European Journal of Clinical Pharmacy

Print ISSN: 2385-409X **Online ISSN**: 3105-0409

Website: https://farmclin.com/

Original Research Article

Latest topical formulations and patents for treatments of Psoriasis: A Practical review

Article History:

Name of Author:

Mohd Wali Ahed* [1], Ritesh Kumar Tiwari[1], Hira khan[1], Prerna Sharma[1]

Affiliation: *[1]Shri Ram Murti Smarak College of Engineering and Technology (Pharmacy), Bareilly, 243202, India*

Corresponding Author:

Mohd Wali Ahed

Received: 11-11-2025

Revised: 26-11-2025

Accepted: 11-12-2025

Published: 31-12-2025

Abstract: Psoriasis is a long-term autoimmune inflammatory skin condition that significantly impacts the quality of life of those affected. Characterized by abnormal keratinocyte proliferation and immune deregulation, it presents in various forms and severity levels. Traditional treatments, particularly topical therapies, are commonly used for mild to moderate cases, yet they often suffer from limited skin penetration and patient compliance issues. ***Objective:*** This practical review focuses on the latest advancements in topical formulations and patents related to psoriasis treatment. The objective is to explore innovative drug delivery systems that enhance efficacy, stability, and patient adherence, while minimizing systemic side effects. ***Results***: Recent studies highlight a variety of advanced topical carriers including nanostructured lipid carriers, liposomes, nanogels, hydrogels, nanoemulgels, and microemulsions. These formulations have demonstrated improved drug entrapment, prolonged release, and enhanced skin permeation, especially for drugs like methotrexate, tacrolimus, and curcumin. Additionally, patented technologies reflect a growing interest in optimized topical therapies, with innovations focusing on stable gel systems, enhanced pharmacokinetics, and skin-targeted compositions. ***Discussion:*** Compared to conventional formulations, these novel carriers provide multiple benefits such as increased drug loading, sustained release, and localized delivery. They offer cosmetic elegance and improve adherence due to their non-invasive nature. Despite these advancements, challenges remain in formulation scalability, regulatory approval, and clinical validation. ***Conclusion***: The emergence of modern topical formulations supported by innovative patents marks a promising shift in psoriasis management. Continued research and collaboration across scientific and clinical fields are essential for translating these technologies into effective, accessible therapies.

Keywords: Psoriasis, exfoliation, Pathogenesis, latest formulation, latest patent

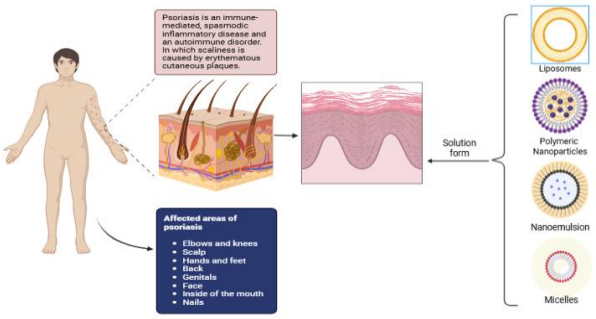

Fig 1: Graphical abstract

INTRODUCTION

Psoriasis is a chronic autoimmune skin condition characterized by inflammation and proliferation, often accompanied by multiple health complications. This condition is not curable, but rather can be effectively managed through treatment[1]. This inflammation leads to red, scaly patches on the skin's surface. About 2-3% of the global population is affected by psoriasis, which is often associated with other health conditions, such as cardiovascular disease, inflammatory bowel disease, and psoriatic arthritis. Psoriasis is an inflammatory disorder involving T cells. Manifestations are established by pathologic findings because of the abnormal proliferation of KCs in addition to erythema secondary to the dilatation of dermal blood vessels and entry of immune cells. However, its actual etiology or pathogenesis remains unclear. Genome-wide association studies revealed over 60 loci determining susceptibility to psoriasis, furthering the great understanding about the mechanisms behind the disease and its pathway. However, it appears that the break of immunological tolerance follows a complex interaction between the genetic predispositions and environmental factors. Thus, the identification of these specific triggers and elucidation of their mechanisms shall be crucial for further advancements in novel therapies or interventions for psoriasis. Symptoms include burning, pain, and itching of the skin. Additionally, psoriasis has been linked to a number of co-morbidities, such as psoriatic arthritis, obesity, metabolic syndrome, cardiovascular disease, inflammatory bowel disease, and mental illnesses linked to systemic inflammation[2-4].

Topical therapy is very effective for mild to moderate psoriasis and is often the first treatment used for severe cases. About 70-80% of patients have a mild form of the disease that can be managed with topical treatments alone. The localized application of topical therapeutics enables close contact with the affected area, resulting in greater effectiveness of topical psoriasis treatment is typically evaluated using the Psoriasis Area Severity Index (PASI) to measure efficacy and minimize systemic side effects, which measures the percentage reduction in disease severity, with scores of PASI 50, PASI 75, and PASI 90 indicating a 50%, 75%, and 90% decline in psoriasis severity compared to baseline levels[5].

