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"Natural Approaches to Psoriasis: Unlocking the Healing Power of Boswellia and Beyond"

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ABSTRACT
Psoriasis is a chronic autoimmune skin disorder characterized by erythema, scaling, and epidermal hyperplasia. Conventional treatments, including corticosteroids and immunosuppressive agents, often present significant side effects. In this context, Boswellia serrata, a traditional medicinal plant known for its anti-inflammatory and immunomodulatory properties, has emerged as a promising natural alternative. This review explores the antipsoriatic potential of Boswellia serrata ethanolic extract, emphasizing its pharmacological mechanisms, experimental evidence in Wistar rat models, and therapeutic relevance.

Keywords: Psoriasis, Natural remedies, Boswellia serrata, Anti-inflammatory, Holistic treatments, Immunomodulatory, Herbal medicine, Turmeric (Curcumin).

I. INTRODUCTION

Psoriasis is primarily driven by immune dysregulation, involving an interplay between the innate and adaptive immune systems. An estimated 2–4% of people worldwide suffer with psoriasis, a persistent, immune-mediated dermatological disorder [1]. Geographic heterogeneity is evident in the syndrome, with lower prevalence rates in East Asia (<1%) and sub-Saharan Africa and greater prevalence rates recorded in nations like Norway (11.4%) and the United States (2.5–3.5%) [2]. Although there are two typical peaks of beginning for the disease, one occurs in early adulthood (15–25 years) and the other in later adulthood (50–60 years) [3]. Given that psoriasis is more prevalent in people with a family history of the condition, a genetic predisposition plays a key role [4].

According to Pathogenesis (2019), it is characterized by ongoing inflammation that leads to unchecked keratinocyte proliferation and differentiation[5]. According to the International Psoriasis Day Collaboration, 125 million people worldwide—roughly 2-3% of the population—have psoriasis[6].

Research indicates that 10–30% of people with psoriasis also have psoriatic arthritis. This negatively impacts the quality of life for people with psoriasis[7,8].The pathogenesis of psoriasis is yet unknown, however, because T-helper cells are present in the psoriatic state, it is believed to be a T-cell-triggered illness[9].

The two clinical types of psoriasis are inverse psoriasis, guttate psoriasis, pustular psoriasis, erythrodermic psoriasis, and chronic plaque psoriasis (psoriasis vulgaris) [10]. Eighty to ninety percent of psoriasis patients have chronic psoriasis vulgaris. Erythematous, well-defined plaques covered with silvery scales are indicative of psoriasis vulgaris [11].

Itching and reddish, flaky skin patches covered with silver scales are the main symptoms of psoriasis [12]. Tiny scale regions, cracked skin, itching, soreness, corroded or swollen nails, genital and inflammatory sores, stiff joints, and excessive scalp dandruff are other symptoms [13].

Psoriasis is a complicated condition that is impacted by immunological, environmental, and hereditary factors[14].

There are 500–600 species of trees or shrubs, many with spines, in the 17 genera that make up the Burseraceae family. Many of them contain oils, gum resins, or latex, which can have a potent scent.
This family is found in all tropical climates and even the subtropics. In arid lowland parts of Eastern Africa, it frequently makes up the majority of the flora. Several species in this family provide resins that are highly valuable commercially as raw materials for myrrh, balm, and incense[15].Trees or shrubs are Boswellia species. About 75% of the species in the genus Boswellia Roxb. Ex Colber (1807) are indigenous in North-East Africa.One species is found in Madagascar, and there are about

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20 species known to exist in the arid regions of tropical Africa and India[15].

When cut, Boswellia trees release a gum resin that can be collected by scraping the tree's bark[16].The pure white resin of Boswellia trees is either scraped off the tree with an iron tool or gathered on palm mats on the ground as it drips off in Oman, where the trees are grown and cultivated. December marks the start of harvesting, which peaks in March and May[17].

Pathogenesis

A prevalent inflammatory skin illness, psoriasis has a complicated pathogenesis that includes environmental exposures, immunological dysfunction, and a genetic component[18]. Numerous consequences, including as obesity, metabolic syndrome, heart disease, and psoriatic arthritis, are associated with it. Obesity exacerbates pre-existing psoriasis, may increase an individual's psoriasis severity, and seems to be a strong predictor of incident psoriasis[19].

