A review on cosmetics in the management of skin diseases.

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Abstract

A persistent cutaneous inflammatory illness marked by breakdown of the skin barrier is eczema, often known as Atopic Dermatitis (AD). There are millions of people affected by this chronic inflammatory skin disorder globally. Although the pathogenesis of the condition is not fully understood, it appears to be the result of a complex interaction between immune dysregulation, environmental and infectious agents, and defects in skin barrier function. As there are no diagnostic tests for AD, the diagnosis is made using precise clinical criteria that consider the patient's medical history and outward signs of the disease. There are many different pharmacological treatments available, but they frequently have serious adverse effects and may not be appropriate for all people. Cosmeceuticals, which are cosmetic products that include biologically active components, have emerged as a viable alternative for the treatment of Eczema. The pathophysiology of eczema, the various cosmeceutical kinds that can be used to treat it and how they work are all covered in this review. The review also covers the potential advantages and disadvantages of these products, as well as the clinical evidence supporting the use of cosmeceuticals in the management of eczema. Overall, cosmeceuticals are a useful tool for managing eczema and provide an alternative to conventional pharmaceutical therapies. Patients should consult carefully with their healthcare experts to choose the best treatment plan according on the kind and severity of their Eczema in order to completely grasp their efficacy and safety.

Keywords: Atopic dermatitis, Skin barrier, Skin diseases, Eczema, Cosmeceuticals, Pharmacological treatments, Immune dysregulation.

Introduction

Atopic Dermatitis (AD) is a multifactorial chronic inflammatory skin disease characterised by a decreased skin barrier function. Environmental and temperature agents, allergens, exogenous irritants, infections, and psychological stress are just a few of the factors that can contribute to the development of AD [1]. Atopic dermatitis has a complicated etiology that includes environmental and genetic variables that result in immune system and epidermal abnormalities. It is thought that the causation is impacted by both hereditary and environmental factors. Although it can affect adults, eczema is more frequently found in youngsters. Individuals who have the condition frequently have infected, dry, and itchy skin. Eczema is frequently referred to as the "itch that rashes" because of the dry skin that causes a rash when scratched or rubbed. Skin hydration is the most crucial aspect of treating eczema, followed by topical steroids for flare-ups. Between the ages of 3 and 6 months, AD often manifests 60% of patients experience an eruption at some point in their life, and 90% do so by age 5. Despite the fact that the majority of those who are affected see their ailment resolve by adulthood, 10 to 30% do not, and a lesser minority first exhibit symptoms as adults [2].

Cosmetics with physiologically active chemicals that treat skin conditions are known as cosmeceuticals. These items are used to enhance the skin's general look, lessen ageing symptoms, and enhance skin texture [3]. There are many different types of cosmetics, including creams, lotions, serums, and masks. They may include a variety of active substances, including peptides, plant extracts, vitamins, and minerals. In order to increase the overall efficacy of therapy, cosmetics are frequently used in conjunction with other forms of treatment [4].

The use of cosmeceuticals in the treatment of eczema has gained popularity in recent years. Cosmeceuticals can help to reduce the symptoms of Eczema, including inflammation, scaling, and itching. They can also improve the appearance and texture of the skin, leading to improved quality of life for people with Eczema [5].

The first-line therapy for mild to moderate eczema is frequently topical therapy. The purpose of topical therapy is to treat any infections, reduce current inflammation, and reestablish the skin's barrier function. Active inflammation is reduced by topical immunosuppressive medications, and the skin's barrier function is restored by moisturizers and emollients [6].

Corticosteroids, calcineurin inhibitors, the recently licensed Phosphodiesterase-4 (PDE4) inhibitor, and other recently

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developing topical treatments currently under development are all examples of topical immunosuppressive therapy [7].

One of the most commonly used cosmeceuticals in the treatment of eczema is Hyaluronic acid. A moisturizer that contains hyaluronic acid is delivered through the stratum corneum and into the dermis, depositing ceramide proteins in the area of the body that is anatomically most advantageous. 19 Furthermore, CD44 on the surface of keratinocytes interacts with hyaluronic acid, promoting the production and release of lamellar bodies. Niacinamide is another bioactive cosmetic agent which is famously being applied as an applicant to treat eczema. It aids in bringing moisture from the atmosphere to your skin. Use hyaluronic acid lotion to the skin to add moisture and to assist with flaky, dry skin. Nicotinamide significantly decreases trans-epidermal water loss. It causes increase in stratum corneum hydration [8]. Products containing glycolic acid, salicylic acid, and retinol have a tendency to irritate or dry up the skin, which is problematic for those who have eczema. Weakness in the skin barrier, which makes it easier for irritant chemicals to penetrate the skin and causes more water to evaporate, is one factor contributing to the condition. Hence it's advisable to stay away from things that exacerbate that issue [9].

