



A Futuristic Review on Advances and Potential Applications of Herbal Plant Product-Based Drug Delivery Systems for Psoriasis

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Abstract

Psoriasis is a skin problem that just will not go away. It is caused by the system not working like it should. This makes the skin cells turn over fast and causes a lot of inflammation. Doctors usually treat psoriasis with things like corticosteroids, retinoids and biologic agents. These treatments can have bad side effects are expensive and people often do not take them like they are supposed to. Because of this people are looking into medicines for psoriasis. Herbal medicines are often seen as safer and cheaper. They also have properties that can help reduce inflammation and make the immune system work better. Psoriasis treatments need to be safe and work well that is why people are looking into medicines, for psoriasis. When we use plants to make medicine in the way the good stuff from the plants does not dissolve well in water it does not go through the skin easily and it breaks down quickly. This means that the medicine does not work well as it should. To make the medicine work better for people with psoriasis scientists are creating ways to deliver the medicine. They are trying different ways to do this including things, like phytosomes, liposomes, nanoemulsions, solid lipid nanoparticles, hydrogels, polymeric micelles and other special systems that can carry the herbal agents to where they are needed. These new systems can protect the things in plants help them get into the skin of people with psoriasis and release them in a way that we can control. This means they can get more of the drug to where it's needed keep it there for longer and maybe even reduce the bad side effects that happen when we take drugs by mouth or put them on our skin. So using remedies with these new delivery systems could be a great addition to the usual way of treating people or even a different way of treating people altogether. This could make people feel better reduce the risks and make patients happier, with their treatment. Herbal remedies and these new systems could really work well together to make people feel better. Future work should prioritize well designed clinical trials, robust standardization of herbal formulations and scalable manufacturing strategies to firmly establish herbal based delivery systems as reliable treatment options for psoriasis.

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1. Introduction

1.1 Pathogenesis Of Psoriasis

Psoriasis is a skin condition that affects a lot of people all over the world. It happens when the immune system gets too active and that makes the skin cells multiply fast. These skin cells build up on the surface of the skin. That causes red, scaly patches and sometimes flat spots. Psoriasis can be very itchy, painful. It looks bad which makes people feel unhappy and it affects their daily life. Psoriasis is a problem that people have to deal with every day. Psoriasis is something that can start at any time in your life. It usually begins when you are an adult. This disease is something that you will have for the rest of your life. It goes, with periods of time when it gets worse and then gets better. Psoriasis affects men and women about the same. There are different types of Psoriasis like the kind that affects your skin your scalp, your nails and other parts of your body. You can have Psoriasis on your skin. It can look like red patches or it can be on your scalp or it can even affect your nails. There are also types, like guttate Psoriasis, pustular Psoriasis and erythrodermic Psoriasis.¹ The way Psoriasis looks and feels can be very different from one person to another. Psoriasis can be mild. It can be very severe and it can show up in different parts of your body.

A variety of internal and external factors can precipitate or aggravate psoriasis. Well recognized triggers include cutaneous trauma, obesity, cigarette smoking, certain systemic medications and hormonal or endocrine influences. Psychological stress and environmental exposures, such as cold climates, also contribute to disease flares. Because of this multifactorial background and persistent course, the long-term management of psoriasis is challenging and generally requires individualized, sustained therapeutic strategies.²

The thing that causes psoriasis is really complicated. It is the result of many things coming together like the person's genes, their immune system not working right and things in their environment. At a level the disease happens because the immune system is not working like it should and this involves certain cells like T lymphocytes, dendritic cells and keratinocytes. When the skin gets hurt or infected the dendritic cells in the skin get excited. Start sending out messages that cause inflammation like tumor necrosis factor alpha, interleukin 12 and interleukin 23.³ Psoriasis is a disease that is affected by these things, and the immune system plays a role in psoriasis especially the cells, like T lymphocytes, dendritic cells and keratinocytes that are involved in psoriasis. These mediators help the T cells that are not experienced to become kinds of cells that do specific jobs like the Th1 cells, the Th17 cells and the Th22 cells. The T cells become these cells, Th17 cells and Th22 cells so they can do their work.

Th17 cells are really important because they release helpers like interleukin 17 and interleukin 22. Interleukin 17 makes skin inflammation worse by bringing in white blood cells and stimulating the skin cells. Interleukin 22 helps the skin cells multiply.⁴ Contributes to the skin getting thicker and forming scales. When the skin cells are activated they make more helpers, which brings in more immune cells to the skin. This creates a cycle of inflammation and skin cells growing much and it just keeps going. The Th17 cells and the helpers they release like interleukin 17 and interleukin 22 are key, to this process.

In addition to immune and epidermal changes, psoriatic plaques exhibit pronounced vascular alterations. Increased angiogenesis and dilatation of dermal capillaries underline the characteristic erythema and edema of lesions. Taken together, immune abnormalities, keratinocyte dysfunction and microvascular remodeling support the concept of psoriasis as a systemic inflammatory disorder rather than a purely cutaneous disease.⁵ Consistent with this view, patients with psoriasis show an elevated risk of comorbidities such as psoriatic arthritis, cardiovascular disease, metabolic syndrome and psychological conditions, including anxiety and depression.

1.2 Causes And Contributing Factors

The exact reason people get psoriasis is not known. Most people think it happens because of a mix of things. You might be born with a tendency to get psoriasis your immune system might not work properly. Something in your environment could trigger it. If someone in your family has psoriasis you are more likely to get it.⁶ This shows that psoriasis can be passed down by your family. Some genes have been found that make people more likely to get psoriasis like HLA Cw6. These genes are involved in how your immune system works and how your skin works. Psoriasis is related to these genes. How they affect your skin and immune system. Environmental and lifestyle factors, such as cold weather, skin trauma (Koebner phenomenon), psychological stress, alcohol consumption and smoking, are known to precipitate or worsen psoriatic lesions. Infections particularly streptococcal pharyngitis can provoke acute eruptions, especially in children and young adults.⁷ Certain medications, for example beta blockers, lithium and some antimalarial agents, are also associated with exacerbation of disease.

