mangifera indica* in various skin conditions including acne, inflammation, microbial infections, wound healing, and oxidative stress-related disorders. Different parts of the plant such as leaves, bark, seeds, and fruit extracts are rich in bioactive phytoconstituents including mangiferin, flavonoids, tannins, and polyphenols, which contribute to its pharmacological activities. The review highlights the antimicrobial, anti-inflammatory, antioxidant, and wound healing properties of *Mangifera indica*, which play a crucial role in the management of dermatological conditions. Various in-vitro and in-vivo studies have demonstrated its effectiveness against acne-causing microorganisms, reduction

of inflammatory mediators, and enhancement of skin regeneration. In addition, recent advancements in pharmaceutics have explored the incorporation of *Mangifera indica* extracts into topical formulations such as gels, creams, and nano-based delivery systems to improve drug stability, bioavailability, and therapeutic efficacy. The compiled evidence suggests that *Mangifera indica* is a promising natural candidate for the development of effective and safe

dermatological formulations. The review concludes that further clinical studies and advanced formulation approaches are necessary to establish its full therapeutic potential and commercial applicability in modern dermatology.

KEYWORDS: *Mangifera indica*, Dermatological disorders, Herbal medicine, Acne vulgaris, Mangiferin, Antioxidant activity, Anti-inflammatory activity, Topical drug delivery, Herbal formulations.

1. INTRODUCTION

1.1. Background

Mangifera indica Linn., commonly known as mango, is a tropical fruit tree belonging to the family *Anacardiaceae*. Beyond its nutritional value, it has long been recognized in traditional medicine systems such as Ayurveda, Unani, and folk practices for its therapeutic applications. The plant parts—including leaves, bark, seeds, and fruit—are rich in bioactive compounds like mangiferin, quercetin, catechins, gallic acid, and β -sitosterol, which contribute to its pharmacological activities.^[1]

1.2 Dermatological Relevance

Skin disorders represent a significant global health burden, ranging from infectious conditions to chronic inflammatory diseases. Conventional therapies often face limitations such as drug resistance, side effects, and high costs. Natural products like *Mangifera indica* offer a complementary approach, with evidence suggesting

- **Antioxidant activity:** Protects skin from oxidative stress and photoaging.
- **Anti-inflammatory effects:** Reduces cytokine-mediated inflammation in conditions like eczema and psoriasis.
- **Antimicrobial properties:** Effective against *Staphylococcus aureus* and *Propionibacterium acnes*, key pathogens in skin infections and acne.
- **Wound-healing potential:** Enhances collagen synthesis and tissue regeneration.^[2]

1.3 Rationale for Review

Given the increasing interest in plant-based therapeutics, a comprehensive review of *Mangifera indica* in dermatology is warranted. This article aims to

- Summarize phytochemical constituents relevant to dermatological applications.
- Highlight experimental and clinical evidence supporting its efficacy.
- Discuss potential mechanisms of action in skin health.

- Identify research gaps and future directions for pharmaceutical development.^[3]

1.4 Ethnopharmacological Importance

Mangifera indica has been deeply rooted in traditional medicine systems such as Ayurveda, Unani, and folk practices, where different parts of the plant—including leaves, bark, seeds, and fruit—have been used to treat skin ailments like burns, wounds, and infections. Its long-standing ethnopharmacological relevance provides a strong foundation for modern scientific exploration, bridging ancient wisdom with contemporary dermatological research.^[4]

1.5. Phytochemical Constituents and Dermatological Relevance

The therapeutic potential of *Mangifera indica* is largely attributed to its diverse phytochemical profile. Compounds such as mangiferin, quercetin, catechins, gallic acid, and β -sitosterol exhibit antioxidant, anti-inflammatory, and antimicrobial properties. These bioactive molecules play a crucial role in protecting the skin against oxidative stress, reducing inflammatory responses in chronic conditions like eczema and psoriasis, and combating microbial pathogens responsible for acne and other infections.^[5]

1.6. Global Burden of Dermatological Disorders

Dermatological disorders represent a significant public health challenge worldwide, affecting millions of individuals across age groups. Conditions such as acne, psoriasis, eczema, and chronic wounds not only impair physical health but also impact psychological well-being and quality of life. Conventional therapies, though effective, often face limitations such as drug resistance, adverse effects, and high costs. In this context, plant-based alternatives like *Mangifera indica* offer promising, safer, and more accessible options for managing skin diseases.^[6]

2. AIM AND OBJECTIVES

2.0 AIM

To comprehensively review the therapeutic potential of *Mangifera indica* in the management of dermatological disorders, with special emphasis on its phytochemical constituents, pharmacological activities, and applications in topical drug delivery systems.^[5]

2.1 OBJECTIVES

- To review the phytochemical composition of different parts of *Mangifera indica* including leaves, bark, seeds, and fruit.