Pathophysiology of eczema

Skin barrier: Some of the essential elements of AD include immune system dysregulation, alteration of the epidermal barrier, and genetic predisposition. The development of the atopic march and AD, which causes more skin irritation and allergy sensitization, may start with a compromised skin barrier. Interleukin 17 and 22, type 2 cytokines, and interleukin 22 all play a role in AD development and skin barrier disruption [10].

Genetics: Key proteins involved in the function of the epidermis include transglutaminases, keratins, filaggrin (FLG), and some inter-cellular proteins. These proteins have flaws that make it easier for allergens and microorganisms to enter the skin [11]. A crucial gene for skin cell maturity is filaggrin. The rough, flat corneocytes that make up the skin's outermost layer of protection are produced by this gene. The corneocytes are neatly arranged and densely packed in a patient with normal skin cells. Because of the disorganized arrangement of the skin cells, a patient with a filaggrin mutation will have a defective skin barrier [12]. Pro-FLG polymers are cleaved and dephosphorylated by proteases to produce FLG monomers, which are related to the gathering of keratin filaments and the development of SC [13]. Pro-FLG polymers are broken by proteases and dephosphorylated to create FLG monomers, which are related to the accumulation of keratin filaments and the development of SC [14]. It is widely established that FLG null mutations reduce the effectiveness of the epidermal barrier and raise the risk of AD. An increased risk of severe AD with earlier onset, longer duration, and skin infections is related with FLG mutations, particularly homozygous mutations [15].

Lipids: The lipid matrix between the corneocytes is made up of lipids such ceramides, long-chain FFAs, and cholesterol. Lamellar bodies are how the lipid matrix is structured [16]. Precursor lipids are stored in lamellar bodies inside the top cell layers of the epidermis and are extruded into the extracellular domain during epidermal development [17]. The primary lipid classes, which are required to preserve the integrity of the epidermal barrier, are produced by subsequent enzymatic processing. Lesional and nonlesional AD skin has altered lipid content [18]. Long-chain EO ceramides in particular are necessary because they coat each corneocyte's surface and are covalently linked to cornified-envelope proteins [19]. Long-chain FFA and EO ceramide levels are decreased by Th2 cytokines in a STAT6-dependent manner [20]. In contrast to patients without S. aureus colonization, individuals with AD and S. aureus colonization had lower levels of long-chain ceramides. Levels of these ceramides were inversely linked with TEWL [21].

Signs, symptoms & types of eczema

Depending on the kind and severity of the condition, Eczema symptoms and indicators can vary, but typical characteristics include:

- Acute eczema symptoms include red, itchy skin that may also include easily broken blisters that ooze (leak liquid). The skin may thicken and become dry and cracked over time. It could also alter structurally, becoming harsher. Itching is the primary symptom, and it may frequently get rather bad [22].
- **Eczema typically flares up or appears in bouts:** It might worsen (flare up) at times and improve at other times. After a while, it could also become entirely evident. Rarely is the inflammation continuous [23].
- The typical affected skin areas and the severity of the symptoms vary from person to person and are also influenced by your age. Eczema primarily affects the cheeks, the outside surfaces of the arms and legs, and - less frequently - the back, belly, and chest in infants. The backs of their knees, the insides of their elbows, and the backs of their necks are where children, teens, and adults with eczema are most frequently afflicted. The soles of their feet and the palms of their hands may also get an itchy rash. The face is seldom affected [24].
- Eczema, also known as atopic dermatitis, is a condition in which the skin becomes dry, itchy, and develops a red, bumpy rash. More adolescents and teenagers than adults are affected by this illness [25]. Eczema may be a persistent, disabling disorder that compromises a person's mental and emotional health in addition to their physical health. To control their symptoms and avoid problems, people with eczema should obtain the right medical care [26].