Psoriasis, a chronic inflammatory skin condition, manifests as red, scaly lesions. Among various treatment options, topical therapies are the primary choice, particularly for mild to moderate cases. Topical corticosteroids and vitamin D analogues are commonly used due to their accessibility and effectiveness. However, determining the superior option remains a topic of debate. A comprehensive review of data from multiple systematic reviews and randomized controlled trials found that both treatments show comparable effectiveness in improving clinical scores. Nonetheless, topical corticosteroids tend to cause fewer local adverse effects, such as skin irritation, compared to vitamin D analogues. Despite the evidence, the long-term safety of these treatments, particularly concerning cutaneous atrophy, remains inadequately studied. This highlights the need for personalized treatment choices and further research to optimize long-term psoriasis management[6].

Emulgel is an advanced topical drug delivery system that combines the properties of both emulsions and gels, making it particularly suitable for skin disorders like psoriasis. It offers advantages such as improved drug penetration, prolonged skin retention, ease of application, and better patient compliance. In the context of psoriasis treatment, emulgels can effectively deliver anti-inflammatory or immunosuppressive agents directly to the affected site, minimizing systemic side effects commonly seen with oral therapies. Their greaseless, non-staining, and spreadable nature enhances user comfort and adherence to treatment. This dual-system formulation enhances solubility and bioavailability, making it a promising option for managing chronic skin conditions[7].

NLCs are advanced drug delivery systems belonging to a class of lipid matrices, where the matrix is of particular nanostructure. One could call it the Solid Lipid Nanoparticles (SLNs), which have a highly ordered structure due to the presence of solid lipids or blends of solid lipids, NLCs have a lipid matrix with significant crystal lattice imperfections. This has enough room for drug molecules, improving drug loading capacity, preventing leakage, and providing greater flexibility for drugs to be released[8,9-12]. Given below is the summery of the latest formulation used for the treatment and management of psoriasis in Table 1.

Table 1: Latest available formulation of psoriasis

S. No.	Topical formulation	Mechanism of action	Findings	Reference
1	Liposomes	AMP-activated protein kinase, a master sensor and regulator of energy balance in mammalian cells, is thought to	In this study, liposomal carriers loaded with metformin and ginger were used to enhance skin penetration. In this research article,	[13]

		be activated, leading to this phenomenon. As a key player in energy balance, AMPK is also a therapeutic target for metabolic diseases	the author has evaluated the product's effectiveness in treating psoriasis in a mouse model.	
2	Topical Gel	The methotrexate loaded ethosomes penetrate the skin more effectively due to ethanol-induced fluidization of skin lipids, while salicylic acid further enhances this penetration by removing hyperkeratotic scales and disrupting barrier layers.	The goal was to create a novel drug delivery method that would improve the medication's entrapment and penetration into the vesicular system. In the study, the author has created and refined ethosomes as a 0.25 percent methotrexate carrier. Then, using SA, the optimized formulation was turned into gel. The second goal was to determine whether adding salicylic acid to topical gel formulations containing methotrexate ethosomes would improve and sustain the MTX delivery rate, resulting in improved anti-psoriatic effectiveness.	[14]
3	Nanogel	**Nanoencapsulation of methotrexate in lipid carriers is to enhance dermal delivery, sustain release,** and **improve therapeutic outcomes in psoriasis** with reduced side effects	This study aimed to develop a nanogel composed of nanostructured lipid carriers loaded with methotrexate, a commonly used medication for treating autoimmune diseases such as psoriasis. The researchers sought to evaluate the effectiveness of this MTX-loaded nanogel using an animal model of psoriasis, which is a chronic inflammatory skin condition characterized by thickened, scaly skin patches.	[15]
4	Hydrogel	These nanostructures possess a neutral to slightly negative net charge, with a particle size of less than 60 nanometers and an inert surface modified with a polyethylene glycol (PEG)-based coating. The hydrophobic immunosuppressive medication Tacrolimus (TAC) is a high payload on nanocarriers.	The study aimed to develop a TAC hydrogel composite compositions safely and effectively deliver medication directly to inflammatory lesions. They showed comparable therapeutic effectiveness to clobetasol propionate in a model of psoriasis-like inflammation.	[16]
5	Topical Gel	Nano-sized colloidal carriers can solubilize water-insoluble medications, extend release, and improve drug bioavailability by altering pharmacokinetic factors.	According to this study, the produced nanosponge loaded topical gel formulation offers a promising approach for the efficient management of PsA by providing better drug solubility, sustained release, and therapeutic potential.	[17]
6	Micro-emulsion	Using a combination of low and high energy techniques, the author introduce a new way for creating microemulsions. Using Quality by Design approaches, the microemulsion's composition and production characteristics were optimized.	According to this study, microemulsions represent a promising new method for delivering tacrolimus to the skin. The author produced stable microemulsions with small droplet sizes using low-energy emulsification and microfluidization. These microemulsions can be used to administer poorly soluble	[18]

