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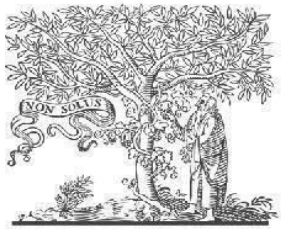

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NANOSTRUCTURED FORMULATIONS FOR TREATING PSORIASIS: A COMPREHENSIVE REVIEW

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Abstract:

Psoriasis is a chronic inflammatory skin disorder affecting approximately 2–5% of the global population, characterized by frequent recurrence. Current therapeutic options, though numerous, often prioritize symptom management over complete cure, necessitating ongoing treatment and compromising patient compliance. Innovative pharmacological approaches or delivery mechanisms that can safely and effectively manage psoriasis are therefore crucial. Nanocarrier-based formulations offer a promising solution by enhancing efficacy, reducing dosage, frequency of administration, and dose-related side effects compared to traditional treatments. These formulations leverage nanosized molecules to improve bioavailability and target delivery of poorly soluble active ingredients to affected areas. This study reviews recent advancements in lipid-based, polymer-based, and metallic anti-psoriatic drug compositions, alongside insights into traditional therapies. Various nanocarrier systems such as liposomes, transferosomes, ethosomes, nanostructured lipid carriers, nanoemulsions, solid lipid nanoparticles, nanocapsules, micelles, dendrimers, gold, and silver nanoparticles are evaluated for their potential in psoriasis treatment. Nano-formulations continue to emerge as promising therapeutic options for managing psoriasis effectively and safely.

Keywords: Nanoformulations, pathogenesis, psoriasis,

Introduction:

Psoriasis affects approximately 0.5-0.1% of children and 2-3% of adults worldwide, presenting as a chronic, autoimmune inflammatory condition characterized by recurring skin plaques that are erythematous, scaling, and localized [1]. Beyond its impact on the skin, psoriasis is associated with various comorbidities such as diabetes, hyperlipidemia, asthma, ischemic heart disease, psoriatic arthritis, peptic ulcer, hepatitis B or C, endocrine and metabolic disorders, and cardiovascular diseases [2]. These conditions contribute to physical stigmatization, exacerbating psychological distress in social, emotional, and professional aspects of patients' lives.

Treatment options for psoriasis include topical therapy, phototherapy, and systemic therapy. Topical treatments are typically recommended as initial therapy for mild cases, while severe cases may require systemic or phototherapy approaches [3]. Despite the availability of

diverse treatments, none offer a definitive cure for psoriasis. Conventional topical formulations are hindered by challenges such as poor patient compliance, frequent dosing requirements, limited drug penetration, and potential side effects [4]. Systemic medications and phototherapy can also lead to adverse effects like skin cancer, liver toxicity, renal toxicity, and hypertension, further complicating treatment options.

1.1 Pathogenesis of Psoriasis:

Psoriasis is characterized by severe autoimmune-mediated dermatitis driven by dominant Th1 and Th17 cells, abnormal epithelial stratification, and epithelial hypertrophy [5]. It is considered more than a skin disorder, resembling a complex clinical syndrome [6]. The autoimmune nature involves activation of multiple T cells and lymphocytes, contributing to skin inflammation and hyperproliferation of keratinocytes (HaCaT). While T cell activation is pivotal in psoriasis development, it does not fully explain all disease aspects. Psoriasis pathogenesis involves a cascade of events with various mediators and cellular interactions, including keratinocytes, neutrophils, macrophages, and B cells [7]. Platelet interactions with lymphocytes, observed in animal models and inflammatory diseases, underscore the systemic inflammatory component of psoriasis, despite unclear roles in patient lesions [8]. Modulation of pro-inflammatory cytokines like tumor necrosis factor (TNF-α), interleukin-1 (IL-1), and interferons (IFNs) class I influences psoriasis lesion severity and type [9]. Plaque psoriasis, the most prevalent form, showcases varying severity and manifestations among affected individuals.

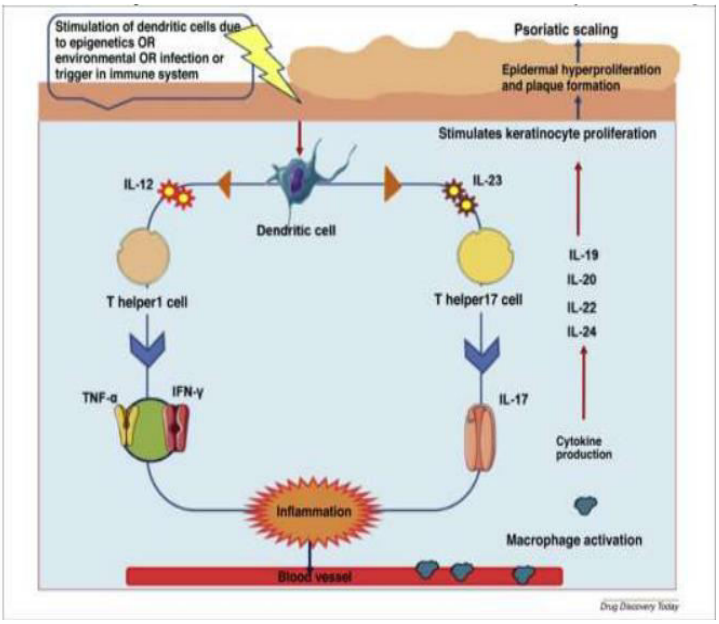

Fig. 1. Pathophysiological mechanism of psoriasis.[10]