1.3 Diagnosis

When doctors look at psoriasis, they mostly do it by checking how it looks on the skin. They want to see if it has the appearance and if it is in the usual places on the skin. The doctor will gently take off the layers of skin to see if there are tiny spots of blood underneath, which is a common sign of psoriasis called the Auspitz phenomenon. If the psoriasis does not look typical or if the doctor needs to be sure they can do a skin biopsy.⁸ When they look at the skin biopsy they usually see that the top layer of skin is thicker than usual and the skin cells are not normal. There is swelling and

inflammation in the skin, which are all signs of psoriasis. Routine blood tests are not diagnostic for psoriasis but may be used to exclude alternative conditions or to monitor potential adverse effects of systemic therapies.

1.4 Epidemiology And Risk Factors

Psoriasis is a problem for a lot of people. It affects about 2 to 3 percent of people around the world. This makes Psoriasis one of the common skin problems that people have to deal with for a long time. Psoriasis can happen to anyone no matter if they are a man or a woman and it can happen at any age. There are two times when Psoriasis more likely to start.⁹ The first time is when people are young before they turn 40 years old. The second time is when people are older after they turn 40 years old. If someone, in your family has Psoriasis you are more likely to get it. This shows that the genes we get from our family can play a role in whether or not we get Psoriasis. Additional risk factors include obesity, cigarette smoking, heavy alcohol intake, psychological stress, infections and exposure to cold climates. Beyond cutaneous manifestations, psoriasis can exert a profound psychological burden, contributing to low self esteem, social withdrawal, anxiety and depressive symptoms due to the visible nature of the lesions.¹⁰

1.5 Complications And Associated Conditions

Psoriasis is not a skin problem. It is a condition that affects the body. People who have psoriasis are more likely to get arthritis. This is a type of arthritis that can cause a lot of damage to the joints if it is not treated properly. Psoriasis is also linked to health issues.¹¹ These include diabetes, high blood pressure and being overweight. People with psoriasis may also have something called metabolic syndrome. This is when someone has a number of health problems that can increase their risk of heart disease.^{12,13}

When the body is inflamed for a time it can increase the risk of heart problems. This includes things like heart attacks and strokes. Psoriasis can also affect a persons mood. It can make them more likely to feel depressed. Psoriasis is a condition that can have a big impact, on a persons life. The disease psoriasis can cause a lot of problems if it is not managed properly.¹⁴⁻¹⁶ Consequently, early diagnosis, comprehensive treatment and lifestyle modification are essential to reduce long term complications and improve overall outcomes.

2. IMPORTANCE OF HERBAL BASED DRUG DELIVERY SYSTEMS IN PSORIASIS TREATMENT

Psoriasis is a lifelong autoimmune disorder of the skin that typically requires continuous or repeated treatment. Although conventional agents, including topical corticosteroids, methotrexate and biologic therapies, are effective for many patients, their use may be limited by adverse reactions, tachyphylaxis and relapse after discontinuation.¹⁷ These limitations have stimulated growing interest among researchers and clinicians in exploring herbal-based therapies and integrating them into advanced drug delivery systems as an adjunct or alternative approach.

2.1 Natural Therapeutic Potential

Many medicinal plants contain bioactive constituents that exhibit anti-inflammatory, antioxidant and immunomodulatory activities, making them attractive candidates for psoriasis management. Such compounds may help attenuate inflammatory signaling pathways and contribute to normalizing the excessive proliferation of epidermal cells characteristic of psoriatic plaques. Examples include turmeric (curcumin), aloe vera, neem, cayenne pepper and tea tree oil, which have long been used in traditional medicine to soothe irritated skin, reduce inflammation and combat microbial colonization all of which are relevant to psoriatic lesions.¹⁸

2.2 Controlled And Targetted Delivery

One of the principal challenges in psoriasis therapy is achieving efficient delivery of active agents to the diseased skin while minimizing systemic exposure. Herbal-based formulations developed as creams, gels, ointments or transdermal systems can be designed to act predominantly at the site of application, thereby reducing the need for systemic drugs that carry greater risks of adverse effects.¹⁹ Because many phytoconstituents have inherently poor skin permeability, incorporating them into modern delivery platforms such as liposomes, nanocarriers or microemulsions can enhance penetration into deeper epidermal and dermal layers, which is crucial for improved therapeutic performance.²⁰

2.3 reduced side effects

Plant-derived formulations are often perceived as gentler on the skin than potent synthetic agents, particularly when used over extended periods.²¹ Long-term application of topical corticosteroids, for instance, is associated with cutaneous atrophy and other local or systemic complications. Appropriately designed herbal drug delivery systems may reduce these risks by enabling lower doses of conventional drugs or, in some cases, by providing effective symptom control without high-potency steroids. Furthermore, topical herbal DDS can be tailored to limit systemic absorption relative to oral therapies or biologics, thereby decreasing the likelihood of systemic toxicity.²²

2.4 Sustained And Lasting Release

Advanced herbal-based delivery platforms can be engineered to provide controlled or sustained release of active constituents.²³ By maintaining therapeutic levels over an extended period, these systems may reduce the frequency of application and enhance patient adherence. When properly formulated, the delivery system can also improve the

stability of sensitive phytochemicals, which are prone to degradation by light, oxygen or pH changes, as is the case with curcumin and several other natural compounds.²⁴

2.5 Synergistic Effects

Traditional herbal medicine frequently employs combinations of plants, aiming to harness synergistic interactions between multiple constituents. A single drug delivery system that incorporates complementary herbs can potentially amplify therapeutic benefits while **reducing the** dose of each individual component.²⁵ For example, a formulation that combines anti-inflammatory, moisturizing and barrier-supporting herbs may provide more comprehensive control of psoriatic symptoms than a single-ingredient product. In addition, herbal DDS can be used alongside established treatments, such as phototherapy, biologics or topical steroids, to improve overall disease control or permit dose reduction of stronger agents.

