



Bioactive-Driven Face Scrub Formulations: Unlocking the Science of Exfoliation and Skin Health

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Abstract

The increasing consumer demand for radiant and healthy skin has catalyzed significant advances in cosmetic formulation science. This study comprehensively examines the complex interactions between cosmetic products and skin physiology, offering insights into how modern formulations influence skin health, barrier integrity, hydration, and the mitigation of age-associated changes. Through an extensive review of clinical research, dermatological evidence, and advancements in cosmetic technology, the investigation elucidates the roles of key ingredients—including moisturizers, emollients, antioxidants, and vitamins—in enhancing skin resilience and function.

A particular focus is placed on bioactive compounds and their capacity to counteract oxidative stress, a major contributor to skin aging. The integration of photoprotective agents within cosmetic formulations is also highlighted, underscoring the dual function of these products in both aesthetic enhancement and environmental defense. Consideration is given to the diverse responses of varying skin types, acknowledging genetic, ethnic, and environmental influences that affect product efficacy and safety.

Furthermore, the study addresses potential adverse reactions, such as sensitivities and allergic responses, emphasizing the importance of patch testing and tailored skincare regimens. The responsible use of cosmetic products is advocated to accommodate the unique needs of individual skin profiles.

This research not only illuminates the pivotal role of cosmetic formulations in promoting and maintaining skin health but also contextualizes these findings within the broader landscape of scientific innovation. By bridging formulation science with dermatological insights, the study advances the development of products that harmonize aesthetic aspirations with optimal skin health, laying a foundation for future research into personalized and bioactive-enriched skincare solutions.

Keywords: *Cosmetic Products, Skin Health, Bioactive Compounds, Antioxidants, Sun Protection, Sensitive Skin*

1. INTRODUCTION

1.1. Skin Structure and Functions

The skin, the body's largest organ, serves as a dynamic barrier and an essential interface between the body and its environment. It is

primarily composed of three layers: the **epidermis**, **dermis**, and **hypodermis** (subcutaneous tissue), each contributing

uniquely to overall skin health and function (Bonté et al., 2019).

The **epidermis**, visible to the naked eye, acts as the skin's frontline defense. This outermost layer is organized into multiple sublayers, including the **stratum corneum** (horny layer), **stratum lucidum** (clear layer, found only in thicker skin areas like the palms and soles), **stratum granulosum**, **stratum spinosum**, and the **stratum basale**. These layers chart the journey of keratinocytes—cells that originate in the basal layer, progressively migrating upward, flattening, and eventually forming the hardened, protective squames of the stratum corneum (Holte & Biswas, 2020, Kumar, 2024). This continuous cycle of renewal and shedding, known as **desquamation**, takes approximately four weeks and lengthens with age.

Beneath the epidermis lies the **dermis**, a robust and elastic layer rich in collagen and elastin fibers. This layer supports vital structures, including blood and lymph vessels, nerve endings, sweat glands, hair follicles, and sebaceous glands that secrete sebum to lubricate the skin. Fibroblasts within the

dermis play a pivotal role in wound healing by synthesizing collagen (Sullivan & Myers, 2022, Sharma et al., 2019). The dermal blood supply not only nourishes the overlying epidermis but also supports sensory functions, alerting the body to tactile stimuli such as pain, pressure, and temperature changes (Abdo et al., 2020).

The **hypodermis**, also known as the **subcutaneous tissue**, forms the deepest skin layer, acting as a cushion and energy reservoir. It comprises loose connective tissue interwoven with collagen fibers and a dense population of adipocytes (fat cells) (Cherkas et al., 2023). This layer facilitates the metabolism and storage of lipids and contributes to thermoregulation and shock absorption, insulating the body from external temperature changes and mechanical impacts (Krishnan et al., 2023).

Together, these three layers not only protect the body from environmental aggressors but also participate in crucial physiological processes such as temperature regulation, hydration balance, immune defense, and sensory perception (Passeron et al., 2021).