- To evaluate the pharmacological activities such as antimicrobial, anti-inflammatory, antioxidant, and wound healing effects relevant to dermatological conditions.
- To analyze the role of *Mangifera indica* in the management of various skin disorders, including Acne vulgaris, infections, and inflammatory conditions.^[6]
- To review recent advancements in topical drug delivery systems incorporating *Mangifera indica* extracts such as gels, creams, and novel carriers.
- To assess the mechanisms of action of bioactive compounds like mangiferin in skin protection and repair.
- To compare the effectiveness of different plant parts and extracts in dermatological applications.
- To identify research gaps and future perspectives for the development of herbal dermatological formulations.
- To summarize the clinical relevance and safety profile of *Mangifera indica* in topical use.

3.0 PLANT PROFILE

3.1 TAXONOMICAL CLASSIFICATION^[7]

Category	Classification
Kingdom	Plantae
Subkingdom	Tracheobionta (Vascular plants)
Superdivision	Spermatophyta (Seed plants)
Division	Magnoliophyta (Angiosperms)
Class	Magnoliopsida (Dicotyledons)
Subclass	Rosidae
Order	Sapindales
Family	Anacardiaceae
Genus	Mangifera
Species	<i>Mangifera indica</i>

Synonyms of *Mangifera indica*^[8]

Language	Synonyms
Sanskrit	Ambrab, Madhuulii, Madhuula, Madhuulaka
English	Mango
Hindi	Aam
French	Mango, Manguier, Manguier

Portuguese	Manga, Mangueira
Dutch	Manja
Tamil	Ambiram, Mambazham, Mambalam, Mangai
Punjabi	Amb, Wawashi
Gujarati	Ambo, Keri, Marvo (unripe)
Kashmiri	Amb
Malayalam	Amram, Choothaphalam, Manga, Manpalam, Mavu
Marathi	Amchur, Amba

3.2. ETHNOMEDICINAL USES^[9]

Mangifera indica has been widely utilized in traditional systems of medicine for thousands of years due to its diverse therapeutic properties. Different parts of the plant, including bark, roots, leaves, flowers, fruits, and seeds, exhibit significant ethnomedicinal value. The bark and roots are known for their acrid, astringent, anti-inflammatory, and styptic properties and are traditionally used in the treatment of conditions such as diarrhea, bleeding piles, leucorrhoea, ulcers, and uterine disorders. Leaves possess astringent, refrigerant, and wound-healing properties and are commonly used to manage cough, dysentery, hemorrhoids, ulcers, and burns, with their ash applied externally and smoke inhaled for throat ailments. The flowers exhibit cooling, astringent, and haemostatic activities and are beneficial in treating hemorrhages, chronic dysentery, anemia, and urinary disorders. Unripe fruits are characterized by acidic, digestive, and antiscorbutic properties and are used in dysentery, eruptions, and gastrointestinal disorders, whereas ripe fruits act as tonic, laxative, cardiogenic, and haemostatic agents, useful in anemia, emaciation, and digestive disturbances. The seed kernel, rich in gallic acid and proteins, demonstrates astringent, anthelmintic, and uterine tonic properties and is traditionally employed in the management of diarrhea, hemorrhages, diabetes, ulcers, and skin-related conditions. Collectively, these ethnomedicinal uses highlight the broad therapeutic potential of *Mangifera indica* in various systemic and dermatological disorders.

4. PHYTOCHEMISTRY

Mangifera indica is rich in a diverse range of bioactive phytoconstituents, which contribute to its wide spectrum of pharmacological activities. Various parts of the plant such as leaves, bark, fruits, and seeds contain numerous chemical compounds, predominantly polyphenols, carotenoids, terpenoids, and tannins, which play a significant role in therapeutic

applications.^[11]

4.1 Polyphenols

Polyphenols are the most abundant class of compounds present in *Mangifera indica*, including flavonoids, xanthenes, and phenolic acids. Major polyphenolic compounds identified include quercetin, gallic acid, mangiferin, kaempferol, ellagic acid, protocatechuic acid, catechins, anthocyanins, and rhamnetin. Among these, mangiferin is a well-known xanthone glycoside that has been extensively studied for its multiple biological activities. These polyphenols exhibit strong antioxidant properties, which are considered the primary mechanism underlying many of the plant's therapeutic effects. Additionally, compounds such as ascorbic acid and dehydroascorbic acid further contribute to the antioxidant potential. It has also been observed that crude extracts are often more effective than isolated compounds due to the synergistic interaction of multiple polyphenols.^[12]