			medications. This is the first publication on optimizing microemulsion manufacturing using QbD-driven microfluidization.	
7	Lipid-Based Formulation	The BCT-OS formulation enhances drug delivery through a nanostructured lipid system that penetrates the skin barrier, provides sustained release, and ensures localized action.	In this study the BCT-OS formulation offers a breakthrough for treating psoriasis by providing localized benefits and avoiding systemic side effects. This is especially true for individuals who suffer negative effects from systemic medications.	[19]
8	Nano-structured lipid carriers	The Acitretin NLCs gel delivers acitretin directly to psoriatic skin in a controlled manner. Acitretin regulates abnormal skin cell proliferation and inflammation, while NLCs enhance skin penetration and sustain drug release, leading to effective, localized psoriasis treatment with fewer systemic side effects.	The results of this study unequivocally show that Acitretin–NLCs gel has a promising function in treating psoriasis.	[8]
9	Emulgel	Method through which tea tree oil acts beneath the skin layer to perhaps reduce the normal inflammatory response in diseases like psoriasis.	The author has created transdermal formulations loaded with curcumin with the goal of improving transdermal drug delivery and efficacy while investigating any possible synergistic effects of tea tree oil and curcumin together.	[20]
10	Nano-emulgel	Patients who are uncomfortable with injections or oral drugs will prefer the non-invasive delivery approach offered by nanoemulgels. This improves patient convenience and compliance.	The novel approach to treating dandruff and scalp psoriasis involves the creation of a nanoemulgel infused with C. odorata essential oil. This innovative method stands out due to its unique combination of the therapeutic properties of C. odorata essential oil and the advanced delivery system of a nanoemulgel. By harnessing the potential of this synergy, the author was able to provide sustained therapeutic benefits and enhanced efficacy in the treatment of these conditions.	[21]
11	Liposomes	Cyclosporine treats psoriasis by specifically preventing T-cell activation.	The current study uses an imiquimod-induced plaque psoriatic model to create, characterize, and investigate in vivo the effectiveness of liposome therapy for the treatment of psoriasis. This study suggests using cationic liposomes as a CYC drug delivery mechanism to treat topical psoriasis.	[22]
12	Micro emulsion and hydrogel	MTX exerts its antipsoriatic effect through the inhibition of keratinocyte proliferation and the reduction of inflammatory cytokine production. The incorporation of MTX into a gel form facilitates sustained release and improved skin	The study shows O/W micro emulsion formulations were assessed to propose a topical formulation by enhancing MTX action, and gel form was tested to compare as a possible application option.	[23]

		adherence.		

Pathophysiology

The rapid proliferation of keratinocytes in individuals with psoriasis results in an accelerated movement from the stratum basal to the upper epidermal layer, typically occurring within a 4 day timeframe[24]. Consequently, the skin's inability to efficiently shed these cells leads to the formation of thick, dry patches or plaques. Psoriasis can manifest in varying degrees of severity, ranging from a mild, almost imperceptible condition to a widespread, severely debilitating form characterized by scaly, thick, and red skin. Notably, psoriasis can affect individuals across all age groups, although it is most commonly diagnosed during adolescence. Other contributing factors to the development of psoriasis include genetic predisposition, genetic mutations, and environmental influences such as climate, psychological stress, potential contagion, and skin trauma. Following are the steps that explain the (Fig. 1) given below, illustrating the immunopathogenesis of psoriasis:

1.) Activated antigen-presenting cells (APCs) migrate to lymph nodes, where they utilize signals 1 and 2 to interact with and activate naive CD45+ T lymphocytes.

2.) The activation of CD45+ T cells results in the secretion of proinflammatory cytokines, which in turn stimulate the proliferation of these cells and their differentiation into memory T cells and T1 central effect cells.

3.) The expression of cutaneous lymphocyte-associated antigen (CLA) on the surface of memory T cells enables them to travel via the bloodstream and reach the skin.

4.) Chemotactic factors released by the inflammatory zone attract T cells and facilitate their interaction with endothelial cells, leading to T cell extravasation.

5.) Proinflammatory cytokines produced by infiltrating T lymphocytes induce keratinocyte hyperproliferation and increased chemotactic factor synthesis.