It is an immune system-mediated hereditary skin condition. The pathomechanisms at play entail intricate interactions between the innate and systems that adapt. T cells use the cytokines released by dendritic cells, keratinocytes, and macrophages to communicate with these cells. Environmental causes include things like streptococcal infection, smoking, stress, obesity, and alcohol use[20]. Numerous problems, including as depression, cancer, and cardiovascular disease, are associated with psoriasis. Vitamin D mimics, corticosteroids, and mild to severe psoriasis and tazarotene were successful treatments. Numerous germs can actually cause this ailment, such as the increased levels of Corynebacterium, Propionibacterium, Streptococcus, and Staphylococcus in psoriatic skin[21].

However, in a different study, Corynebacterium, Propionibacterium, Streptococcus, and Staphylococcus were all on the rise whereas Staphylococci were much reduced in lesional skin when compared to healthy controls[22].

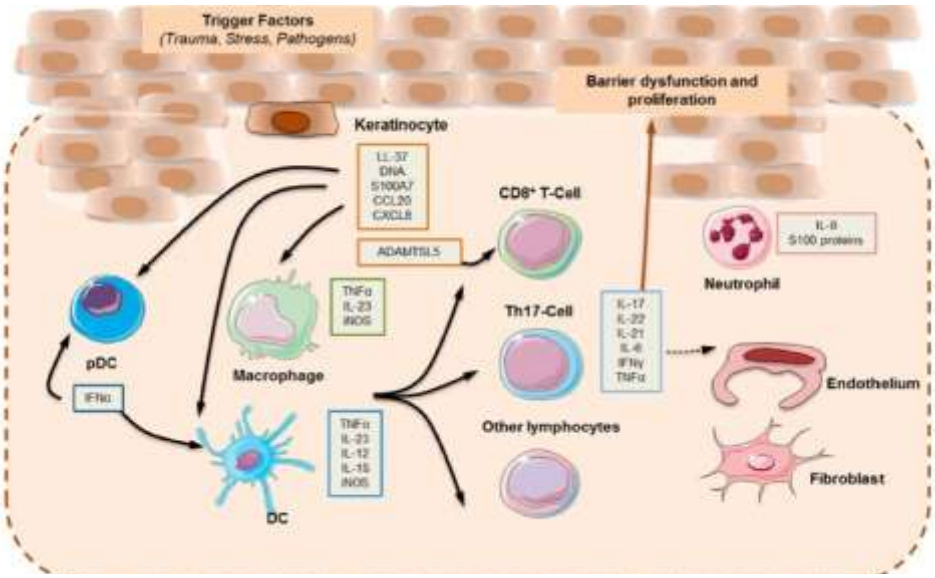

Fig. No. 1: Basic pathogenesis of psoriasis[23].

A chronic inflammatory skin condition, psoriasis is impacted by immunological, microbial, and genetic factors. According to a study, psoriatic lesions had lower amounts of Staphylococci than healthy skin. Nonetheless, psoriasis has been connected to viruses like the human papillomavirus (HPV) and fungus like Candida albicans and Malassezia & Notably, both healthy and psoriatic skin have high levels of Malassezia [24].

Th1 cytokines, such as interleukin-12 (IL-12), tumor necrosis factor-alpha (TNF-α), and interferon-gamma (IFN-γ), are the main drivers of the immune response in psoriasis and are increased in psoriatic lesions, but Th2 cytokines, such as IL-4, IL-5, and IL-10, are not. Furthermore, cytotoxic T-lymphocytes (TC1) and Th1 effector cells are identified as important participants in the disease pathogenesis because epidermal T cells in psoriasis vulgaris mostly generate type 1 cytokines (IFN-γ,

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IL-2, and TNF-α). Despite the fact that TNF-α and IFN-γ do not directly promote keratinocyte proliferation, psoriasis is thus classified as a Th1-driven illness [25].

Additionally, the hypothalamus-pituitary axis, which is connected to obesity, insulin resistance, and hypertension, can be activated by IL-6 and other pro-inflammatory cytokines . According to IL-6 also increases the generation of C-reactive protein (CRP) in hepatocytes and, in conjunction with TNF-α, interferes with insulin signaling, changing insulin sensitivity. In addition to causing inflammation on the skin, psoriasis also involves interactions between keratinocytes, innate and adaptive immune cells, and dermal vascular structures. Psoriasis has both autoimmune and autoinflammatory characteristics. In certain situations, T-cell-driven autoimmune responses contribute to the development of the illness, while in others, innate immune activation brought on by intrinsic danger signals or cytokines plays a part[26].