4.2. Carotenoids

Carotenoids are natural pigments responsible for the characteristic yellow color of mango fruit peel and pulp. These include β -carotene, luteoxanthin, neoxanthin, violaxanthin, cryptoxanthin, and zeaxanthin, with β -carotene being the most predominant. The concentration of carotenoids increases during fruit ripening. These compounds act as potent free radical scavengers and play a crucial role in protecting cells from oxidative stress.^[13]

4.3 Terpenoids and Volatile Compounds

Mangifera indica contains a variety of terpenoids and volatile compounds such as terpinolene, ocimene, myrcene, limonene, and carene, which are responsible for the characteristic aroma of mango. In addition, triterpenoids such as lupeol and lupeol linoleate are also present and contribute to anti-inflammatory and pharmacological activities.^[14]

4.4 Tannins (Gallotannins)

Hydrolyzable tannins, commonly known as gallotannins, are present in the leaves, bark, fruit pulp, and seed kernel of *Mangifera indica*. These compounds exhibit strong astringent and antimicrobial properties, contributing to their traditional use in treating diarrhea, wounds, and skin infections.^[15]

4.5 Tocopherols (Vitamin E Compounds)

The fruit peel and pulp of *Mangifera indica* contain tocopherols, including alpha-, beta-, and

gamma- tocopherols. These compounds function as lipid-soluble antioxidants, protecting cellular membranes from oxidative damage.^[16]

4.6 Phenolic Lipids (Resorcinolic Lipids)

Another important group of compounds found in *Mangifera indica* are phenolic lipids (resorcinolic lipids), which are present in bark, peel, and pulp. These compounds possess various biological activities, including antimicrobial and anticancer properties.^[17]

4.7 Halogenated Compounds

Recent studies have identified the presence of halogenated compounds in *Mangifera indica* bark, such as bromomangiferic acid and chloromangiferamide. These findings are significant as such compounds were previously thought to be limited to marine organisms.^[18]

4.8 Safety and Toxicity Profile of Major Phytoconstituents

Key phytochemicals such as mangiferin, quercetin, and kaempferol have been extensively studied for their safety and toxicity. Available research indicates that these compounds are relatively non-toxic and safe for consumption, with studies in animal models demonstrating low toxicity levels. This supports their suitability for use in pharmaceutical and dermatological formulations.^[19]

5. PHYTOCHEMICALS IN DIFFERENT PARTS OF *Mangifera indica*

5.1 Leaves

Leaves of *Mangifera indica* contain a wide variety of phytoconstituents including amino acids, polyphenols, terpenes, alcohols, sterols, and phenylpropanoids. The major amino acids present include leucine, alanine, valine, glycine, tyrosine, and γ -aminobutyric acid. Polyphenolic compounds such as catechin, protocatechuic acid, mangiferin, hyperin, gallic acid, quercetin, ethyl digallate, shikimic acid, and ellagic acid are abundantly present. Alcohols like ethyl, isobutyl, and methyl alcohols are also reported. Terpenes such as friedelin, linalool, lupeol, β -bulnesene, α -guaiene, humulene, α -farnesene, myrcene, car-3-ene, limonene, β -ocimene, β -terpinene, and α -terpinolene contribute to biological activity. Additionally, phenylpropenes (elemicin, methyleugenol, estragole) and sterols (β -, γ -, and δ -sitosterol) are present.^[20]

5.2 Fruit (Flesh and Peel)

The fruit pulp and peel are rich in triterpenoids, polyphenols, carotenoids, fatty acids, and

resorcinolic lipids. Triterpenoids such as cycloartenol, α -amyrin, β -amyrin, dammarenediol II, and ocotillol are present. Polyphenols include quercetin, mangiferin, gallic acid, ferulic acid, caffeic acid, vanillin, kaempferol, and their glycosides. Resorcinolic lipids such as 5-(heptadecenyl)-resorcinol are also reported. Carotenoids like β -carotene, zeaxanthin, luteoxanthin, neoxanthin, and violaxanthin provide antioxidant activity. Long-chain fatty acids such as linoleic, oleic, and linolenic acids are also present.^[21]

4.3 Root

Roots contain mainly triterpenoids and steroids. Important compounds include cycloartenol, friedelin, α -amyrin, β -amyrin, and friedelan-3 β -ol. Steroidal compounds such as β -sitosterol and chromone derivatives are also reported, contributing to pharmacological activities.^[22]

5.4 Bark

The bark is a rich source of polyphenols, triterpenoids, amino acids, saponins, and hydrocarbons. Major polyphenols include catechin, protocatechuic acid, mangiferin, kaempferol, gallic acid, and shikimic acid. Triterpenoids such as friedelin, manglupenone, mangiferolic acid derivatives, and cycloartane derivatives are present. Unique compounds such as halogenated amides and long-chain hydrocarbons (e.g., tetracosane) have also been identified. Terpenoid saponins (Indocoside A and B) and amino acids like glycine and alanine are also present.^[23]