2.6 Patient Acceptance And Adherence

Patients are naturally attracted to herbal products because they feel they are safe and provide a 'holistic' approach to health. The addition of herbal compounds to modern drug delivery systems may therefore increase patient acceptance and long-term adherence in patients with chronic diseases such as psoriasis, particularly those who are averse to taking purely synthetic drugs.²⁶ By providing a solution to both the problem of efficacy and the problem of patient preference, herbal drug delivery systems have the potential to provide a more sustainable approach to disease management.

TABLE:1 Herbal Plant Based Drug Delivery Systems

# S.No.	Plant Name (Scientific)	Indigenous	Parts Used for Anti-Psoriatic Activity	Key Phyto-constituents	Drug Delivery System	Evaluation Methods	Example Formulations
1	Aloe vera (Aloe barbadense)	Indigenous to Africa	Leaf Gel	Antraquinones, Polysaccharides, Saponins	Topical Gel, Creams, Ointments	Skin irritation test, Anti-inflammatory activity	Aloe-based cream, Lotion
2	Turmeric (Curcuma longa)	Indigenous to Southeast Asia	Rhizome	Curcumin, Desmethoxycurcumin, Bisdemethoxycurcumin	Topical application, Oral formulations	Anti-inflammatory, Antioxidant activity	Curcumin gel, Capsules
3	Neem (Azadirachta indica)	Indigenous to India and Myanmar	Leaves, Bark	Azadirachtin, flavonoids, Quercetin	Topical oil, Cream, Soap	Anti-inflammatory, Antimicrobial tests	Neem oil, Soap, Cream
4	Witch Hazel (Hamamelis virginiana)	Indigenous to North America	Bark, Leaves	Tannins, Flavonoids, Essential oils	Topical cream, Lotion	Skin irritation test, Efficacy in reducing inflammation	Witch Hazel cream
5	Chamomile (Matricaria chamomilla)	Indigenous to Europe and Asia	Flowers	Apigenin, Chamazulene, Bisabolol	Topical gel, Oil	Anti-inflammatory, Antioxidant activity	Chamomile-infused lotion
6	Licorice (Glycyrrhiza glabra)	Indigenous to Europe and Asia	Root	Glycyrrhizin, Liquiritigenin, liquiritin.	Topical cream, Gel, Oral capsules	Anti-inflammatory, Skin irritation tests	Licorice extract cream
7	Jjoba (Simmondsia chinensis)	Indigenous to North America	Seeds	Fatty acids, Vitamin E, Jjoba oil	Topical oil, Cream, Gel	Moisturization, Anti-inflammatory activity	Jjoba oil, Cream
8	Black Cumin (Nigella sativa)	Indigenous to Asia	Seeds	Thymoquinone, Carvacrol, Timol	Oil, Capsule, Topical cream	Anti-inflammatory, Antioxidant activity	Black cumin oil, Capsules
9	Burdock (Arctium lappa)	Indigenous to Europe, Asia, North America	Root	Inulin, Arctigenin, Lignans	Oral extract, Topical ointment	Anti-inflammatory, Antioxidant activity	Burdock root tincture, Cream

10	Calendula (Calendula officinalis)	Indigenous to Europe	Flowers	Flavonoids, Carotenoids, Saponins	Topical cream, Lotion	Anti-inflammatory, Wound healing	Calendula cream
11	Cayenne Pepper (Capsicum annuum)	Indigenous to Central/South America	Fruit	Capsaicin	Topical cream, Oil	Analgesic, Anti-inflammatory activity	Capsaicin cream
12	Sandalwood (Santalum album)	Indigenous to India, Southeast Asia	Heartwood	α -Santalol, β -santalol	Topical oil, Cream	Anti-inflammatory, Antimicrobial	Sandalwood oil, Cream
13	Ginger (Zingiber officinale)	Indigenous to Southeast Asia	Rhizome	Gingerol, Shogaol	Oral capsules, Topical gel	Anti-inflammatory, Antioxidant	Ginger cream
14	Eucalyptus (Eucalyptus globulus)	Indigenous to Australia	Leaves	Eucalyptol, Flavonoids	Essential oil, Cream	Anti-inflammatory, Analgesic	Eucalyptus oil
15	Lavender (Lavandula angustifolia)	Indigenous to Mediterranean	Flowers	Linalool, Linalyl acetate	Topical oil, Cream, Gel	Anti-inflammatory, Antioxidant	Lavender essential oil
16	Tea Tree (Melaleuca alternifolia)	Indigenous to Australia	Leaves	Terpinen-4-ol, Alpha-terpinene	Topical oil, Cream	Antimicrobial, Anti-inflammatory	Tea tree oil, Cream
17	Peppermint (Mentha piperita)	Indigenous to Europe and Asia	Leaves	Menthol, Menthone	Topical gel, Cream	Cooling effect, Anti-inflammatory	Peppermint oil, Cream
18	Basil (Ocimum basilicum)	Indigenous to Asia, Africa	Leaves	Eugenol, Linalool	Topical cream, Oil	Anti-inflammatory, Antioxidant	Basil extract cream
19	St. John's Wort (Hypericum perforatum)	Indigenous to Europe, Asia	Flowers, Leaves	Hypericin, Hyperforin	Topical oil, Cream, Oral	Anti-inflammatory, Antidepressant properties	St. John's Wort oil
20	Olive Leaf (Olea europaea)	Indigenous to Mediterranean	Leaves	Oleuropein, Hydroxytyrosol	Oral capsule, Topical gel	Anti-inflammatory, Antioxidant	Olive leaf extract
21	Ashwagandha (Withania somnifera)	Indigenous to India	Root	Withanolides, Alkaloids	Oral powder, Capsules	Adaptogen, Anti-inflammatory	Ashwagandha capsules
22	Gotu Kola (Centella asiatica)	Indigenous to Asia	Leaves, Stems	Asiaticoside, Madecassoside	Topical cream, Gel	Wound healing, Anti-inflammatory	Gotu Kola cream
23	Saw Palmetto (Serenoa repens)	Indigenous to Southeastern USA	Berries	Fatty acids, Phytosterols	Oral capsules	Anti-inflammatory, Hormonal effects	Saw palmetto extract
24	Moringa (Moringa oleifera)	Indigenous to India, Africa	Leaves, Seeds	Moringosides, Quercetin, Vitamin C	Oral capsules, Topical cream	Antioxidant, Anti-inflammatory	Moringa extract cream
25	Fennel (Foeniculum vulgare)	Indigenous to Mediterranean	Seeds	Anethole, Fenchone	Oral capsules, Topical oil	Anti-inflammatory, Antioxidant	Fennel seed oil, Capsules
26	Pomegranate (Punica granatum)	Indigenous to Southeast Asia	Fruit, Seed	Punicalagins, Ellagic acid	Oral extract, Topical cream	Anti-inflammatory, Antioxidant	Pomegranate extract cream
27	Pepper (Piper nigrum)	Indigenous to India	Fruit	Piperine	Oral capsules, Topical cream	Anti-inflammatory, Skin penetration enhancer	Pepper extract cream