Medicinal Plants Effective for Psoriasis Treatment

Plant Name	Active Compounds	Mechanisms Of Action	Mode Of Application	References
Boswellia serrata (Indian Frankincense)	Boswellic acids (AKBA, KBA)	Inhibits 5-LOX, COX, and NF-κB pathways, reducing inflammation; regulates keratinocyte proliferation	Oral supplements, Topical creams	Ammon (2006); Siddiqui (2011)[27]
Aloe vera	Aloin, Acemannan, Glycoproteins	Anti-inflammatory, immunomodulatory; accelerates wound healing and reduces erythema	Gel, Creams	Surjushe et al. (2008)[28]
Curcuma longa (Turmeric)	Curcumin	Inhibits NF-κB, TNF-α, IL-6; antioxidant and anti-inflammatory effects	Oral supplements, Topical paste	Heng et al. (2000)[29]
Nigella sativa (Black Seed)	Thymoquinone	Modulates immune response, inhibits inflammatory cytokines (IL-17, TNF-α)	Oil, Capsules	Salem (2005)[30]
Camellia sinensis (Green Tea)	Epigallocatechin gallate (EGCG)	Reduces oxidative stress, inhibits keratinocyte proliferation	Tea extracts, Creams	Katiyar (2011)[31]
Glycyrrhiza glabra (Licorice)	Glycyrrhizin, Liquiritigenin	Corticosteroid-like effects; reduces inflammation and itching	Topical creams, Oral decoctions	Fu et al. (2005)[32]
Silybum marianum (Milk Thistle)	Silymarin	Antioxidant, hepatoprotective, reduces inflammation	Oral capsules, Extracts	Omer et al. (2010)[33]
Mahonia aquifolium (Oregon Grape)	Berberine, Alkaloids	Inhibits keratinocyte hyperproliferation, reduces IL-8 expression	Creams, Extracts	Wananukul et al. (2013)[34]

Boswellia serrata

Indian frankincense, or Boswellia serrata, is a tree that is indigenous to both India and Pakistan's Punjab region. Because of its anti-inflammatory qualities, its resin has long been utilized in Ayurvedic medicine. Its possible

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medicinal uses have been investigated in recent scientific investigations, especially in inflammatory diseases[35].

Fig. No. 2:Boswellia serrata plant parts [36]

Plant Profile: Boswellia serrata
Scientific Classification:
Kingdom: Plantae
Family: Burseraceae
Genus: Boswellia
Species: Boswellia serrata

The history and applications of Boswellia resin

Several ancient manuscripts make reference to the resin of Boswellia species (also known as "frankincense" and "olibanum") (Figure 03). Boswellia resin was once valued by numerous cultures as a valuable commodity for bartering and trading, on par with gold and ivory[37].

Fig.No.3: Boswellia resin[38]

According to the Ebers Papyrus, frankincense, or Boswellia resin, has been used medicinally and ceremonially since 1500 BC[39]. It was known symbolically as the "tears of Horus" in ancient Egypt[38]. Its enormous trade, which reached North Africa, China, and Rome, is described in Greek and Roman writings[40].

While Celsus (2nd century C.E.) suggested using frankincense to cure wounds, internal bleeding, and bruising when combined with leek juice, the first-century physician Dioscorides (Dioscorides, 1st century C.E.)[41] observed that it could cause madness. Boswellia resin was essential to Temple incense rituals in ancient Judea[42]. Some academics speculate that the drink provided to Jesus prior to his crucifixion may have contained frankincense, which was used to numb the senses of condemned criminals in wine, according to the Babylonian Talmud (3rd–6th centuries C.E.)[43].

The first-century physician Dioscorides observed that frankincense could cause insanity (Dioscorides, 1st century C.E.)[44], whereas Celsus (2nd century C.E.) suggested using it to heal internal bleeding, cuts, and bruises when combined with leek juice[41]. Temple incense rituals in ancient Judea relied heavily on Boswellia resin[42]. Some academics speculate that the drink provided to Jesus before to his crucifixion may have contained frankincense, as the Babylonian Talmud (3rd–6th centuries C.E.) claims that it was used in wine to numb the senses of condemned criminals[43].

In the 11th century, the Persian scholar Ibn Sina (Avicenna) documented Boswellia's use for urinary tract infections, inflammation, and cognitive disorders like amnesia and amentia[45].