5.5 Kernel and Seed

The seed kernel contains fatty acids, sterols, terpenoids, and polyphenols. Major fatty acids include eicosanoic acid, linoleic acid, arachidonic acid, oleic acid, stearic acid, palmitic acid, and linolenic acid. Sterols such as campesterol, sitosterol, and stigmasterol are present. Terpenoids like myrcene, limonene, and α -pinene are also found. Polyphenols include mangiferin, gallic acid, ascorbic acid, and quercetin.^[24]

5.6 Flowers

Flowers contain amino acids, polyphenols, and volatile terpenoids. Amino acids such as tryptophan, alanine, valine, and threonine are present. Polyphenols include mangiferin, ellagic acid, gallic acid, and quercetin. Volatile terpenoids such as β -pinene, limonene, nerol, α -phellandrene, and α -pinene contribute to aroma and biological activity.^[25]

5.7 PHARMACOLOGICAL ACTIVITIES

5.6.1 Antioxidant Activity

Mangifera indica exhibits strong antioxidant activity due to the presence of polyphenols such as mangiferin, quercetin, and ascorbic acid. These compounds scavenge reactive oxygen species (ROS), protect biomolecules like DNA, proteins, and lipids, and prevent oxidative damage. Extracts such as Vimang have shown iron-chelating ability and inhibition of lipid peroxidation, thereby providing protection against oxidative stress.^[26]

5.7.2 Antidiabetic Activity

Leaf and bark extracts demonstrate significant hypoglycemic activity by reducing blood glucose levels in experimental models. The mechanism involves enhanced insulin secretion, reduced intestinal glucose absorption, and improved lipid profiles. Mangiferin has shown antidiabetic, antihyperlipidemic, and antioxidant properties without causing hypoglycemia.^[27]

5.7.3 Antiviral Activity

Mangiferin exhibits antiviral activity by inhibiting viral replication. It has shown effectiveness against herpes simplex virus (HSV-1 and HSV-2) and HIV by blocking late stages of viral replication.^[28]

5.7.4 Anthelmintic and Anti-Allergic Activity

Stem bark extracts and mangiferin show anthelmintic activity against parasites such as *Trichinella spiralis*. Additionally, anti-allergic properties have been observed due to modulation of immune responses.^[29]

5.7.5 Antiparasitic Activity

Mangiferin has demonstrated activity against *Cryptosporidium parvum*, showing comparable efficacy to standard drugs.^[30]

5.7.6 Anti-Inflammatory Activity

Extracts of *Mangifera indica*, especially seed kernel and bark, exhibit significant anti-inflammatory effects by reducing edema and inhibiting inflammatory mediators.^[31]

5.7.7 Antimicrobial Activity

Mangiferin and extracts show activity against various bacteria and fungi including *Staphylococcus aureus*, *E. coli*, and *Aspergillus* species.^[32]

5.7.8 Anticancer Activity

Polyphenols and mangiferin exhibit cytotoxic effects against multiple cancer cell lines by inducing apoptosis and inhibiting cell proliferation.^[33]

5.7.9 Gastroprotective Activity

Mangiferin protects gastric mucosa by reducing acidity and oxidative damage, demonstrating anti-ulcer activity.^[34]

5.7.10 Cardioprotective Activity

Mangiferin protects myocardial tissue by reducing lipid peroxidation and maintaining enzyme levels.^[35]

5.7.11 Immunomodulatory Activity

Extracts enhance immune response by increasing glutathione levels and regulating inflammatory pathways such as NF- κ B.^[36]

5.7.11 Management of various skin disorders, including Acne vulgaris, infections, and inflammatory conditions

Table 1: management of various skin disorders, including Acne vulgaris, infections, and inflammatory conditions.^[37,38,39,40,41,42,43]

Section	Component	Findings	Role in Acne Management
Plant Source	<i>Mangifera indica</i> leaves	Polyphenol-rich extract	Natural anti- acne agent
Main Phytomarkers	Mangiferin	Major xanthone polyphenol	Sebum regulation, antioxidant
	Penta-O- galloyl- β -D-glucose	Polyphenolic compound	Antimicrobial, antioxidant
	Iriflophenon e-3-C- β -glucoside	Phenolic compound	Lipogenesis regulation
	Maclurin-3- C- β -glucoside	Phenolic compound	Seboregulation, enzyme targeting
Target Microorganism	Cutibacterium acnes	Main acne- causing bacteria	Lipase production, inflammation
Seboregulation (In vitro)	Lipid reduction	↓ 40% in sebocytes	Controls oily skin
Sebum Quality (Ex vivo)	Triglycerides	↓ 12%	Improves sebum composition
Section	Component	Findings	Role in Acne Management
	Squalene	↓ 18%	Reduces acne- promoting lipids
	Free Fatty Acids (FFA)	↓ (non- significant)	Less irritation