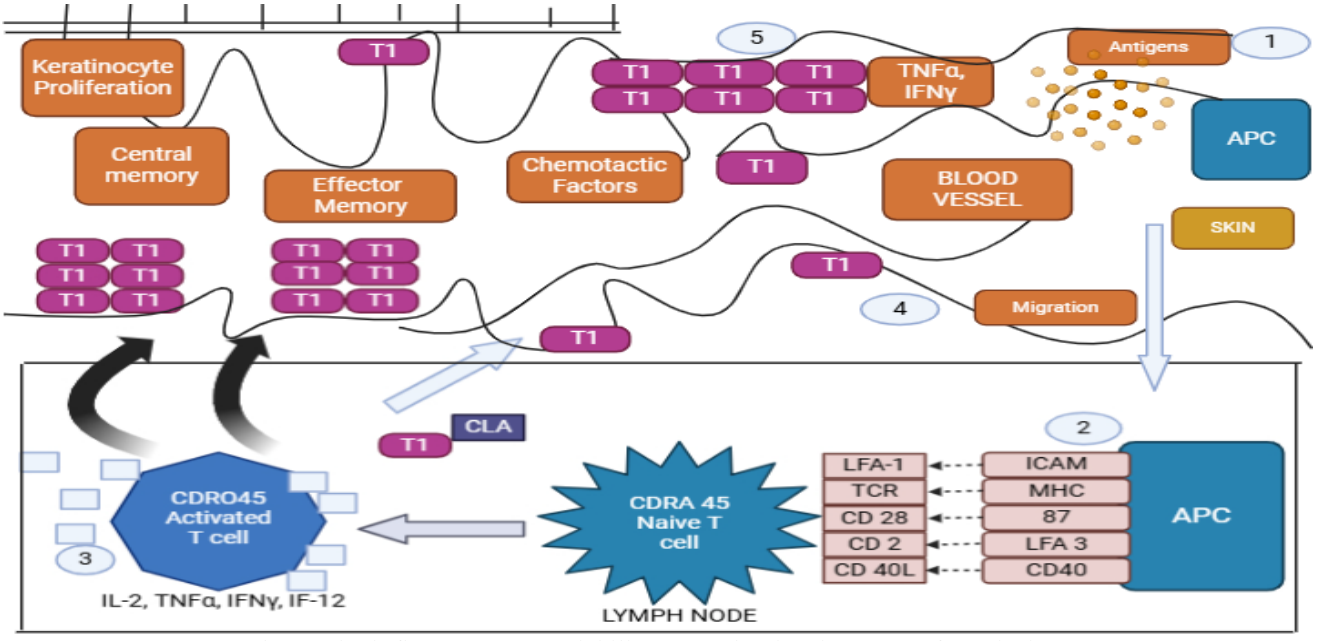

Fig 2: The inflammatory model illustrates the development of psoriasis.

Epidemiology

The global distribution of the disease exhibits significant variability, influenced by both racial and geographical factors. Notably, the highest prevalence rates are observed in Norway and the Arctic regions, ranging from 5-12% of the population. In contrast, the intermediate prevalence in Northern Europe and the USA is approximately 3%, while Central Europe exhibits a lower rate of 1.5%. The disease is relatively rare among Asian populations, as well as among North American Indians and Africans from the Western region, with prevalence rates ranging from 0-0.3%. Onset of the disease occurs at any age; occurrence of the condition is reported both in a newborn baby with

the disease and also in old ages. Psoriasis is equally present in both sexes. These nanostructures possess a neutral to slightly negative net charge due to their inert PEG-based surface and a particle size of less than 60 nm[3,25-28]. Psoriasiform drug eruptions, new-onset psoriasis, and exacerbation of pre-existing psoriasis have all been linked to various medications (Fig. 2).