Beyond the Near East, boswellia resin is used for its purportedly psychotropic, anti-inflammatory, and wound-healing qualities. In the

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Christian community, its application inthe fourth or fifth century saw the rise of worship [8,9] Boswellia trees are native to Ethiopia, where they are thought to provide a calming effect[46].
There are numerous non-pharmaceutical uses for boswellia resin.These days, frankincense isfrequently used as incense in Catholic Christian churches, along with other places of worship andsecular customs. It is also a crucial part of toiletries and perfumes[47]. Boswellia resin is sold extensively as a dietary supplement.

Active ingredients

Resins from Boswellia spp. have been found to contain over 200 chemicals [48]. The long-standing customs of treating patients using Boswellia resin. Numerous research teams that concentrated on boswellic acids successfully tested them for inflammatory disorders (Figure No. 4).

Nevertheless, in contrast to the results obtained, the use of crude extracts in assays linked to inflammation occasionally revealed biphasic potentiating/inhibitory effects. They are by refined components from these extracts[49], and a number of studies show that purified boswellic acids may not always be as active as boswellia resin.[50]

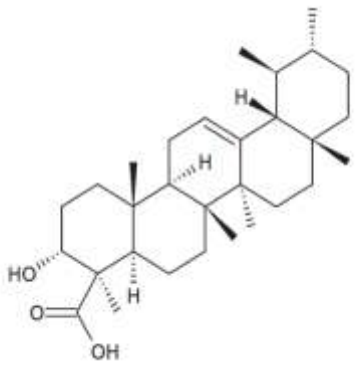

Fig. No. 4: Boswellic acid [51]

These findings imply that many ingredients influence the resin's anti-inflammatory activity.
Few components have been identified and extracted during the early research on the anti-inflammatory properties of Boswellia resin extracts. The triterpene boswellic acids, which are thought to be biomarkers of olibanum, and the diterpenes incensole (Figure 5) and isoincensole, as well as their oxide or acetate derivatives, were identified as some of the main constituents of the resin[52].

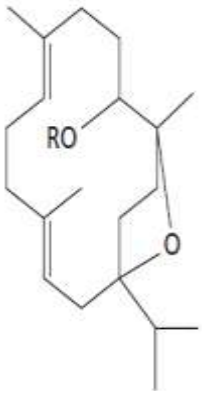

Fig. No. 5: The structures of incensole acetate (R = Ac) and incensole (R = H) [51]

The ubiquity of boswellic acids, pentacyclic triterpenoids present in boswellia resin, led to their early identification. The anti-inflammatory and cytotoxic qualities of these compounds, especially acetyl-β-boswellic acid (AbBA), 11-keto-β-boswellic acid, and acetyl-11-keto-β-boswellic acid (AKBA), have been thoroughly investigated[53]. β-configured compounds are more efficacious than their α-isomers, according to studies. Studies have also verified that these substances are present in human plasma following administration of extracts from Boswellia resin, indicating a certain degree of bioavailability. Extracting these chemicals from various Boswellia sources has been done using a variety of solvents, such as methanol, ethanol, and acetone[54].

Boswellic acid's mode of action in treating psoriasis

Boswellia serrata's active ingredients, especially boswellic acids, are primarily responsible for its medicinal promise in treating psoriasis. It has been demonstrated that these substances alter inflammatory pathways that are essential to the pathophysiology of psoriasis.

Inhibition of Pro-Inflammatory Cytokines: According to computational calculations, frankincense's diterpenoids and triterpenoids may be able to target important cytokines that aggravate psoriasis, such as interleukin-17 (IL-17) and tumor necrosis factor-alpha (TNF-α). These cytokines are essential to the inflammatory mechanisms that underlie psoriasis[55][56].
Signaling Pathway Modification: Boswellic acids may have an impact on important signaling pathways related to inflammation. According to in

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silico research, these substances have the ability to impact pathways like nitric oxide synthase (NOS) and Janus kinase (JAK), which are linked to the inflammatory response linked to psoriasis[56].

Anti-inflammatory Effects: The main way that BAs reduce inflammation is by blocking important enzymes that are involved in the production of inflammatory mediators. They specifically block the cyclooxygenase (COX) and 5-lipoxygenase (5-LOX) pathways, which lowers the generation of prostaglandin and leukotriene, two essential components of the inflammatory cascade linked to psoriasis. The inflammatory reactions that are typical of psoriatic lesions are lessened by this dual inhibition [57].