Mechanism – Molecular Targets	PPAR- γ receptor	Activated by mangiferin	Controls lipid synthesis
	Retinoid receptors	Targeted by phyto compounds	Regulates sebocyte activity
	Lipogenic enzymes	Inhibited (e.g., squalene synthase)	Reduces sebum production
Anti-bacterial Action	Lipase inhibition	↓ 23–29% activity	Reduces bacterial virulence
Sebum Biomarker	TG/FFA ratio	↑ 49–55%	Indicates reduced bacterial metabolism
Clinical Sebum Reduction	Sebum level	↓ 13.2% (28 days)	Less oily skin
Porphyrins	Acne markers	↓ ~7%	Indicates reduced bacterial activity
Microbiota Effect	Skin flora balance	Maintained (no dysbiosis)	Microbiota- friendly
Inflammation Control	Polyphenols	Antioxidant + anti-inflammatory	Reduces acne inflammation
Synergistic Effect	Whole extract vs mangiferin	Extract more effective	Multi- compound action
Overall Outcome	Acne condition	Improved skin quality	Prevents & treats acne

6.0 RECENT ADVANCEMENTS IN TOPICAL DRUG DELIVERY SYSTEMS. OF *MANGIFERA INDICA*

Table 2: Recent Advancements in Topical Drug Delivery Systems of *Mangifera indica*. ^[48,49,50]

Heading	Formulation Type	Research Model	Key Molecules	Findings	Significance in Acne & Skin Therapy
Conventional Topical Systems	Creams & Ointments	Antimicrobial formulation studies	Mangiferin, polyphenols	Effective antimicrobial activity and safe topical delivery	Useful for acne due to antibacterial action
	Carbopol Hydrogel	Hydrogel formulation study (2019)	Mangifera leaf extract	Strong antibacterial effect against skin pathogens	Suitable for sustained topical delivery
Gel-Based Systems ^[44]	Conventional Gel	Basic gel formulations	Mangiferin	Limited penetration and bioavailability	Needs enhancement for better efficacy
	Nano-hydrogel (Phospholipid-based)	Advanced topical nano-gel (2023)	Mangiferin-loaded microemulsion	↑ Skin retention (≈5%), controlled release, ↑ cellular uptake (3×)	Improved dermal delivery and prolonged action
Nanoemulsion Systems ^[45]	Nanoemulsion	Anti-acne cosmeceutical formulation (2020)	Mango kernel extract	Enhanced stability and skin permeation	Better penetration into sebaceous glands

Nanoparticle-Based Systems ^[46]	Nanostructured Lipid Carriers (NLCs)	Anti-aging & oxidative stress study	Mangifera extract + lipids	Improved antioxidant activity & skin parameters	Protects skin, reduces inflammation
	Green Nanoparticles	Extract-loaded nanoparticles	Polyphenols (mangiferin, flavonoids)	Enhanced bioactivity and safety	Promising eco- friendly delivery system
Advanced Nanocarriers	Microemulsion - based systems	Drug delivery research	Mangiferin	High entrapment (>75%), improved solubility & bioavailability	Overcomes poor solubility issues
	Nanocarrier systems (general)	Review studies (2024)	Mangiferin	Sustained release, targeted delivery, improved pharmacokinetics	Ideal for chronic skin conditions like acne
Mechanism-Oriented Delivery ^[47]	Lipid-based carriers	Dermatokinetic studies	Mangiferin	Increased residence time in skin layers	Enhances therapeutic duration
Challenges Identified	Conventional delivery	Multiple studies	Mangiferin	Poor solubility (<2% bioavailability orally)	Justifies need for topical nano-delivery

7.0 MECHANISMS OF ACTION OF BIOACTIVE COMPOUNDS IN SKIN PROTECTION AND REPAIR

7.1. Antioxidant Activity

Bioactive compounds present in *Mangifera indica*, particularly mangiferin, exhibit strong antioxidant properties that play a crucial role in skin protection. Mangiferin acts as a potent free radical scavenger, neutralizing reactive oxygen species (ROS) generated due to environmental stressors such as UV radiation and pollution. By reducing oxidative stress, it prevents lipid peroxidation, cellular damage, and premature skin aging, thereby maintaining skin integrity and promoting repair processes.^[51]