28	Coriander (Coriandrum sativum)	Indigenous to Europe, Asia	Seeds, Leaves	Linalool, other terpenes.	Oral capsules, Topical cream	Anti-inflammatory, Antioxidant	Coriander seed oil
29	Cat's Claw (Uncaria tomentosa)	Indigenous to South America	Bark, Root	Oxindole alkaloids, Tannins	Oral capsules, Topical extract	Immunomodulatory, Anti-inflammatory	Cat's Claw extract
30	Sage (Salvia officinalis)	Indigenous to Mediterranean	Leaves	Rosmarinic acid, Flavonoids	Topical oil, Cream	Antioxidant, Anti-inflammatory	Sage leaf extract

3. PSORIASIS: DISEASE PROFILE, PATHOGENESIS, AND TYPES

Psoriasis is a chronic, immune-mediated inflammatory disorder characterized by erythematous plaques with silver-white scaling. It significantly impacts the quality of life, as it can cause physical discomfort, emotional stress, and social stigma. Psoriasis affects approximately 2–3% of the global population, with a higher prevalence in temperate climates. While the disease can manifest at any age, there are two peaks of onset: early-onset begins before age 40 and late-onset begins after age 40.²⁷ Both genetic predisposition and environmental triggers contribute to its pathogenesis.

3.1 Disease Profile

Clinical Presentation: Psoriasis presents as sharply demarcated, raised, red plaques covered with silvery scales. Commonly affected areas include the scalp, elbows, knees, lower back, and nails. In severe cases, it can involve extensive body areas, including the palms and soles.²⁸

Associated Comorbidities: Psoriasis is linked to systemic diseases such as psoriatic arthritis, cardiovascular disease, metabolic syndrome, diabetes, obesity, depression, and inflammatory bowel disease.

Triggers: External factors like infections, trauma (Koebner phenomenon), stress, cold weather, and certain medications (e.g., beta-blockers, antimalarials) can exacerbate psoriasis.

3.2 Pathogenesis

The pathogenesis of psoriasis involves a complex interplay between the immune system, genetic predisposition, and environmental factors. It primarily results from dysregulation of the immune system, particularly involving T cells and dendritic cells, leading to excessive keratinocyte proliferation and abnormal differentiation.²⁹ The key aspects of psoriasis pathogenesis include:

3.2.1 GENITICS

Psoriasis is a polygenic disease with high heritability.

The PSORS1 region on chromosome 6p21, linked to the HLA-C*06 allele, is the most important genetic susceptibility region.³⁰

Other genes that have been implicated include those that regulate skin barrier and immune homeostasis, including IL23R, TNIP1, and CARD14.

3.2.2 Immune Dysregulation:

Psoriasis is a Th17-cell-mediated disease, with a predominance of pro-inflammatory cytokines.

Dendritic cells, upon activation, secrete IL-12 and IL-23, which stimulate the differentiation and activation of Th1 and Th17 cells.

Th17 cells secrete cytokines like IL-17, IL-22, and TNF-alpha, which induce keratinocyte hyperproliferation, angiogenesis, and inflammation.³¹

IL-17 also induces neutrophil recruitment, which contributes to pustular lesions and inflammation.

3.2.3 Keratinocyte Abnormalities:

Keratinocytes in psoriatic lesions show increased proliferation and defective apoptosis, resulting in thickening of the epidermis (acanthosis) and scaling.

Cytokines like IL-22 inhibit keratinocyte differentiation, leading to disruption of the epidermal barrier.³²

3.2.4 Angiogenesis and Vascular Abnormalities:

Psoriatic lesions show increased angiogenesis, with dilated and tortuous capillaries visible in the lesions.^{33–35}

VEGF (vascular endothelial growth factor) is an important mediator of these vascular abnormalities.³⁶

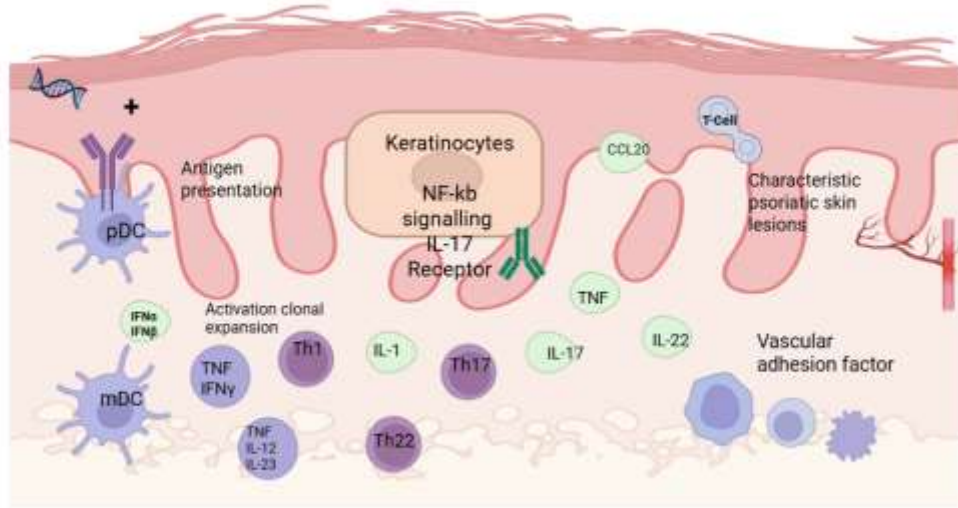


Figure 1. Schematic representation of immune-mediated inflammatory pathways involved in psoriasis, highlighting the IL-23/IL-17 axis and keratinocyte activation.