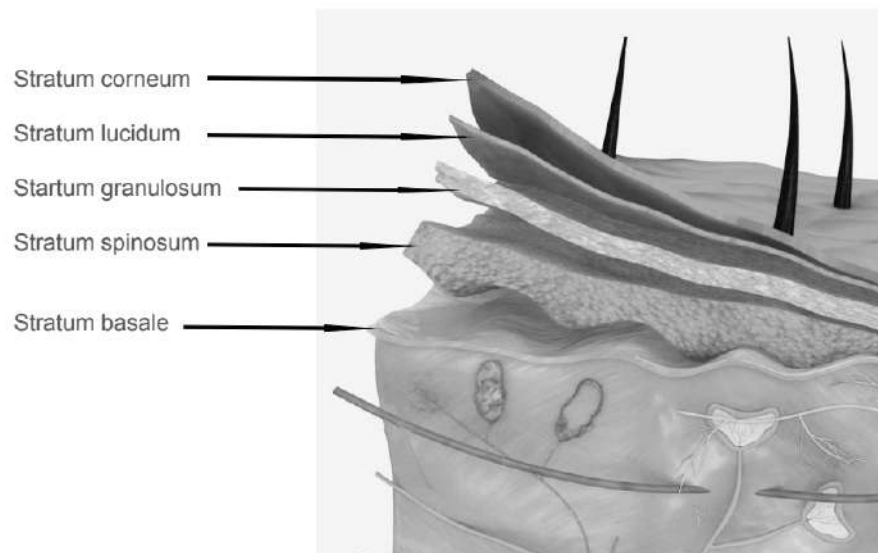


Figure 1. Structure of the skin

In addition to these functions, the skin's layers also house other appendages that play important roles. These are hair follicles, sebaceous glands, sweat glands, nails (Peate, 2021).

Sebaceous gland

Sebaceous glands produce *sebum* which ensures both skin and hair are normally kept healthy, shiny and supple. Sebum is a natural emollient (skin softener). It is composed of fatty acids, fatty alcohols and esters (waxes) (Mohiuddin, 2019). When combined they produce an oily substance that waterproofs the skin, helps to retain moisture within the skin and imparts a healthy sheen to skin and hair. Absolutely, sebum encompasses natural salts and lactic acid, playing a crucial role in maintaining its natural and slightly acidic nature. (pH of 4.5 to 6) of skin and hair. (Swaney, et. al., 2023).

Over or under production of sebum can result in either greasy or dry skin. There are a greater number of sebaceous glands on the face, chest and upper back. Sebum secretion is controlled by hormones circulating in the bloodstream, becoming very active at puberty. (Clayton, et. al., 2019).

Sweat glands

Sweat glands or sudoriferous glands are of two types:

- ❖ Eccrine.
- ❖ Apocrine

Eccrine glands

The body is full of eccrine glands. They produce sweat, which aids in the body's cooling process. Because the dry air physically sucks the moisture from the skin, these glands produce additional fluid in harsh conditions like an airplane or a sweltering home (Casey, 2009). It is important to bear this in mind, as in these modern times most people have to put up with many hours in dry environments (Steinberg, 2002).

Apocrine glands

Nearly all apocrine glands are located in the armpit. They sweat more heavily, especially

when they're anxious or under stress. Additionally, apocrine sweat gland secretions smell (Hodge et al., 2018).

The skin is the human body's largest organ, and performs variety important role:

- It facilitate in control of the temperature of the body (Kuht & Farmery et al., 2015).
- Regulation and the Heat-Exchange Mechanisms of the Body (Namisnak et al., 2022)
- Absolutely, the presence of bacterial colonies on the skin's surface is crucial for supporting and maintaining a healthy immune system. (Luger et al., 2021).
- The skin is one of the most important organs of elimination- sweating out minerals and waste products from the body (Cramer et al., 2022)
- It acts as an environmental barrier – preventing our water-rich bodies from drying out. (Choe et al., (2020).
- Sensory nerves are abundant in the skin – making it an invaluable organ of touch. (Tóth, et al., 2019).

1.2. Functions Of Skin

- Holding the body's contents together: The skin serves as a protective barrier, enclosing and holding together the internal organs and structures of the body. It acts as a structural boundary that maintains the integrity of bodily tissues and prevents them from being exposed to the external environment (Hart, 2019).
- Waterproofing: The outermost layer of the skin, known as the stratum corneum, acts as a waterproof barrier, preventing excessive water loss from the body. This waterproofing property is crucial for maintaining optimal hydration levels in the body and preventing dehydration (Liu, 2022).
- Protection from sunlight:

Melanin, a pigment produced by cells in the skin called melanocytes, provides protection against the harmful effects of ultraviolet (UV) radiation from the sun. This protection helps prevent sunburn, premature aging, and reduces the risk of skin cancer associated with prolonged sun exposure (Solano, 2020).