Eczema comes in a variety of forms, each with its own special traits and signs. The most prevalent types of eczema include:

Atopic eczema

According to estimates, 10%–20% of the general population suffers with Atopic Dermatitis (AD), a relatively prevalent chronic condition. At least in emerging nations, the frequency

of AD appears to be rising continuously. Atopic Dermatitis (AD) often develops during infancy and progresses in a highly protracted, relapsing manner. There have been two pathogenetic mechanisms mentioned. According to the "inside-to-outside concept," immunological abnormalities are traditionally regarded to be the fundamental cause of AD's initial development. Another theory postulates that the epidermal barrier has a fundamental flaw. Due to this barrier flaw, irritants or allergens can easily pass through the epidermal barrier and cause an immune reaction [27].

Symptoms

- The rash frequently develops in the creases of your knees or elbows.
- The skin's look around the rash may get wider, paler, or darker.

Contact dermatitis

Skin inflammation brought on by exposure to an environmental factor is known as contact dermatitis. Dermatitis and eczema are terms used interchangeably to describe a polymorphous pattern of skin inflammation that is at least initially characterized by erythema, vesiculation, and itching. Haptens are non-protein compounds that cause contact dermatitis after a single encounter or numerous exposures by triggering innate skin immunity (irritant contact dermatitis) or both innate and acquired specific immunity (allergic contact dermatitis)[28].

Symptoms

- Your skin becomes irritable, uncomfortable, red, hyper pigmented, pinkish, or purple in colour.
- Hives, which are itchy lumps, might develop on your skin.
- Liquid-filled blisters that just might rupture and scab over can form.

Dyshidrotic eczema

The hallmark of dyshidrotic eczema, sometimes referred to as dyshidrotic dermatitis or pompholyx, is the presence of deep-seated, tight, itchy vesicles that are most prominent on the palms and lateral surfaces of the fingers. Scaling, desquamation, fissuring, and occasionally lichenification may be noticed during the chronic phase. Between the ages of 20 and 30, the onset is at its height. The incidence of each sex is almost equal. Idiopathic conditions are the norm. Atopy, contact allergens, contact irritants, dermatophyte infection, allergy to ingested metal, hyperhidrosis, continuous use of protective gloves, intravenous immunoglobulin, emotional stress, and smoking are predisposing factors. While the illness is benign, its duration is often long and recurrent. A systematic, multifaceted approach is necessary for effective therapy, including avoiding triggers and practicing good skin care [29].

Seborrheic eczema

Seborrheic dermatitis or Seborrheic eczema is a common chronic inflammatory skin condition that affects regions with a lot of sebaceous glands and is characterized by erythema and greasy scales. The occurrence of seborrheic dermatitis has two peaks: the first occurs during the first three months of life, and the second starts during adolescence and peaks between the ages of 30 and 40. When a baby has seborrheic dermatitis, the scalp frequently exhibits localized or widespread scaling and crusting. The face, postauricular areas, trunk, intertriginous, and flexural regions of the body may all be affected by erythematous or salmon-colored, clearly delineated patches with yellow-white scales [30].

Neurodermatitis

A skin condition called neurodermatitis is characterized by persistent itching or scaling. Usually on the neck, wrists, forearms, legs, or groin area, you'll notice raised, rough, itchy patches of skin. A scratchy patch of skin is the first sign of neurodermatitis. Scratching aggravates the itching.

Symptoms

- On your arms, legs, scalp, soles of your feet, backs of your hands, or genitalia, thick, scaly patches can develop.
- While you're calm or sleepy, the spots might be quite irritating.
- Scratching the spots may end up in infection and blood loss.

Nummular eczema

Nummular eczema is an idiopathic, inflammatory skin condition that often progresses slowly and recurs. This illness is considered to be caused by a variety of reasons, including atopic dermatitis, dry skin, mental stress, and seasonal variations [31].

Symptoms

- Round coin-shaped lesions appear on your skin.
- Itchy or scaly patches are possible.

Stasis dermatitis

A persistent inflammatory skin condition of the lower limbs called stasis dermatitis. It is the cutaneous expression of venous hypertension brought on by venous reflux, and it mainly affects elderly people. Such retrograde venous blood flow is brought on by damaged or ineffective venous valves as well as venous blockage. Eczema characterizes stasis dermatitis. Leg swelling brought on by the related venous valve dysfunction may result in dangerous disorders such venous ulcerations. Due to its clinical similarities to other skin disorders and clinicians' limited clinical awareness, diagnosis might be difficult [32].

Symptoms

- Redness and swelling in lighter skin tones
- Darker skin tones in the colors brown, purple, grey, or ashen.