4. TYPES OF PSORIASIS

Beyond the fundamentals, there are several clinical forms of psoriasis, each with distinct morphology, epidemiology, complications, and genetic connections to type I/II distinctions from earlier sections. By including pathogenesis, comorbidities, and subtleties of management, this expanded content is appropriate for review articles.³⁷

4.1 Plaque Psoriasis:

Acute inflammation gives rise to chronic stable plaques; in 25% of cases, the Koebner phenomenon lesions at trauma sites occurs. Because atherosclerosis and cardiovascular disease share IL-17/23 pathways, there is a twofold increase in cardiovascular risk.³⁸ For moderate-to-severe disease, treatment progresses from vitamin D analogues (calcipotriol) to biologics (secukinumab).

4.2 Guttate Psoriasis:

Resolution often spontaneous, but recurrence risk rises post-throat infections; biopsy reveals sparse lymphocytic infiltrate vs. dense in plaque. Aetiology confirmation is guided by anti-streptolysin O titers; paediatric predominance (age 8–12). 80% clearance is attained by narrowband UVB.^{39,40}

4.3 Pustular Psoriasis:

Acrodermatitis continua gradually erodes nails and toenails; the von Zumbusch variant cycles every ten days with leukocytosis. dysregulation of the IL-36 pathway (not HLA-driven like type I); infliximab provides quick pustule resolution.⁴¹ Foetal monitoring is necessary for pregnancy-associated impetigo herpetiformis.

4.4 Inverse Psoriasis:

In obese diabetics, yeast superinfection is common (50%) and resembles intertrigo. Tacrolimus ointment is preferred over steroids to prevent atrophy; minimal scaling helps distinguish it from eczema.^{42,43} Metabolic connections: Insulin resistance affects 40% of people.

4.5 Erythrodermic Psoriasis:

Thermoregulatory failure can lead to high-output heart failure, and protein loss may exceed 20 g/day. Cyclosporine induction (3–5 mg/kg) usually stabilizes patients within a week; methotrexate is contraindicated initially. Mortality is 4–6%, mainly from sepsis.

4.6 Nail and Scalp Psoriasis:

Nail involvement predicts arthritis, with about an 80% correlation; the oil-drop sign and onychomadesis are pathognomonic. Scalp disease often responds poorly to topicals a clobetasol foam plus salicylic acid combination works best; excimer laser can help in refractory cases.

4.7 Psoriatic Arthritis:

Most cases are oligoarticular (70%) rather than polyarticular; dactylitis (“sausage digits”) is a hallmark. HLA-B27 is seen in the axial subtype, mirroring type II patterns. Early DMARDs (for example, leflunomide) help prevent erosions. Enthesitis, especially at the Achilles and other entheses, is common.⁴⁴

TABLE: 2. Herbal drug delivery systems

Herb Name	Delivery Systems	Applications/Benefits
Aloe Vera	Nanoparticles, Gels, Liposomes, Nano emulsions, Creams	Moisturizing, wound healing, and anti-inflammatory effects.
Turmeric	Nano emulsions, Solid Lipid Nanoparticles (SLNs), Hydrogels, Tablets	Anti-inflammatory, anticancer, antioxidant properties.
Neem	Nano emulsions, Microcapsules, Biopolymers	Antibacterial, antifungal, and antiparasitic activities.
Witch Hazel	Liposomes, Gels, Ointments	Astringent and anti-inflammatory benefits for skincare.
Chamomile	Solid Lipid Nanoparticles (SLNs), Micelles, Hydrogels	Soothing and anti-inflammatory for skin and gastrointestinal issues.
Licorice	Liposomes, Nano emulsions, Creams	Anti-inflammatory, skin brightening, and antioxidant properties.
Jojoba	Nano emulsions, Hydrogels, Lipid Carriers	Moisturizing and skin repair benefits.
Black Cumin	Nanoparticles, Liposomes, Nano emulsions	Antioxidant, antimicrobial, and immune-enhancing effects.
Burdock	Phytosomes, Liposomes, Hydrogels	Detoxifying, antioxidant, and skin-clearing benefits.
Calendula	Lipid Carriers, Creams, Nano emulsions	Skin healing and anti-inflammatory for wounds and irritation.
Cayenne	Liposomes, Microcapsules, Gels	Pain relief, anti-inflammatory, and muscle relaxation benefits.
Sandalwood	Nano emulsions, Creams, Liposomes	Skin brightening, antimicrobial, and anti-inflammatory benefits.
Ginger	Liposomes, Nano emulsions, Micelles	Antioxidant, anticancer, and digestive health benefits.
Eucalyptus	Lipid Carriers, Nano emulsions, Micelles	Respiratory relief, antimicrobial, and pain-relieving properties.
Lavender	Nano emulsions, Creams, Liposomes	Soothing, calming, and antimicrobial effects.
Tea Tree	Solid Lipid Nanoparticles (SLNs), Gels, Micelles	Antimicrobial and anti-inflammatory for acne and infections.
Peppermint	Nano emulsions, Gels, Liposomes	Cooling effect, pain relief, and digestive health.

5. DRUG DELIVERY METHODS

5.1 Topical Application:

Many plants that help with psoriasis are used on the skin through creams, gels, ointments, and oils. These are great for targeting specific skin issues like psoriasis directly.

5.2 Oral Consumption: Some plants can be taken as capsules, powders, or tablets. This is especially true for those that help reduce inflammation throughout the body.⁴⁵

5.3 Transdermal Patches: Plants such as Pepper (*Piper nigrum*) and Capsicum (*C. annuum*) can be included in patches to improve how well their active ingredients are absorbed.⁴⁶

6. TESTING METHODS

6.1 Skin Irritation Tests: These tests check if topical products are safe for use on the skin.

6.2 In Vitro Anti-inflammatory Tests: This is done to see if the product can lower inflammation markers.

6.3 Antioxidant Tests: This evaluates how well a plant can fight off free radicals.

6.4 Clinical Trials: These are necessary to prove that the treatment works for psoriasis in everyday situations.⁴⁷

7. COMPARISON OF DELIVERY METHODS

Topical (Creams, Ointments): These are applied directly to the skin and are good for local treatment, but they don't penetrate deeply.