- **Recognising foreign:**
The skin contains specialized cells, such as Langerhans cells, that play a role in recognizing and responding to foreign invaders, such as bacteria or viruses. This recognition is part of the body's immune response and contributes to the defense against infections (Strizova, 2023).
- **Controlling body temperature:**
Through processes like sweating, The skin assists in regulating body temperature by dispersing surplus heat. Blood vessels in the skin have the ability to expand (dilate) or contract (constrict) to regulate blood flow, aiding in temperature control in response to environmental conditions (Lõhmus , 2018)
- **Pain/ injury warning:**
Nerve endings in the skin are sensitive to various stimuli, including pressure, temperature, and pain. When the skin is injured or subjected to harmful stimuli, these nerve endings send signals to the brain, prompting protective responses and alerting the individual to potential dangers (Crosson et al., 2019)
- **Protection from infection:**
The physical barrier of the skin, along with the presence of antimicrobial substances, helps protect against the entry of pathogens. If the skin is breached, the immune response is activated to prevent and combat potential infections (Smith, 2020).

Each of these functions highlights the skin's multifaceted role in maintaining the overall health and well-being of the body in general.

1.3. Cosmetic Products

Cosmetic products are substances used to enhance or alter one's appearance. They come in various forms such as makeup, skincare, haircare, and fragrances. It is important to understand the different types of cosmetic products and their ingredients to make informed decisions about their use. Cosmetics products as we all know that are substances used on our body, basically or particularly skin, nails, lips, eyes and hair for treatment and beautifying the body, particularly to altered or enhanced person's appearance. Cosmetics are mostly used to clean, beautify, enhanced beauty or change the look of body without affecting it's structure or function (Baki,2022). With the increasing demand for hypoallergenic personal care products, there is a need to explore and develop body lotion and body scrub options that utilize natural ingredients. These products should be formulated to minimize the risk of triggering allergic reactions, while still providing effective hydration and exfoliation for the skin. One potential solution is to incorporate ingredients such as MOO which is widely used in body creams, lotions, balms, and scrubs due to its non-greasy after feel (Mohiuddin, 2019).

It is also important to consider the presence of food allergens in these products, especially when it comes to skincare for children. Therefore, it is crucial to conduct research and testing to determine the presence and concentration of food allergens and essential oils in moisturizing personal care products intended for use on children's skin. (Horimukai et al., 2023). By utilizing the information from the mentioned sources, it is possible to develop hypoallergenic body lotion and body scrub options that not only incorporate natural ingredients but also prioritize halal certification and marketing. These products should cater to the needs of individuals with

religious considerations, while also addressing health reasons and promoting halal awareness among consumers.

- Cosmetics covered a wide range such as;

Skin Care products:

In this category it deals with moisturizers, cleansers, serums, toners, and Anti-aging creams that is used to improve skin appearance and improve skin health.

Nail Care product:

Products used to improve the health and care and decoration of the nails, such as polish of nail and polish remover.

Items for caring of hair:

Hair dyes, shampoos, conditioners and hairstyling products all fall into this category.

Make up products:

Lipsticks, eyeshadow, mascara, blush and foundation are all used to on face to enhance or alter the appearance.

Personal care products:

This items facilitate in personal grooming and hygiene, such as toothpaste body wash and deodorants.

Fragrance

Are items used to add a pleasant scent to the body, such as colognes, body sprays, perfumes.

1.3.1. Effects of Cosmetics

Cosmetics influence the health of your skin in various ways. However, this doesn't necessarily imply that you should steer clear of the makeup counter. To install more confidence in your beauty regimen, here are potential adverse effects to be aware of and proactive measures you can take to mitigate common problems associated with cosmetic use. (Alves et al., 2020).

- **Positive Effects of Cosmetic Products**

- Cosmetic products can enhance one's appearance and boost self-confidence.