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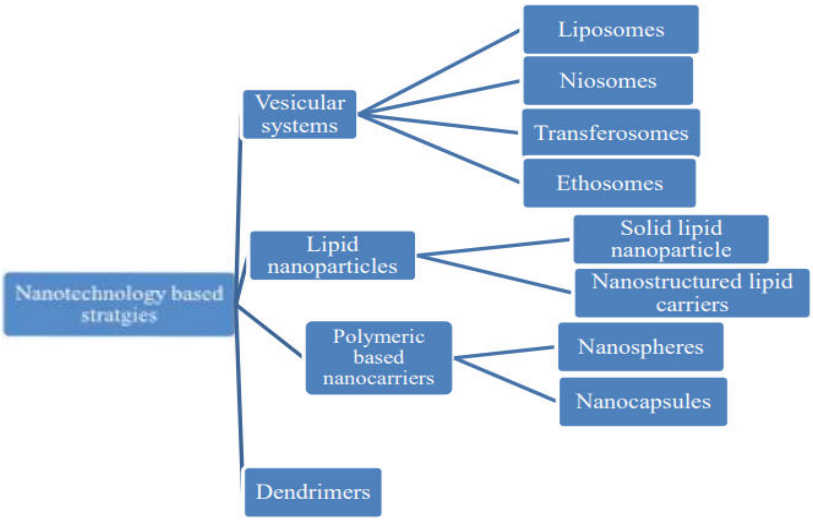

Fig.2. Different nanotechnology-based strategies for topical treatment of psoriasis

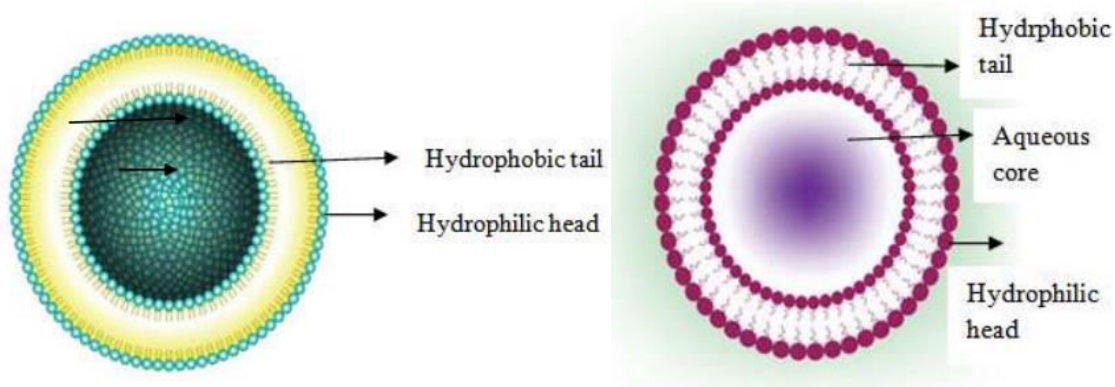

Figure 3: Structure of Liposome & Niosomes

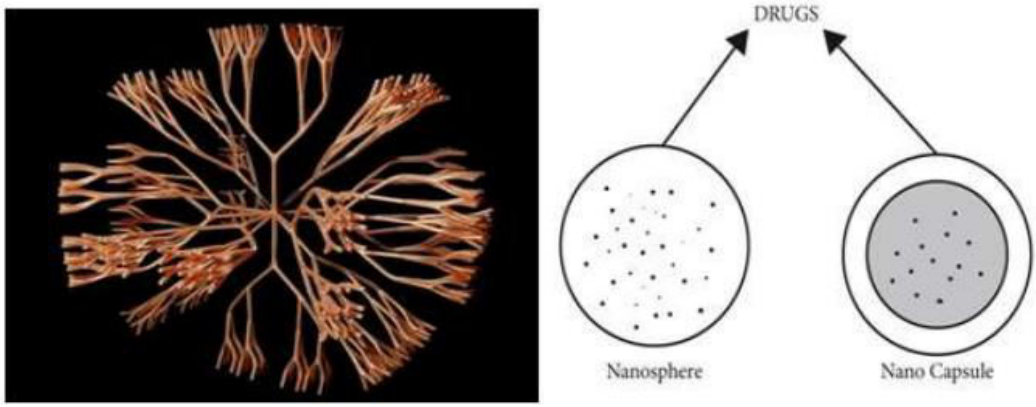

Figure 4: Structure of Dendrimer & Nanocaspsules

Conclusion:

Psoriasis, characterized by excessive cell proliferation, is influenced by genetic and environmental factors. Treatments include topical, systemic non-biologic, systemic biologic, and phototherapy options. Despite the variety of available therapies, topical treatments

remain the most practical for delivering medications through the skin barrier. Lipid-based nanoparticles, such as liposomes and nanoemulsions, show promise as innovative methods to enhance drug delivery to target sites. Research indicates these lipid nanocarriers effectively encapsulate various APIs and improve skin penetration, retention, and sustained release, particularly benefiting psoriasis lesion alleviation. Continued exploration into alternative lipid-based nanocarrier designs like ethosomes, transfersomes, and niosomes is crucial to fully unlock their potential in topical antipsoriatic therapy.

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