Oral (Capsules, Tablets): These can have broader effects across the body and are often used for long-term treatment, but they might lead to side effects.

Transdermal (Patches, Gels): These allow for better absorption through the skin, making them more effective for localized treatment.^{48,49}

8. FORMULATIONS

8.1 Creams and Lotions: Used for hydration and delivering active ingredients.

8.2 Oils: Easy to apply and can reach deep into the skin.

8.3 Capsules/Tablets: Used for treating psoriasis from within.

The table provides an overview of the plants and their healing capabilities for psoriasis treatment. More research is needed for specific products and to conduct clinical assessments.

When evaluating plant extracts or products for psoriasis, various lab tests are utilized to measure their effectiveness, safety, and health benefits. Below are the key tests with general procedures that can be adjusted for different plants or products.

9.1 Skin Irritation Test

Goal: To determine the safety of topical products and check for skin irritation.

Process

Test Animals: Usually, rabbits, guinea pigs, or rats are used for the tests.

Application: A small bit of the cream or ointment is put on a small area of the animal's skin.

Observation: The area is watched for any irritation signs like redness or swelling at intervals (like 24-, 48-, and 72-hours post-application).⁵⁰

Scoring: The irritation is rated based on severity, using a simple scale.

Control: Include a control group with no treatment for comparison.

Results

A low irritation score means the product is likely safe to use.

A high irritation score suggests it may need to be reformulated.

9.2 Anti-Inflammatory Activity (In Vitro)

Goal: To see if plant extracts can lower inflammation, which is important for psoriasis.

Process

Cell Culture: Use human skin cells (HaCaT cells) or similar.

Induce Inflammation: This is done by adding pro-inflammatory substances to the cell cultures.

Treatment: Mix the cells with different amounts of the plant extract.

Cytokine Measurement: Check for the release of inflammatory substances using simple tests.

Gene Expression: Analyze how inflammation-related genes are expressed.

Viability: Use specific tests to make sure that effective doses are safe for the cells.

Results

Reduced inflammation markers show the extract's effectiveness.

Compare with a known anti-inflammatory drug for reference.

9.3 Antioxidant Tests

Goal: To check how well the plant extract can neutralize harmful reactive oxygen species.

Process

DPPH Test: This measures how well the extract can eliminate free radicals.

Mix the extract with a DPPH solution and check the absorbance.

A decrease in absorbance means good antioxidant activity.

ABTS Test: This is another method to assess antioxidant power.

Create ABTS radicals and mix with the plant extract to see the absorbance change.

FRAP Test: This checks how well the extract can change Fe^{3+} to Fe^{2+} .

Results

High activity in these tests indicates strong antioxidant properties, which could help with oxidative damage in psoriasis.

9.4 Anti-psoriatic Activity in Animal Models (In Vivo)

Goal: To see if the plant extract can reduce psoriasis-like symptoms in animal tests.

Process

Animal Model: Commonly, mice are used with imiquimod to induce a psoriasis-like condition.

Treatment: Apply the plant directly to the affected skin after inducing psoriasis.

Observation: Monitor the animals for skin changes and record severity.

Histological Analysis: Collect skin samples for further examination.

Cytokine Measurement: Measure inflammatory substances in the skin tissue.⁵¹

Results

A decrease in skin irritation and better histological outcomes compared to control groups shows promise against psoriasis.

9.5 Patch Test (Human Skin Sensitization)

Goal: To check if the plant formulation causes allergic reactions on human skin.

Process

Subjects: Involve a small group of healthy volunteers (about 20-30).

Application: Apply the formulation (usually a patch) on a small area of the forearm.

Observation: Watch for reactions at the site for up to 48 hours.

Reactions: Record any significant reactions.

Follow-up: Continue monitoring for delayed reactions for a few weeks.

Results

If there are no reactions, the formulation is likely safe.

Any major reactions suggest it might be allergenic.

9.6 Skin Penetration and Bioavailability Studies

Goal: To find out how well the active compounds get through the skin layers, which is important for topical treatments.

Process

Franz Diffusion Cells: These cells help study how well the plant extract or its active parts go through the skin.

Method:

Apply the formulation to the skin in the Franz cell.

Collect samples from the chamber below the skin at set times.

Analyze the concentration of active compounds.⁵²

Results:

Good penetration rates indicate the formulation can reach effective levels in deeper skin layers.

9.7 In Vitro Toxicity Tests (MTT Assay or Cytotoxicity Assay)

Goal: To check if the plant formulations are safe for human skin cells.

Process:

Cell Line: Use human skin cell lines.

Treatment: Expose the cells to the plant extract for a period.

MTT Assay: Add a reagent after exposure to see how many cells are still alive.

Results:

A high percentage of live cells suggests the extract is safe for use.

These evaluation tests are common practices to ensure the safety, effectiveness, and possible side effects of anti-psoriasis plant products. The specific methods can differ based on the plant and regulatory standards.⁵³

10. FUTURE PERSPECTIVES AND CHALLENGES

Although herbal based drug delivery system presents a promising therapeutic option for psoriasis, a number of obstacles need to be overcome before their full potential may be realized:

10.1 Personalized Treatments: By adjusting the herbal-based drug delivery systems for each patient according to the severity of the illness, and their genetic composition, therapeutic results may be maximized.

10.2 Safety and Regulatory Issues: Regulatory frameworks must be created in order to guarantee quality control and additional clinical trials are required to confirm the effectiveness and safety of herbal-based drug delivery systems.

10.3 Combination Therapies: The synergistic effects caused by using herbal DDS in conjunction with traditional therapies like biologics may enhance the overall therapeutic results.