7.2. Anti-inflammatory Mechanism

Mangiferin demonstrates significant anti-inflammatory activity by modulating key inflammatory pathways. It inhibits the production of pro-inflammatory cytokines and mediators involved in skin inflammation. This action is particularly beneficial in conditions like acne, where inflammation contributes to lesion formation. By reducing redness, swelling, and irritation, mangiferin supports faster healing and restoration of normal skin physiology.^[52]

7.3. Seboregulation and Lipid Modulation

One of the important mechanisms of mangiferin is its ability to regulate sebum production. It interacts with nuclear receptors such as PPAR- γ (Peroxisome proliferator-activated receptor gamma), which are involved in lipid metabolism within sebaceous glands. Through this interaction, mangiferin reduces excessive lipid synthesis, thereby preventing oily skin conditions and minimizing acne formation. Additionally, it improves the quality of sebum by reducing harmful lipid components like triglycerides and squalene.^[53]

7.4. Antimicrobial and Anti-*C. acnes* Activity

Mangiferin and other polyphenols exhibit antimicrobial properties, particularly against *Cutibacterium acnes*. These compounds inhibit bacterial growth and reduce enzymatic activities such as lipase production, which is responsible for breaking down triglycerides into inflammatory free fatty acids. By controlling bacterial activity without disturbing the overall skin microbiota, mangiferin helps maintain a balanced microbial environment essential for healthy skin.^[54]

7.5. Modulation of Skin Microbiota

Unlike conventional antimicrobial agents, mangiferin supports the balance of the skin microbiota rather than causing dysbiosis. It selectively reduces pathogenic activity while preserving beneficial microorganisms. This microbiota-friendly action contributes to long-term skin health, enhances the skin barrier function, and reduces the recurrence of acne and other inflammatory conditions.^[55]

7.6. Enhancement of Skin Barrier Function

Mangiferin contributes to the repair and strengthening of the skin barrier by promoting cellular regeneration and maintaining lipid balance in the epidermis. It helps in restoring the structural integrity of the skin, reducing transepidermal water loss (TEWL), and improving hydration. This leads to enhanced protection against external irritants and supports overall skin resilience.^[56]

7.7. Anti-aging and Photoprotective Effects

Due to its antioxidant and anti-inflammatory properties, mangiferin also exhibits anti-aging benefits. It protects skin cells from UV-induced damage, reduces collagen degradation, and prevents the formation of wrinkles and fine lines. Its photoprotective effect makes it a valuable compound in formulations aimed at preventing photoaging and maintaining youthful skin.^[57]

8.0 COMPARISON OF DIFFERENT PLANT PARTS AND EXTRACTS OF *MANGIFERA INDICA* IN DERMATOLOGICAL APPLICATIONS

Table: 3 Comparison of Different Plant Parts and Extracts of *Mangifera indica* in Dermatological Applications. ^[58,59,60,61,62]

Plant Part	Type of Extract	Major Bioactive Compounds	Dermatological Activity	Applications
Leaves	Ethanollic / Hydroalcoholic extract	Mangiferin, iriflophenone, maclurin, polyphenols	Seboregulation, anti-acne, antioxidant, antimicrobial	Acne treatment, oily skin control, microbiota balance
Bark	Aqueous / Methanolic extract	Mangiferin, tannins, phenolics	Anti-inflammatory, antioxidant, wound healing	Skin repair, anti-inflammatory creams
Fruit Peel	Methanolic / Ethanol extract	Polyphenols, flavonoids, carotenoids	Antioxidant, anti-aging, photoprotection	Anti-aging products, UV protection
Fruit Pulp	Aqueous extract	Vitamins (A, C), sugars, carotenoids	Moisturizing, nourishing, mild antioxidant	Skin hydration, cosmetic formulations
Seed Kernel	Ethanollic extract / Oil	Fatty acids, phenolics	Antimicrobial, emollient, anti-acne	Acne creams, moisturizers
Flower	Alcoholic extract	Flavonoids, phenolics	Antioxidant, anti-inflammatory	Skin soothing formulations
Root	Methanolic extract	Phenolic compounds, tannins	Anti-inflammatory, antimicrobial	Traditional skin treatments
Whole Plant Extract	Hydroalcoholic extract	Mixed phytochemicals	Synergistic antioxidant & antimicrobial	Broad dermatological applications