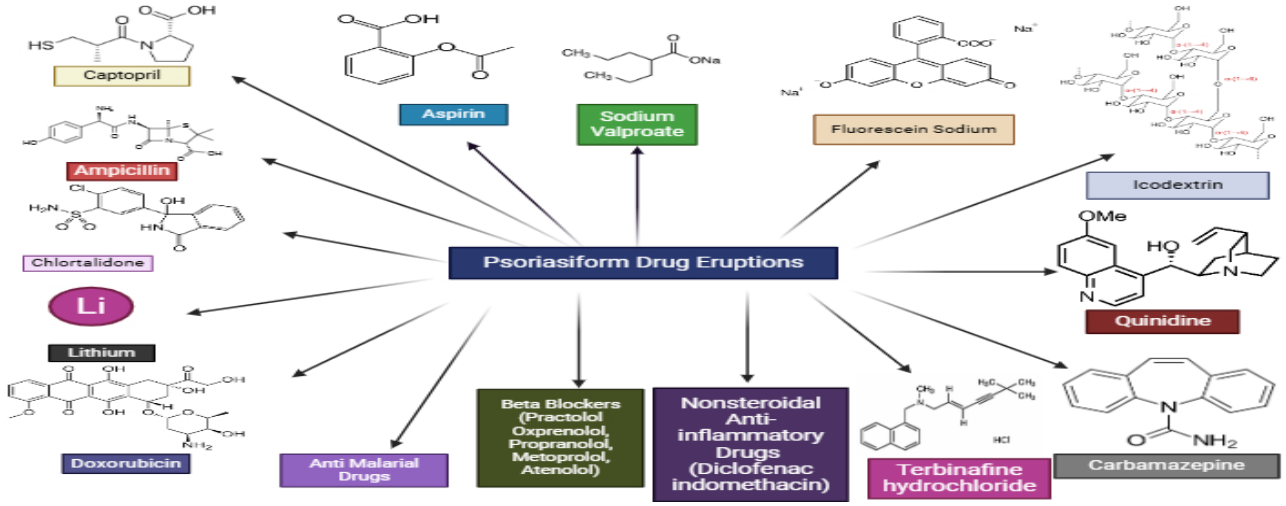

Fig 3: Medications associated with psoriasiform drug eruptions and exacerbation of psoriasis

Genetics of Psoriasis

The inheritance pattern of psoriasis is not well defined and seems to vary. In cases where both parents are suffering from the disease, about 50% of siblings suffer from psoriasis; the figure decreases to 16% in cases where only one parent is suffering and further declines to 8% in cases where neither parent suffer from the disease. Up to 72% of children with psoriasis have a family history of the condition[25,27]. The genetic factors involved in susceptibility to this disease include:

A. Psoriasis Susceptibility genes

The disease's genetic predisposition has been linked to 19 distinct potential loci thus far. Both PSORS9 and PSORS1-7, are found on separate chromosomes. No designation has been made for the remaining loci yet. Particularly noteworthy are the genes found in the sections of particular chromosomes that are connected to HLA and TNF, an immune factor that is closely linked to psoriasis.

B. Human leukocyte antigen Molecules

All autoimmune diseases use mechanisms involving the HLA system, which is subject to genetic governance. The fundamental role of HLA molecules is to capture particular fragments of antigens in a selective manner and to expose these to the cell surface so that parts of the immune system may recognize and clear them out. This system, in one way or another, is somehow broken in most immunological diseases, including psoriatic arthritis.

Exacerbating factors for psoriasis

As explained below, a number of circumstances, including environmental conditions, triggers, certain medications, chemicals, and weather, might cause the dormant dominant gene to express itself.

A. Psychogenic Factors

Psoriasis flare-ups are closely linked to stress, suppressed rage, and emotional illnesses like anxiety and depression.

B. Infection

Some cases of psoriasis can be brought on by bacterial infections (such as *Helicobacter pylori* infection and streptococcal infection) or viral infections (such as HIV 29 and human papillomaviruses, HPV).

C. Drugs

Chloroquine, an antimalarial medication; ACE inhibitors; progesterone used in female hormone treatments; lithium; beta blockers; indomethacin (a nonsteroidal anti-inflammatory drug (NSAID)); interferons; tetracyclines; and corticosteroid withdrawal are some of the medications that can exacerbate or trigger pre-existing latent psoriasis.

D. Obesity

The pathogenesis of psoriasis and obesity is connected because a network of pro-inflammatory cytokines, particularly TNF-α, are crucial

E. Endocrine Factors
Psoriasis is most common throughout adolescence and menopause, and it can be made worse by pregnancy, the premenstrual cycle, or elevated estrogen levels.

F. Environmental Initiators
While most patients find that hot, humid, sunny weather helps to alleviate their psoriasis, cold, dry weather frequently triggers flare-ups. Some people's psoriasis flares up and becomes better when they are exposed to sunlight.

G. Metabolic Factors
Psoriasis may be triggered by hypocalcemia.

H. Smoking and Alcohol
While smoking appears to be more strongly linked to psoriasis in women, alcohol appears to have a bigger impact on the development of psoriasis in men.

I. Köbner Response affecting skin injuries
Psoriasis appears later at the location of skin damage in the Köbner response, which is a delayed reaction. Even minor abrasions can occasionally result in an eruption, which could contribute to the prevalence of elbow or knee psoriasis. Surgical trauma might worsen psoriasis that already exists[29, 30].

Conventional topical treatment of psoriasis
For mild to moderate psoriasis, topical therapy is usually considered the first line of treatment. In contrast, moderate to severe psoriasis may also be treated with creams, gels, and ointments that contain anti-psoriatic active ingredients. However, these are often used in combination with other therapies, such as systemic therapy or phototherapy. Corticosteroids are a widely prescribed and effective class of drugs for treating psoriasis symptoms, primarily due to their ability to significantly reduce inflammation and immunological reactions in the skin. The most common way to treat psoriasis with corticosteroids is through topical application, which involves applying the medication directly onto the skin[16,31-33]. Given below are the various available treatments of different types of psoriasis based on data compiled from various research and review articles are presented in Table 2.

