NEWS, VIEWS, AND REVIEWS

Cannabidiol in Dermatology: Progress and Pitfalls

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INTRODUCTION

Cannabidiol (CBD), a non-psychostimulatory compound from *Cannabis sativa*, has gained increasing attention in dermatology over the past decade.[1] Despite its growing popularity and clinical evidence for dermatologic applications, CBD-containing topical products have struggled to gain retailer acceptance.[2] This review aims to provide an update on the clinical applications of CBD in dermatology and to discuss barriers that restrict its marketability.

Background

CBD primarily acts on G-protein-coupled cannabinoid receptors CB1 (CB1R) and CB2 (CB2R), found on cutaneous nerves, mast cells, and keratinocytes.[3] When activated, these receptors initiate an intracellular cascade that modulates an immune response, most notably, enhancing adenosine A2A receptor activity, which downregulates immune cells and reduces inflammation.[3]

Existing literature has supported CBD's role in the treatment of acne vulgaris, chronic pruritus, asteatotic eczema (AE), and atopic dermatitis (AD). For instance, Olah et al demonstrated CBD's role in acne vulgaris management by demonstrating its inhibition of sebocyte lipogenesis and NF-κB-driven inflammation in vitro.[3] Additionally, a small split-face trial revealed that topical 3% cannabis seed extract reduced sebum production and erythema over a 12-week study period.[3] Other studies focused on CBD's role in AE and AD primarily due to its antipruritic properties.[3] It is postulated that these effects result from the inhibition of inflammatory mediators via NF-κB attenuation and the modulation of peripheral nerve function. Current literature supports CB1Rs' role in reducing inflammation, but further investigation is warranted.[3]

Recent literature has focused on the antioxidant, UV-protective, and wound-healing properties of CBD, as well as the application of nanoformulated CBD products. We herein provide an update on the application of CBD in these recently studied areas and discuss the hurdles to promoting and accessing CBD-based skincare.

Antioxidant and UV-Protective Effects

CBD's antioxidant properties have further enhanced its public appeal and application in skincare. Antioxidants protect the skin from oxidative stress, which causes premature aging and environmental damage.[4] Studies have demonstrated that CBD activates regulators of the cellular antioxidant response, such as nuclear factor erythroid 2-related factor 2 (Nrf2), heme oxygenase 1, and peroxisome proliferator-activated receptor gamma.[4,6] Nrf2 reduces UV-induced cell death in keratinocytes and melanocytes, decreases reactive oxygen species (ROS), and enhances the levels of antioxidants, vitamins A and E.[4]

In 2024, the first human clinical trial demonstrated the UV-protective properties of topical nanoformulated CBD, providing evidence that supports CBD's potential to mitigate damage from photocarcinogenesis, inflammation, and oxidative stress.[6] Among nineteen participants, the trial identified a significant reduction in observed erythema, histologic epidermal hyperplasia, and nuclear and mitochondrial DNA mutations on CBD-treated skin compared to vehicle cream after UV-A irradiation.[6]

Wound Healing/Surgical Application

Kong et al. present recent evidence supporting CBD's role in wound healing and highlight its potential benefits in post-surgical recovery and the management of chronic wounds.[7] CBD influences fibrinogenesis, re-epithelialization, and inflammation modulation.[7] In murine models, CB2 receptor expression during wound healing suggests an intrinsic role for the endocannabinoid system in skin repair.[7]

Case reports in patients with epidermolysis bullosa reveal accelerated wound closure, decreased blister formation, and reduced pain with topical CBD, further highlighting its regenerative and analgesic potential in dermatologic surgery.[7]

Nanoformulated Delivery Systems

To enhance topical efficacy, advanced formulations are exploring the encapsulation of CBD within nanoparticles, such as lipid nanoparticles and nanomicelles. These delivery systems improve dermal penetration, provide sustained release, and enhance bioavailability.[1]

Nanoformulated CBD has shown promise in treating acne, psoriasis, and eczema, with studies demonstrating improved absorption, decreased inflammation, and enhanced patient compliance.[1]

A 2025 analysis of sixteen studies from 2014 to 2019 identified improved skin delivery, tolerability, and sustained release in nanoformulated CBD compared to traditional formulations.[1]

Several studies have assessed the lipid nanoparticle and nanostructure formulations of CBD, demonstrating enhanced skin penetration with high-certainty evidence of stability and safety. Various animal models support its benefits in wound healing and inflammation. These technologies could optimize the delivery of CBD to specific skin layers, potentially increasing therapeutic efficacy and reducing systemic exposure.[1]

Marketplace Hurdles

Despite the expanding literature on the promising potential of CBD in dermatology, CBD-containing products have struggled to gain market acceptance. Brand owners developing CBD products experience restrictions and backlash from retailers, which has impeded their ability to thrive in the market.[2]

The sale of CBD-containing skincare products experienced significant growth from 2018 to 2021, following the enactment of the 2018 Farm Bill, which removed hemp-containing products, including CBD with less than 0.3% Δ9-THC, the psychoactive ingredient, from the definition of marijuana under the Controlled Substances Act.[2] This act federally legalized CBD, but did not remove FDA oversight. However, sales plummeted from 2021 to 2023 and have slowly been increasing since the enactment of the Modernization of Cosmetics Regulation Act (MoCRA) in 2023, which restored retailer confidence in CBD-containing products.[8]

Although topical CBD products are legal in the United States when marketed as cosmetics, many retailers, software systems, and advertising platforms restrict the promotion of CBD products on their platforms. Shopify, Facebook, Instagram, and Amazon have all restricted the sale and marketing of CBD-containing products via shadow banning, a practice that involves partially banning or limiting the visibility of user content without informing them, or outright banning it. Retailers are consequently hesitant to carry CBD-containing products because of the risk of being banned or having their products classified as "sensitive content."[2] Additional barriers to the sale of CBD products include expensive insurance fees, high-risk payment processing, and up to thousands of dollars in state registration fees.[2]

The 2023 enactment of MoCRA further shifted the marketability of CBD skincare products. It more clearly defined the legality of CBD-containing skincare, but simultaneously increased federal regulation of it.[8] The effects of MoCRA have supported high-end CBD skincare brands make their way back to the market; however, they have made it harder for smaller brands to survive past the federal regulatory phase. Altogether, the sales of CBD-containing products have steadily increased over the past year. Still, it is reasonable to suspect that these sales are undermined compared to what they would be without the history of retailer backlash, challenges with online promotion, and federal regulations.

CONCLUSIONS

Current literature supports the role of CBD as an antioxidant, photoprotectant, anti-inflammatory, and wound-healing agent, especially in nanoformulated topicals. With increasing evidence supporting the safety, efficacy, and broad spectrum of dermatologic applications of CBD, it serves as a promising agent in skin care and dermatologic therapy. However, the ability to market and disseminate CBD-containing products remains a challenge, limiting the potential of these products to fully reach and benefit consumers.

DISCLOSURE

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