8.1 Research gaps and future perspectives for the development of herbal dermatological formulations

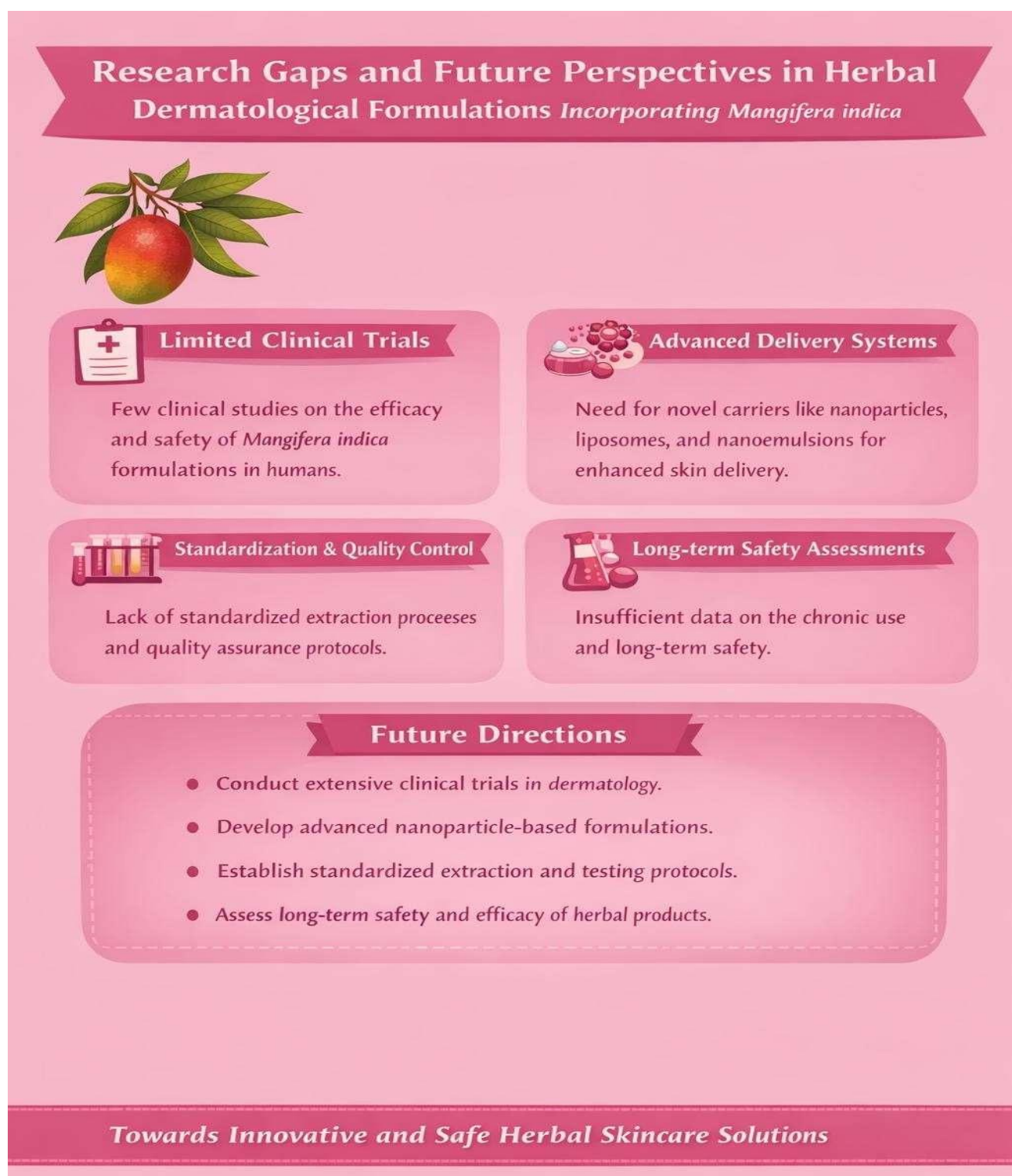


Figure 1: Research gaps and future perspectives for the development of herbal dermatological formulations.

8.2 Clinical Relevance and Safety Profile of *Mangifera indica* in Topical Use

8.2.1. Clinical Relevance in Dermatology

Mangifera indica has gained significant attention as a promising herbal ingredient in dermatological formulations due to its multi-targeted therapeutic actions. The leaf extract, rich in bioactive compounds such as mangiferin and other polyphenols, has demonstrated effectiveness in managing acne by regulating sebum production, improving sebum quality, and reducing bacterial activity. Clinical studies have reported a noticeable reduction in sebum levels and acne-associated biomarkers such as porphyrins after topical application. Additionally, its ability to inhibit the lipase activity of *Cutibacterium acnes* contributes to decreased inflammation and lesion formation. These findings highlight its potential as a natural alternative to conventional anti-acne therapies.^[63]

8.2.2. Microbiota-Friendly Action

One of the unique clinical advantages of *Mangifera indica* extract is its ability to maintain the natural balance of the skin microbiota. Unlike synthetic antimicrobial agents that may disrupt beneficial microorganisms and lead to dysbiosis, *Mangifera indica* selectively modulates pathogenic activity while preserving commensal flora. Clinical observations have shown that formulations containing this extract prevent undesirable shifts in microbial populations, thereby supporting long-term skin health and reducing recurrence of acne.^[64]