Table 2: Various available treatments of different types of psoriasis

S.No.	Psoriasis Type	Drug	Treatment Category	References
1	**Plaque Psoriasis (Mild–Mod)**	Clobetasol propionate	Topical corticosteroid	[33]
2	**Plaque Psoriasis (Topical)**	Tapinarof	AhR agonist topical	[34]
3	**Plaque Psoriasis (Systemic)**	Methotrexate	Oral systemic DMARD	[35]
4	**Plaque Psoriasis (Systemic)**	Acitretin	Oral systemic retinoid	[36]
5	**Plaque Psoriasis (Systemic)**	Apremilast	Oral PDE-4 inhibitor	[37]
6	**Plaque Psoriasis (Biologics)**	Etanercept, Infliximab, Adalimumab	TNF-α inhibitors	[38]
7	**Plaque Psoriasis**	Tofacitinib	Oral JAK1/3 inhibitor	[39]

Latest patents
Recent patents have been reviewed, and they are based on topical formulations utilized for the treatment of psoriasis, as illustrated in Table 3.

Table 3: Patent on Psoriasis

S.No.	Patent Number	Title	Year	Assignee
1	US20050003023A1	Topical treatments for psoriasis and related skin disorders.	**2006**	Lorraine Meisner
2	WO2001083031A2	The topical composition designed for the treatment of psoriasis and associated skin conditions.	**2008**	Lorraine F. Meisner
3	AU-B-28218/95	Stable gel formulation for topical treatment of skin conditions	**2009**	Prakash M Charu
4	US4294852A	Skin treating compositions.	**2013**	Richard H. Wildnauer, William T. Humphries

5	US6217914B1	Composition and method of ascorbic acid for aging or damaged skin treatment.	**2017**	Lorraine Faxon Meisner
6	ES2396775R1	Therapeutic composition for the treatment of psoriasis	**2019**	Vicea Maria Isabel Penalver
7	US6319392B1	Coal tar extract with reduced aromatic hydrocarbon content and methods and compositions for its use.	**2020**	Roger Navarro
8	AU2003260695A1	Psoriasis formulation and method of preparation	**2021**	Edward Houston
9	US4473551A	Anti-inflammatory composition	**2025**	Michael Schinitsky
10	US 12,016,848 B2	Roflumilast formulations with enhanced pharmacokinetic properties.	**2025**	David Osborne

CONCLUSION

The way that psoriasis therapy has changed throughout the years is a testament to the progress that has been made in diagnosing and treating this condition. There was much discussion of both intrinsic and extrinsic risk factors for the onset of psoriasis. Psoriasis treatment has undergone a significant transformation thanks to biologics. On the other hand, disease control also depends on removing the risk factors. This advancement has been made possible in large part by a cooperative strategy involving patients, physicians, researchers, and the pharmaceutical industry. While there is currently no known cure for psoriasis, some people can now realistically hope to completely eradicate the condition with the use of the most recent biologic treatments. More effective topical treatments and a wider use of biosimilars are still needed, despite significant advancements in systemic therapy for psoriasis. Concepts like early intervention with systemic therapy and better access to care are being discussed more and more. Here is where research and service development meet, necessitating creative strategies and research techniques to meet this objective.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ACKNOWLEDGEMENT

The authors acknowledge the support and facilities provided by the Chairman of SRMS Trust, Bareilly.

FUNDING

This research was not supported by any specific grant from public, commercial, or not-for-profit funding agencies.

REFERENCES

1. Pandey S, Tripathi P, Gupta A, Yadav JS. A comprehensive review on possibilities of treating psoriasis using dermal cyclosporine. Drug Deliv and Transl Res. 2022 Jan 1;12:1541–55. doi: 10.1007/s13346-021-01059-5.
2. Sieminska I, Pieniawska M, Grzywa TM. The Immunology of Psoriasis—Current Concepts in Pathogenesis. Clinic Rev Allerg Immunol. 2024 Jan 1;66:164–91. doi: 10.1007/s12016-024-08991-7.
3. Greb JE, Goldminz AM, Elder JT, Lebwohl MG, Gladman DD, Wu JJ, et al. Psoriasis. Nat Rev Dis Primers. 2016 Jan 1;2:16082. doi: 10.1038/nrdp.2016.82.
4. Armstrong AW, Read C. Pathophysiology, Clinical Presentation, and Treatment of Psoriasis: A Review. JAMA. 2020 Jan 1;323:1945. doi: 10.1001/jama.2020.4006.
5. Chong HT, Kopecki Z, Cowin AJ. Lifting the Silver Flakes: The Pathogenesis and Management of Chronic Plaque Psoriasis. BioMed Research International. 2013 Jan 1;2013:1–9. doi: 10.1155/2013/168321.
6. Venegas-Iribarren S, Andino R. Topical corticosteroids or vitamin D analogues for plaque psoriasis? Medwave. 2017 Jan 1;17:e6981–e6981. doi: 10.5867/medwave.2017.6981.
7. Khan BA, Ahmad N, Alqahtani A, Baloch R, Rehman AU, Khan MK. Formulation development of pharmaceutical nanoemulgel for transdermal delivery of feboxostat: Physical characterization and in vivo evaluation. European Journal of Pharmaceutical Sciences. 2024 Jan 1;195:106665. doi: 10.1016/j.ejps.2023.106665.
8. Agrawal YO, Mahajan UB, Mahajan HS, Ojha S. Methotrexate-Loaded Nanostructured Lipid Carrier Gel Alleviates Imiquimod-Induced Psoriasis by Moderating Inflammation: Formulation, Optimization, Characterization, In-Vitro and In-Vivo Studies. IJN. 2020 Jan 1;15:4763–78. doi: 10.2147/IJN.S247007.
9. Gungor S, Rezigue M. Nanocarriers Mediated Topical Drug Delivery for Psoriasis Treatment. Current Drug Metabolism. n.d.;18:454–68. doi: 10.2174/1389200218666170222145240.
10. Tapeinos C, Battaglini M, Ciofani G. Advances in the design of solid lipid nanoparticles and nanostructured lipid carriers for targeting brain diseases. Journal of Controlled Release. 2017 Jan 1;264:306–32. doi: 10.1016/j.jconrel.2017.08.033.
11. Jenning V, Gysler A, Schäfer-Korting M, Gohla