- They also provide protection from environmental factors such as pollution and UV radiation.
- Some products can improve skin condition by addressing specific concerns such as acne or dryness.
- There are many or numerous number of effects of cosmetics products on our skin both positives and negatives, and also it depends on some factors which may contribute or lead to positive or negative impact
- *Here are some of the factors; skin type, method of application, ingredients that used to made up of the products:*
- Skin type is one of the factors that contribute to the negative impacts of cosmetic products to our skin. i.e, there are some people with (oily skin type and some have dry skin type), People with Oily skin type should always check the type of product that would be applied to the skin, because if you use products are not made for your skin it affect your skin, if you use oily product your skin might become more oily and produce excessive oil to our skin, which may lead/contribute to clogged pores and breakout on our skin. (Pimentel, et al., 2017).
- High/extreme dry skin (*xerosis*) by applying product that make our skin extremely dry may lead to rough skin, scaly and itchy patches or even leads to crack and bleed.
- *Negative effects of cosmetic products:*
 - Certain cosmetic products can clog pores and lead to breakouts.
 - They may also cause induced oiliness or dryness, depending on the product and skin type.
 - Long-term use of some products can result in premature aging and pigmentation changes.

1.3.2. *Ingredients Used In Cosmetics And Their Harmful Effects*

Many cosmetic products contain toxic ingredients that can have harmful effects on the skin and overall health. It is important to be aware of these ingredients and their potential risks.

Common Toxic Ingredients:

Examples of toxic ingredients in Cosmetic products:

Parabens: Commonly used as preservatives in cosmetics, parabens can disrupt hormone function and have been detected in breast tumor tissues (Hager et al., 2022).

Phthalates: Found in many fragrances, phthalates have been linked to hormonal disruptions and developmental issues. They can be labeled as "fragrance" on ingredient lists (Ravichandran et al., 2022).

Formaldehyde: Often used as a preservative, formaldehyde and its releasers can cause skin irritation and are classified as a known human carcinogen (de Groot et al., 2019).

Lead: Found in certain lipsticks and other cosmetics, lead is a heavy metal that can accumulate in the body over time, leading to various health issues, especially neurotoxic effects (Collin et al., 2022).

Mercury: Some skin-lightening creams and mascaras may contain mercury, which can cause damage to the kidneys, digestive system, and nervous system (Bastiansz et al., 2022).

Triclosan: Used in antibacterial soaps and some cosmetics, triclosan may disrupt thyroid function and contribute to antibiotic resistance (Maksymowicz et al., 2021).

Coal Tar Dyes: Found in some hair dyes and cosmetics, coal tar dyes can be contaminated with heavy metals and are linked to cancer (Moustafa et al., 2015).

Sodium Lauryl Sulfate (SLS) and Sodium Laureth Sulfate (SLES): These surfactants, commonly used in shampoos and cleansers, can cause skin and eye irritation (Dutta, 2019).

- *Long-term Effects of Toxic Ingredients*

- Toxic ingredients can persist on the skin and cause long-term damage.
- They may also increase the risk of skin cancer and other health issues.
- It is important to be cautious when using products with these ingredients and to seek safer alternatives
- Hormonal Disruption: Some toxic ingredients, like phthalates and parabens, can disrupt hormonal balance, potentially leading to long-term endocrine system issues.
- Cancer Risk: Certain ingredients, such as formaldehyde and coal tar dyes, are classified as carcinogens and may increase the risk of cancer with prolonged exposure.
- Neurotoxic Effects: Heavy metals like lead and mercury, found in some cosmetics, can accumulate in the body over time, leading to neurotoxic effects and cognitive issues.
- Reproductive Health Concerns: Endocrine disruptors in cosmetics may impact reproductive health, potentially causing fertility issues or developmental problems in offspring.
- Skin Sensitization: Prolonged exposure to irritants like sodium lauryl sulfate can lead to chronic skin sensitization, causing persistent skin problems.
- Allergies: Ingredients like fragrances and preservatives can cause allergic reactions that may worsen over time with continued exposure.
- Kidney Damage: Mercury, present in some cosmetics, can contribute to kidney damage when absorbed through the skin over an extended period.