11. Conclusion

Psoriasis is a chronic condition with significant impact on patients' lives, necessitating treatments that are both effective and safe for long-term use. The integration of herbal products with advanced drug delivery methods offers promising potential by enhancing therapeutic benefits, improving biocompatibility, and minimizing side effects. Novel technologies such as nanoparticles, liposomes, nanoemulsions, phytosomes, and hydrogels have revolutionized the delivery of herbal compounds like curcumin, aloe vera, neem, and licorice. These advances facilitate better stability, targeted delivery, and bioavailability of herbal agents, overcoming limitations of conventional therapies.

Recent progress points towards more personalized and sustainable psoriasis treatments through herbal-based delivery platforms. Innovations in nanotechnology, polymer sciences, and formulation approaches enable precise, controlled drug release aligned to individual patient needs. Additionally, the use of environmentally friendly components supports the trend towards sustainable healthcare practices.

However, obstacles remain, including limited clinical evidence, manufacturing challenges, and regulatory complexities that restrict widespread adoption. Thorough testing in both laboratory and clinical settings is essential to ensure safety and efficacy. Close collaboration among experts in botany, pharmacology, materials science, and clinical medicine is vital to translate research developments into viable treatments.

Looking forward, combining herbal-based drug delivery with emerging technologies like artificial intelligence, machine learning, and bioinformatics has the potential to enhance design, optimize outcomes, and streamline development pathways. Emphasizing patient-centered approaches and regulatory compliance will be key to establishing these systems as integral to psoriasis management.

In conclusion, merging traditional herbal medicine with cutting-edge delivery technologies opens exciting avenues for improving psoriasis care. Despite challenges, these systems offer promising prospects for enhancing patient health, reducing adverse effects, and providing sustainable therapeutic options. Continued innovation and interdisciplinary collaboration could transform the treatment landscape for psoriasis and other chronic diseases.

References

- Mahajan, T. et al. Recent Updates on Psoriasis: A Review. *Asian Journal of Pharmaceutical Research* 76–83 (2022) doi:10.52711/2231-5691.2022.00012.
- Tejaswini G.Khonde et al. Review on Psoriasis and Their Managements. *Asian Journal of Pharmaceutical Research and Development* 12, 147–152 (2024).
- Sondhi, S., Singh, N. & Jindal, S. Natural remedies used in the treatment of psoriasis: A short review. *Asian Journal of Pharmaceutical Research* 11, 43–45 (2021).
- Navneet Kharpe, Dr. Sunita Ogale & Jayshree Aate. Herbal Drugs in the Treatment of Psoriasis. *Tropical Journal of Pharmaceutical and Life Sciences* 10, 87–95 (2023).
- Salgaonkar, S. P. et al. New Insights in Psoriasis Management using Herbal Drug Nanocarriers. *Curr. Pharm. Des.* 30, 2550–2561 (2024).
- Armstrong, A. W. & Read, C. Pathophysiology, Clinical Presentation, and Treatment of Psoriasis. *JAMA* 323, 1945 (2020).
- Parisi, R., Symmons, D. P. M., Griffiths, C. E. M. & Ashcroft, D. M. Global Epidemiology of Psoriasis: A Systematic Review of Incidence and Prevalence. *Journal of Investigative Dermatology* 133, 377–385 (2013).
- Snast, I. et al. Psychological stress and psoriasis: a systematic review and meta-analysis. *British Journal of Dermatology* 178, 1044–1055 (2018).
- Griffiths, C. E. M., Armstrong, A. W., Gudjonsson, J. E. & Barker, J. N. W. N. Psoriasis. *The Lancet* 397, 1301–1315 (2021).
- Zhou, X., Chen, Y., Cui, L., Shi, Y. & Guo, C. Advances in the pathogenesis of psoriasis: from keratinocyte perspective. *Cell Death Dis.* 13, 81 (2022).
- Nestle, F. O., Kaplan, D. H. & Barker, J. Psoriasis. *New England Journal of Medicine* 361, 496–509 (2009).
- Ober, C. & Thompson, E. E. Rethinking genetic models of asthma: the role of environmental modifiers. *Curr. Opin. Immunol.* 17, 670–678 (2005).
- Parisi, R. et al. National, regional, and worldwide epidemiology of psoriasis: systematic analysis and modelling study. *BMJ* m1590 (2020) doi:10.1136/bmj.m1590.
- Dommasch, E. D. et al. The risk of infection and malignancy with tumor necrosis factor antagonists in adults with psoriatic disease: A systematic review and meta-analysis of randomized controlled trials. *J. Am. Acad. Dermatol.* 64, 1035–1050 (2011).
- Gelfand, J. M. et al. The Risk of Mortality in Patients With Psoriasis. *Arch. Dermatol.* 143, (2007).
- Gudjonsson, J. E. et al. Assessment of the Psoriatic Transcriptome in a Large Sample: Additional Regulated Genes and Comparisons with In Vitro Models. *Journal of Investigative Dermatology* 130, 1829–1840 (2010).
- Xie, J. et al. Advances in the Application of Natural Products and the Novel Drug Delivery Systems for Psoriasis. *Front. Pharmacol.* 12, (2021).
- Deng, S., May, B. H., Zhang, A. L., Lu, C. & Xue, C. C. L. Topical herbal medicine combined with pharmacotherapy for psoriasis: a systematic review and meta-analysis. *Arch. Dermatol. Res.* 305, 179–189 (2013).