Mechanism of action of cosmeceuticals used in the treatment of eczema

A cosmetic substance known as a cosmeceutical is one that claims to have medicinal value that can benefit the skin long

after application. It is a product designed to alter the body's structure or any functionality, or to be used in the diagnosis, reduction, cure, or prevention of disease [33]. The mechanism of action of cosmeceuticals used in the treatment of eczema varies depending on the active ingredients they contain.

Some of the common mechanisms of action of cosmeceuticals used in the treatment of eczema are as follows:

Steroidal actions corticosteroid creams and ointments

The efficacy of topical corticosteroid compound treatments varies substantially. Leukocytes involved in inflammatory and proliferative skin conditions, as well as epidermal and dermal cells, have altered functionalities as a result of corticosteroids. Corticosteroids interact with receptor proteins in the cytoplasm after passing through the cell membrane to create a steroid-receptor complex. This complex enters the nucleus and attaches to DNA there. The transcription of messenger RNA is then altered by the binding process (mRNA). The mRNA required for the production of interleukin-1 is inhibited by corticosteroids. The effects of corticosteroids on the production of interleukin-1 and the metabolism of arachidonic acid are anti-inflammatory, immunosuppressive, and anti-mitogenic [34].

Immunosuppressant action

Cyclosporin A, azathioprine, methotrexate, interferon gamma, mycophenolate mofetil, and other immunosuppressive active agents. A calcineurin inhibitor called cyclosporin-A works by preventing the transcription of T-cell cytokine genes. The expression of interleukin-2, interleukin-3, interleukin-4, granulocyte macrophage colony-stimulating factor), tumor necrosis factor-alpha, and interferon-gamma are also inhibited. All systemic immunosuppressive therapies for atopic eczema generally work by blocking the inflammatory pathways [35].

Antihistamines

Eczema is a typical chronic illness. The main sign of eczema is itch, and dry skin is a common side effect. As a result of frequent scratching, skin lesions include rash, redness, and bleeding. They may have been used with antihistamines that are very sedative, such as chlorpheniramine and hydroxyzine, primarily for their sedative effects. Given that they have a sedative effect, they can lessen the likelihood of nighttime scratching [36].

Barrier repair moisturizing action

Occlusive agents prevent trans-epidermal loss of moisture by creating a thin hydrophobic coating on the skin's surface. They resemble the ceramide, cholesterol, and free fatty acid-based intercellular lipid bilayers. Lanolin, mineral oils, olive oil, petrolatum ceramide, paraffin, and silicone are a few examples. Water vapors are drawn in by humectants to moisturize the skin [37].

Biologics

These drugs inhibit immune system proteins to reduce immune system response.

Phototherapy

Exposure to UVA or UVB waves is required for this. Mild dermatitis can be treated with this technique. Over the course of therapy, a doctor will keep a constant eye on the skin. Phototherapy affects cytokine outputs, targeting inflammatory cells, and significantly reduces bacterial growth [38]. By modifying cytokine production, causing invading T cells to die, and decreasing Langerhans cells' ability to present antigens, UV radiation affects inflammatory cells on the skin and has immunosuppressive effects that are beneficial. Moreover, it thickens the stratum corneum, which may reduce eczematous responses and stop external antigens from penetrating [39].

Recent advances in cosmeceuticals used in the treatment of eczema

The synthesis of cosmeceuticals for the treatment of eczema has made a number of recent strides. They consist of:

Cannabinoids

It is undeniable that the human endocannabinoid system affects cutaneous biology. Abuse of synthetic cannabinoids has been linked to the identification of ECS receptors in the skin. It is a cannabis plant component that is not psychotropic. Topical cannabinoids may be effective in treating some conditions or maintaining overall skin health since the ECS has a significant regulatory role in the skin. The modulation of inflammatory responses by Phyto-cannabinoids has been demonstrated to include many underlying mechanisms [40].

Nanoparticles

Drugs that are currently on the market have a low skin bioavailability and may result in serious side consequences. Nanotechnologies, such as nanoparticles, liposomes, nanogels, nano-mixtures, nano-emulsions, and other nano-carriers, provide previously unheard-of solutions to these problems, allowing for: I the management of various clinical forms of atopic dermatitis, particularly the recalcitrant ones, better bioavailability and transdermal drug delivery that targets the site of inflammation, dose control, fewer adverse events, and an improved safety profile [41].

Plant based ingredients

A variety of chemically diverse components found in medicinal plants, such as free fatty acids, phenolic compounds, sterols, terpenoids, and alkaloids, are designed to control the pathological state of eczema. Plant based phytoconstituents such as Rosemary Oil, Aloe, Honey, Rose hip oil, Shea butter, Argan oil, etc. have shown some promising effect on eczema therapy [42].