Immunomodulatory Activity: Acetyl-11-keto-β-boswellic acid (AKBA) stands out among the other BAs due to its immunomodulatory qualities. By inhibiting the nuclear factor-kappa B (NF-κB) signaling pathway, AKBA reduces the synthesis of pro-inflammatory cytokines such interleukin-6 (IL-6), interleukin-17 (IL-17), and tumor necrosis factor-alpha (TNF-α). These cytokines are essential to the pathophysiology of psoriasis, and reducing their expression helps to lessen the symptoms of the condition [58].

Regulation of Keratinocyte Proliferation: The hallmark of psoriasis is keratinocyte hyperproliferation, which results in thicker skin plaques. According to studies, BAs may reduce epidermal hyperplasia by modifying keratinocyte development. Normalizing skin cell turnover and reducing skin thickness and scaling linked to psoriatic lesions are two benefits of this modulation [59].

Antioxidant Properties: One important factor in the pathophysiology of psoriasis is oxidative stress. Strong antioxidant activity is exhibited by BAs, which neutralize reactive oxygen species and lessen oxidative damage to skin cells. BAs help reduce inflammation and cellular damage in psoriatic skin by reducing oxidative stress.[60]

Boswellia serrata's effects on various illnesses

Osteoarthritis & Rheumatoid Arthritis

Action: Reduces cartilage breakdown, enhances joint function, and inhibits pro-inflammatory enzymes(5-lipoxygenase).

Effectiveness: Research indicates that there is less discomfort, stiffness, and increased mobility.[61]

Inflammatory Bowel Disease (IBD)(Ulcerative Colitis, Crohn's Disease)

Action: Promotes gut healing, lowers intestinal inflammation, and lowers leukotriene synthesis.

Effectiveness: Research indicates symptom improvements that are on par with those of common therapies like mesalazine.[62]

Asthma & Respiratory Disorders

Action: Improves lung function, lowers airway inflammation, and decreases leukotrienes that cause bronchoconstriction.

Effectiveness: Studies show that asthma symptoms are lessened and breathing ability is enhanced.[63]

Cancer

Action: Induces apoptosis, inhibits angiogenesis, and modulates the immune system to exhibit anti-tumor actions.

Effectiveness: More research is required, however some studies indicate promise in thetreatment of pancreatic cancer, breast cancer, and brain tumors (glioblastomas).[64]

Neurological Disorders (Alzheimer's, Multiple Sclerosis)

Action: Protects neurons, lowers neuroinflammation, and may prevent the development of amyloid plaque.

Effectiveness: Initial research suggests possible advantages for neuroprotection and cognitive function.[65]

Cardiovascular Diseases

Action: Enhances endothelial function, lowers cholesterol, and lessens inflammation.

Effectiveness: Additional study is required, but some studies point to a cardioprotective role.[66]

Diabetes & Metabolic Disorders

Action: Reduces oxidative stress, enhances insulin sensitivity, and lowers blood glucose.

Effectiveness: Research points to decreased complications from diabetes and better glycemic control.[67]

II. FUTURE PERSPECTIVES

Research on the mechanisms underlying psoriasis, standardization, and integration with contemporary medicine are key to the future of natural treatments for the condition, especially the usage of Boswellia serrata. To determine its specific therapeutic effect, future research should concentrate on clarifying the molecular pathways via which boswellic acids control inflammation, especially within the NF-κB, JAK-STAT, and IL-23/Th17 axes. Bioavailability and efficacy will be increased by standardizing Boswellia extracts and developing better drug delivery methods such liposomes, nanoparticles, and transdermal

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formulations. Its therapeutic efficacy, ideal dosage, and long-term safety must be confirmed by extensive randomized controlled trials (RCTs). Future studies will examine how Boswellia interacts with the microbiota to control systemic inflammation, as the gut-skin axis has also been a major focus of interest. Personalized medicine breakthroughs using genetic

III. CONCLUSION

Compared to traditional medications, natural therapies—especially Boswellia serrata—offer promising opportunities for psoriasis management with fewer adverse effects. People with psoriasis may have improved symptom management and general well-being by combining herbal therapy, dietary changes, and lifestyle adjustments. Integrating these natural methods into evidence-based dermatological care will require more study and clinical validation.

Author Contributions:

The author conceptualized, researched, and drafted the manuscript. They performed a comprehensive review of the literature, synthesized relevant findings, and contributed to the critical analysis of the topic. Additionally, the author revised and finalized the article for publication, ensuring clarity and accuracy.

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Conflict of Interest

The authors hereby declare that they have no conflict of interest.

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