19. Mohd Nordin, U. U., Ahmad, N., Salim, N. & Mohd Yusof, N. S. Lipid-based nanoparticles for psoriasis treatment: a review on conventional treatments, recent works, and future prospects. *RSC Adv.* **11**, 29080–29101 (2021).
20. Gupta, M., Agrawal, U. & Vyas, S. P. Nanocarrier-based topical drug delivery for the treatment of skin diseases. *Expert Opin. Drug Deliv.* **9**, 783–804 (2012).
21. Gupta, S. C., Patchva, S. & Aggarwal, B. B. Therapeutic Roles of Curcumin: Lessons Learned from Clinical Trials. *AAPS J.* **15**, 195–218 (2013).
22. Patel, A., Jain, P., Thakur, A. & Ajazuddin. Recent Review on Herbs and Medicinal Plant-based Nanotechnological Approach in Treating Psoriasis. *Curr. Bioact. Compd.* **21**, (2025).
23. Burlec, A. F., Hăncianu, M., Ivănescu, B., Macovei, I. & Corciovă, A. Exploring the Therapeutic Potential of Natural Compounds in Psoriasis and Their Inclusion in Nanotechnological Systems. *Antioxidants* **13**, 912 (2024).
24. Herman, A. & Herman, A. Topically Used Herbal Products for the Treatment of Psoriasis – Mechanism of Action, Drug Delivery, Clinical Studies. *Planta Med.* **82**, 1447–1455 (2016).
25. Gaikwad, R. G., Shinde, A. J. & Hajare, A. A. Herbal Treatment for Management of Psoriasis: An Overview. *Res. J. Pharm. Technol.* 1385–1392 (2022) doi:10.52711/0974-360X.2022.00231.
26. Yuan, X. et al. Relationship between rosacea and dietary factors: A multicenter retrospective case–control survey. *J. Dermatol.* **46**, 219–225 (2019).
27. Man, A.-M., Orăsan, M. S., Hoteiuc, O.-A., Olănescu-Vaida-Voevod, M.-C. & Mocan, T. Inflammation and Psoriasis: A Comprehensive Review. *Int. J. Mol. Sci.* **24**, 16095 (2023).
28. Greb, J. E. et al. Psoriasis. *Nat. Rev. Dis. Primers* **2**, 16082 (2016).
29. Kanda, N. Psoriasis: Pathogenesis, Comorbidities, and Therapy Updated. *Int. J. Mol. Sci.* **22**, 2979 (2021).
30. Dascălu, R. C. et al. Review: A Contemporary, Multifaced Insight into Psoriasis Pathogenesis. *J. Pers. Med.* **14**, 535 (2024).
31. Ghoreschi, K., Balato, A., Enerbäck, C. & Sabat, R. Therapeutics targeting the IL-23 and IL-17 pathway in psoriasis. *The Lancet* **397**, 754–766 (2021).
32. Bowcock, A. M. & Krueger, J. G. Getting under the skin: the immunogenetics of psoriasis. *Nat. Rev. Immunol.* **5**, 699–711 (2005).
33. Sieminska, I., Pieniawska, M. & Grzywa, T. M. The Immunology of Psoriasis—Current Concepts in Pathogenesis. *Clin. Rev. Allergy Immunol.* **66**, 164–191 (2024).
34. Wu, M., Dai, C. & Zeng, F. Cellular Mechanisms of Psoriasis Pathogenesis: A Systemic Review. *Clin. Cosmet. Investig. Dermatol.* **Volume 16**, 2503–2515 (2023).
35. Blauvelt, A. & Chiricozzi, A. The Immunologic Role of IL-17 in Psoriasis and Psoriatic Arthritis Pathogenesis. *Clin. Rev. Allergy Immunol.* **55**, 379–390 (2018).
36. Heidenreich, R., Röcken, M. & Ghoreschi, K. Angiogenesis drives psoriasis pathogenesis. *Int. J. Exp. Pathol.* **90**, 232–248 (2009).
37. Koca, T. T. A short summary of clinical types of psoriasis. *North. Clin. Istanbul.* <https://doi.org/10.14744/nci.2016.16023> (2016) doi:10.14744/nci.2016.16023.
38. Rendon, A. & Schäkel, K. Psoriasis Pathogenesis and Treatment. *Int. J. Mol. Sci.* **20**, 1475 (2019).
39. Krueger, J. G., Pagotto, A., Haftel, S. & Gradl, B. Targeted Review of IL36RN Mutations in Patients with Generalised Pustular Psoriasis. *Skin Health and Disease* **4**, (2024).
40. Reynolds. Generalized Pustular Psoriasis: A Review of the Pathophysiology, Clinical Manifestations, Diagnosis, and Treatment. *Cutis* **110**, (2022).
41. Kharouf, F. & Gladman, D. D. Advances in the management of psoriatic arthritis in adults. *BMJ* **387**, e081860 (2024).
42. van Doorn, R. & van Zuuren, E. J. Epidermal growth factor receptor inhibitor-associated rash prevented by oral tetracyclines. *British Journal of Dermatology* **175**, 1135–1136 (2016).
43. Mekić, S. et al. Prevalence and determinants for xerosis cutis in the middle-aged and elderly population: A cross-sectional study. *J. Am. Acad. Dermatol.* **81**, 963-969.e2 (2019).
44. Chan, E. S., Herlitz, L. C. & Jabbari, A. Ruxolitinib Attenuates Cutaneous Lupus Development in a Mouse Lupus Model. *Journal of Investigative Dermatology* **135**, 1912–1915 (2015).
45. Mo, J. et al. Scutellarin protects against vascular endothelial dysfunction and prevents atherosclerosis via antioxidation. *Phytomedicine* **42**, 66–74 (2018).
46. Prausnitz, M. R. & Langer, R. Transdermal drug delivery. *Nat. Biotechnol.* **26**, 1261–1268 (2008).
47. Mosmann, T. Rapid colorimetric assay for cellular growth and survival: Application to proliferation and cytotoxicity assays. *J. Immunol. Methods* **65**, 55–63 (1983).
48. Re, R. et al. Antioxidant activity applying an improved ABTS radical cation decolorization assay. *Free Radic. Biol. Med.* **26**, 1231–1237 (1999).
49. Benzie, I. F. F. & Strain, J. J. The Ferric Reducing Ability of Plasma (FRAP) as a Measure of “Antioxidant Power”: The FRAP Assay. *Anal. Biochem.* **239**, 70–76 (1996).
50. Society for Investigative Dermatology 2016 Board of Directors Meeting Minutes. *Journal of Investigative Dermatology* **137**, 2655–2662 (2017).
51. Franz, T. J. Percutaneous Absorption. On the Relevance of in Vitro Data. *Journal of Investigative Dermatology* **64**, 190–195 (1975).