Biologics

While not strictly considered cosmeceuticals, biologics are a type of medication that can be administered topically and have shown significant efficacy in the treatment of Eczema [43]. In recent years, targeted treatments for AD, such as IL4/13 inhibitors, JAK inhibitors, and IL-13 inhibitors administered both topically and systemically, have been made available to moderate-to-severe AD patients with systemic therapy resistance [44]. There are now several biologics being

Figure 1: *Represents the Types of Eczema.*

researched or in the experimental phase. Contrarily, certain biologics are presently undergoing phase 2 and 3 clinical studies, and a small number of treatments, such dupilumab and crisaborole cream, have been further focused on clinical use in the context of real-world settings [45]**.**

Overall, these recent developments in the creation of cosmeceuticals and associated goods provide intriguing new therapy options for eczema [46]. Patients should consult carefully with their registered healthcare professionals to choose the best treatment plan or regimen therapy depending on the degree and type of their eczema in order to fully grasp their efficacy and safety [47].

Cosmeceuticals available in the market for the treatment of eczema

For the treatment of eczema, there are several cosmeceuticals on the market. These treatments have a variety of bioactive substances that function through several modes of action to lessen eczematous skin lesions' appearance and minimise swelling, scaling, and itching. The following are some of the cosmeceuticals that are most frequently used to treat eczema.

Topical Corticosteroids

Topical corticosteroids have a complex mechanism of action that includes anti-inflammatory, anti-mitotic, and immunosuppressive effects. Topical corticosteroids' ability to reduce inflammation is mediated via vasoconstriction, suppression of phospholipase A2 release, and direct inhibition of inflammatory and the DNA transcription factors [48]. If skin care or moisturizers are unable to control your eczema, your doctor may recommend low-potency topical corticosteroids (TCSs) [49].

Moisturizer

A moisturizer is a crucial aspect of fundamental daily skin care, especially when the epidermal barrier has been altered and the water content of the epidermis has decreased. Treatment and flare prevention for atopic dermatitis entail long-term skin barrier regeneration [50]. Regardless of the severity, moisturizers are the most crucial fundamental skin therapy for atopic dermatitis recovery [51]. Since moisturisers may enter the skin and aid in restructuring its layers, they are advised as a crucial component of the atopic dermatitis treatment process [52].

Vitamin-D restoration

The immune system and skin barrier function, both crucial in the development of eczema, are known to be regulated by vitamin D [53]. Humans normally obtain >90% of their vitamin D needs through cutaneous synthesis when being exposed to ultraviolet B (UVB) radiation from the sun[54].

Coal tar

One of the earliest treatments for Atopic Dermatitis (AD), a T-helper 2 (Th2) lymphocyte-mediated skin condition linked to loss-of-function mutations in the skin barrier gene filaggrin, is topical application of coal tar (FLG). In skin equivalents and lesional AD skin, coal tar elevates the expression of filaggrin [55]. It is often administered once or twice daily to the skin's afflicted regions and is available as a topical cream, ointment, or shampoo. Use cautious while using coal tar because it might cause skin irritation and photosensitivity [56].

Conclusion

For patients and their doctors, cosmetics present both difficulties and opportunities. Since society places such a high value on looking young and healthy, many individuals are concerned about their ageing skin and want to know what they can do about it [57]. Cosmetics have become a potentially effective approach for treating Eczema. These items can help Eczema patients live better lives by providing a secure and efficient alternative to conventional pharmaceutical therapies [58]. Cosmeceuticals have a complicated and variable mode

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of action, but they often perform by lowering inflammation, enhancing skin barrier function, and re-establishing the natural balance of the skin microbiota [59]. For the treatment of Eczema, a range of cosmeceuticals are available, including moisturisers, emollients, keratolytics, and anti-inflammatory drugs. To obtain the best results, these medications can be used alone or in conjunction with other medicines, such as systemic therapy or topical corticosteroids [60]. The efficacy and safety of cosmeceuticals in the treatment of Eczema still need to be thoroughly investigated. In order to choose the best treatment plan based on the kind and severity of their Eczema, patients should consult closely with their medical professionals [61]. Overall, cosmeceuticals are a useful tool for managing Eczema and provide an alternative to conventional pharmaceutical therapies [62]. The variety of cosmeceuticals for Eczema will probably keep growing as a result of continuous research and development, giving patients more alternatives for treating this chronic illness [63].

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