8.2.3. Safety and Tolerability

Topical formulations of *Mangifera indica* have demonstrated a favorable safety profile in clinical settings. Studies involving human volunteers reported good tolerability with no significant adverse effects such as irritation, redness, or hypersensitivity reactions. The extract is generally considered safe for cosmetic use, especially when formulated at appropriate concentrations (e.g., 1% in creams). Its natural origin and long history of use in traditional medicine further support its safety in dermatological applications.^[65]

8.2.4. Non-Comedogenic and Skin Compatibility

Mangifera indica extract is considered non-comedogenic, meaning it does not clog pores or exacerbate acne conditions. Instead, it improves skin texture and reduces oiliness, making it suitable for acne-prone and sensitive skin types. Its compatibility with various skin formulations such as creams, gels, and serums enhances its applicability in modern cosmeceuticals.^[66]

9.0 SUMMARY

The present review comprehensively highlights the therapeutic potential of *Mangifera indica* in the management of various dermatological disorders. The plant, widely recognized in traditional systems of medicine, possesses a rich phytochemical profile comprising bioactive compounds such as mangiferin, flavonoids, tannins, polyphenols, and carotenoids. These constituents are responsible for its diverse pharmacological activities, particularly in skin health.

Different parts of the plant—including leaves, bark, fruit, seeds, and flowers—have demonstrated significant biological activities relevant to dermatology. Among these, mangiferin, a $\text{U}^{\text{मुख}}$ xanthone glycoside, plays a central role due to its strong antioxidant, anti-inflammatory, antimicrobial, and seboregulatory properties.

The review summarizes extensive in-vitro and in-vivo studies that validate the effectiveness of *Mangifera indica* in treating skin conditions such as acne, infections, inflammation, oxidative stress-induced damage, and wound healing. Its ability to regulate sebum production, inhibit microbial growth (especially *Cutibacterium acnes*), and modulate inflammatory pathways makes it a promising natural alternative to conventional dermatological therapies.

Furthermore, recent advancements in pharmaceuticals have significantly enhanced its therapeutic applicability. Novel drug delivery systems such as nanoemulsions, nanostructured lipid carriers, microemulsions, and hydrogels have improved the stability, bioavailability, skin penetration, and sustained release of mangiferin and other phytoconstituents. These innovations address limitations associated with conventional formulations and increase clinical efficacy.

The review also emphasizes the microbiota-friendly nature of *Mangifera indica*, which maintains the balance of skin flora without causing dysbiosis. Additionally, clinical studies indicate a favorable safety and tolerability profile, supporting its suitability for topical use in dermatological formulations.

Despite these promising findings, certain limitations exist, including a lack of extensive clinical trials, variability in extract standardization, and insufficient long-term safety data. These gaps highlight the need for further research to fully establish its therapeutic potential.

9.1 CONCLUSION

In conclusion, *Mangifera indica* emerges as a highly promising natural candidate for the development of effective and safe dermatological formulations. Its multi-targeted mechanisms of action—including antioxidant, anti-inflammatory, antimicrobial, and wound-healing effects—make it particularly valuable in the management of acne and other skin disorders.

The integration of advanced drug delivery systems has further strengthened its potential by overcoming challenges related to solubility, bioavailability, and skin penetration. Moreover, its favorable safety profile, non-comedogenic nature, and compatibility with skin microbiota enhance its clinical relevance in modern dermatology and cosmeceutical applications.

However, to translate its full potential into clinical practice and commercial products, future research should focus on

- Standardization of extracts and formulations
- Large-scale clinical trials for efficacy and safety validation
- Exploration of novel delivery systems
- Long-term toxicity and stability studies

Overall, *Mangifera indica* represents a valuable bridge between traditional medicine and modern pharmaceutical science, offering a sustainable, effective, and safer alternative for the treatment of dermatological disorders.

9.2 Research Gap and Future Perspectives

Despite the promising dermatological benefits of *Mangifera indica*, several research gaps remain. Most studies are limited to in-vitro and preclinical models, with a lack of well-designed clinical trials to confirm efficacy and long-term safety in humans. Variability in extraction methods and absence of standardized formulations lead to inconsistent results. Additionally, limited data are available on optimal dosage, formulation stability, and large-scale production. Future research should focus on conducting controlled clinical studies, developing standardized and stable formulations, and exploring advanced drug delivery systems such as nanocarriers to enhance bioavailability and targeted skin delivery. These efforts will help establish *Mangifera indica* as a reliable and effective ingredient in modern dermatological therapy.

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