SH. Vitamin A loaded solid lipid nanoparticles for topical use: occlusive properties and drug targeting to the upper skin. European Journal of Pharmaceutics and Biopharmaceutics. 2000 Jan 1;49:211–8. doi: 10.1016/S0939-6411(99)00075-2.
12. Kamel AE, Fadel M, Louis D. Curcumin-loaded nanostructured lipid carriers prepared using Peceol™ and olive oil in photodynamic therapy: development and application in breast cancer cell line. IJN. 2019 Jan 1;14:5073–85. doi: 10.2147/IJN.S210484.
13. Jenabikordi K, Zadeh BSM, Rezaie A. Co-encapsulation of metformin and ginger into the liposomes: in vitro characterization and in vivo anti-psoriasis evaluation. Drug Development and Industrial Pharmacy. 2021 Jan 1;47:1447–58. doi: 10.1080/03639045.2021.2001488.
14. Chandra A, Aggarwal G, Manchanda S, Narula A. Development of Topical Gel of Methotrexate Incorporated Ethosomes and Salicylic Acid for the Treatment of Psoriasis. PNT. 2019 Jan 1;7:362–74. doi: 10.2174/2211738507666190906123643.
15. Avasatthi V, Pawar H, Dora CP, Bansod P, Gill MS, Suresh S. A novel nanogel formulation of methotrexate for topical treatment of psoriasis: optimization, in vitro and in vivo evaluation. Pharm Dev Technol. 2016 Jan 1;21:554–62. doi: 10.3109/10837450.2015.1026605.
16. Gabriel D, Mugnier T, Courthion H, Kranidioti K, Karagianni N, Denis MC, et al. Improved topical delivery of tacrolimus: A novel composite hydrogel formulation for the treatment of psoriasis. Journal of Controlled Release. 2016 Jan 1;242:16–24. doi: 10.1016/j.jconrel.2016.09.007.
17. Hani U, Paramshetti S, Angolkar M, Alqathanin WK, Alghaseb RS, Al Asmari SM, et al. Cyclodextrin-Nanosponge-Loaded Cyclo-Oxygenase-2 Inhibitor-Based Topical Gel for Treatment of Psoriatic Arthritis: Formulation Design, Development, and In vitro Evaluations. Pharmaceuticals. 2024 Jan 1;17:1598. doi: 10.3390/ph17121598.
18. Srishti SA, Pinky PP, Taylor R, Guess J, Karlik N, Janjic JM. Quality by Design (QbD)-Driven Development and Optimization of Tacrolimus-Loaded Microemulsion for the Treatment of Skin Inflammation. Pharmaceutics. 2024 Jan 1;16:1487. doi: 10.3390/pharmaceutics16121487.
19. Mohammadi-Meyabadi R, Mallandrich M, Beirampour N, Garrós N, Espinoza LC, Sosa L, et al. Lipid-Based Formulation of Baricitinib for the Topical Treatment of Psoriasis. Pharmaceutics. 2024 Jan 1;16:1287. doi: 10.3390/pharmaceutics16101287.
20. Reena K, Mittal S, Faizan M, Jahan I, Rahman Y, Khan R, et al. Enhancement of Curcumin's Anti-Psoriatic Efficacy via Formulation into Tea Tree Oil-Based Emulgel. Gels. 2023 Jan 1;9:973. doi: 10.3390/gels9120973.
21. Alam P, Imran M, Ali A, Majid H. Cananga odorata (Ylang-Ylang) Essential Oil Containing Nanoemulgel for the Topical Treatment of Scalp Psoriasis and Dandruff. Gels. 2024 Jan 1;10:303. doi: 10.3390/gels10050303.
22. Walunj M, Doppalapudi S, Bulbake U, Khan W. Preparation, characterization, and in vivo evaluation of cyclosporine cationic liposomes for the treatment of psoriasis. Journal of Liposome Research. 2020 Jan 1;30:68–79. doi: 10.1080/08982104.2019.1593449.
23. Levent Alparslan A, Karasulu E, Türkyilmaz GY, Uvey D. O/W microemulsion and hydrogel formulation of methotrexate and comparison of releasing studies. Jrp. 2023 Jan 1;27(2):873–82. doi: 10.29228/jrp.367.
24. Ortonne. Recent developments in the understanding of the pathogenesis of psoriasis. Br J Dermatol. 1999 Jan 1;140:1–7. doi: 10.1046/j.1365-2133.1999.140S54001.x.
25. Raut AS, Prabhu RH, Patravale VB. Psoriasis Clinical Implications and Treatment: A Review. 2013 Jan 1;30. doi: 10.1615/critrevtherdrugcarriersyst.2013005268
26. Gelfand JM, Stern RS, Nijsten T, Feldman SR, Thomas J, Kist J, et al. The prevalence of psoriasis in African Americans: Results from a population-based study. Journal of the American Academy of Dermatology. 2005 Jan 1;52:23–6. doi: 10.1016/j.jaad.2004.07.045.
27. Mahil SK, Capon F, Barker JN. Genetics of Psoriasis. Dermatologic Clinics. 2015 Jan 1;33:1–11. doi: 10.1016/j.det.2014.09.001.
28. Langley RGB, Krueger GG, Griffiths CEM. Psoriasis: epidemiology, clinical features, and quality of life. Annals of the Rheumatic Diseases. 2005 Jan 1; 64:ii18–23. doi: 10.1136/ard.2004.033217.
29. Raut AS, Prabhu RH, Patravale VB. Psoriasis Clinical Implications and Treatment: A Review. Crit Rev Ther Drug Carrier Syst. 2013 Jan 1; 30:183–216. doi: 10.1615/CritRevTherDrugCarrierSyst.2013005268.
30. Bodnár K, Fehér P, Ujhelyi Z, Bácskay I, Józsa L. Recent Approaches for the Topical Treatment of Psoriasis Using Nanoparticles. Pharmaceutics. 2024 Jan 1;16:449. doi: 10.3390/pharmaceutics16040449.
31. Fereig SA, El-Zaafarany GM, Arafa MG, Abdel-Mottaleb MMA. Tackling the various classes of nano-therapeutics employed in topical therapy of psoriasis. Drug Delivery. 2020 Jan 1;27:662–80. doi: 10.1080/10717544.2020.1754527.
32. Uva L, Miguel D, Pinheiro C, Antunes J, Cruz D, Ferreira J, et al. Mechanisms of Action of Topical Corticosteroids in Psoriasis.

International Journal of Endocrinology. 2012 Jan 1;2012:1–16. doi: 10.1155/2012/561018.
33. Bhutani T, Koo J, Maibach HI. Efficacy of clobetasol spray: Factors beyond patient compliance. Journal of Dermatological Treatment. 2012 Jan 1;23:11–5. doi: 10.3109/09546634.2010.512952.
34. Samarasekera EJ, Sawyer L, Wonderling D, Tucker R, Smith CH. Topical therapies for the treatment of plaque psoriasis: systematic review and network meta-analyses. Br J Dermatol. 2013 Jan 1;168:954–67. doi: 10.1111/bjd.12276.
35. Czarnecka-Operacz M, Sadowska-Przytocka A. The possibilities and principles of methotrexate treatment of psoriasis – the updated knowledge. Pdia. 2014 Jan 1;6:392–400. doi: 10.5114/pdia.2014.47121.
36. Zhu B, Jing M, Yu Q, Ge X, Yuan F, Shi L. Treatments in psoriasis: from standard pharmacotherapy to nanotechnology therapy. Advances in Dermatology and Allergology. n.d. doi:10.5114/ada.2021.108445
37. Forchhammer S, Ghoreschi K. Update on the treatment of psoriasis and psoriatic arthritis – role of apremilast. n.d. doi:10.2147/PTT.S69476
38. Alzahrani SA, Alzamil FM, Aljuhni AM, Thaqfan NAA, Alqahtani NY, Alwarwari SA, et al. A Systematic Review Evaluating the Effectiveness of Several Biological Therapies for the Treatment of Skin Psoriasis. n.d. doi: 10.7759/cureus.50588
39. Wang T, Wu W, Zhang X, Gan B, Zhou Y, Cheng X. Tofacitinib treatment for plaque psoriasis and psoriatic arthritis: A meta-analysis of randomised controlled trials. n.d. doi: 10.25259/IJDVL_14_2024.