- **Respiratory Issues:** Inhaling airborne particles from certain cosmetics containing toxic ingredients may lead to respiratory problems in the long run.
- **Antibiotic Resistance:** Ingredients like triclosan may contribute to antibiotic resistance when used consistently over the long term.
- **Systemic Toxicity:** Cumulative exposure to various toxic ingredients can lead to systemic toxicity, affecting multiple organs and bodily functions over time (Bilal & Iqbal, 2019).

It's essential to read ingredient labels carefully and, if possible, choose products with natural and non-toxic alternatives. Additionally, staying informed about potential risks associated with certain ingredients can help consumers make healthier choices.

Caring for Your Skin While Using Makeup

For those who frequently use cosmetics, the article provides suggestions to mitigate negative effects and maintain skin health:

- Choose makeup with gentle, non-comedogenic ingredients suitable for your skin type.
- Monitor expiration dates and discard old products.
- Clean makeup brushes and sponges weekly to eliminate bacteria and remove residues.
- Avoid wearing makeup during workouts to prevent pore-clogging and allow the skin to breathe.
- Implement a double-cleansing routine to thoroughly remove makeup each night.
- Use medical-grade skincare products for effective skin improvement.
- Seek regular skincare specialist appointments for specialized facials and targeted skin care.
- Consider physician-led medical spas for preventative and corrective

treatments, utilizing advanced procedures such as laser skin resurfacing, microneedling, and Hydrafacial MD. (Melchart et al., 2015).

Skin is not mean to be taking of only when it comes to make up, but also in our daily life activities as a routine, we need to check the products we use for our body.

1.4. Body Scrubs: Properties And Their Influence On Skin

A body scrub also known as a facial skin exfoliant or body polish, is a skincare product designed to exfoliate the skin by removing dead skin cells, unclogging pores, and promoting a smoother, more radiant complexion. It typically contains abrasive particles or granules suspended in a base that may include oils, creams, gels, or other moisturizing ingredients (Ogorzałek et al., 2024).

1.4.1. Benefits of scrub:

● *Exfoliation:*

The primary purpose of a body scrub is to. Indeed, exfoliating the skin is beneficial for removing dead skin cells, revealing fresh, The underlying, freshly regenerated skin. This process can improve the overall texture and appearance of the skin .

● *Enhance Radiance:*

Absolutely, the consistent use of body scrubs can help achieve a more radiant complexion through eliminating dullness and encouraging smoother, fresher skin. Dead skin cells and promoting a healthy skin turnover.

● *Smooth and soften:*

Absolutely, by effectively eliminating dead skin cells, body scrubs contribute to a smoother and softer feel of the skin. This can be particularly beneficial for areas with rough or dry skin, such as elbows, knees, and heels.(Tran et al., 2011).

● *Stimulate circulation:*

The massaging action of applying a body scrub can help stimulate blood circulation,

potentially contributing to healthier-looking skin.(Mukherjee, et. al, 2011).

- *Prepare for other skincare products:*

Exfoliating with a body scrub can help other skincare products, such as moisturizers or self-tanners, penetrate more effectively into the skin, enhancing their overall efficacy.

(Loden and M. 2003).

Body scrubs come in various formulations, and the choice of ingredients can vary. Common abrasive particles found in body scrubs include sugar, salt, coffee grounds, crushed fruit seeds, or even synthetic beads. The base of the scrub often includes moisturizing components like oils (such as coconut oil, jojoba oil) or creams to help nourish and hydrate the skin.

It's essential to use body scrubs in moderation, typically a few times a week, as excessive exfoliation can lead to skin irritation. Additionally, individuals with sensitive skin should choose gentler formulations and perform a patch test before applying a body scrub to a larger area.(Tran et al., 2011).

1.4.2. *Negative impact of scrub*

While using a body scrub can offer benefits like exfoliation and smoother skin, it's essential to be aware of potential disadvantages and side effects, especially when used incorrectly or excessively. Here are some potential drawbacks:

- *Skin Irritation*

Scrubs with abrasive particles can cause irritation, redness, or microtears in the skin if used too aggressively or too frequently. Individuals with sensitive skin should choose gentler exfoliants. (Farage et al., 2010).

- *Over-Exfoliation:*

Excessive exfoliation, whether through frequency or harsh scrubbing, can disrupt the skin barrier, leading to increased sensitivity, dryness, and a compromised protective layer. (Draelos et al., 2010).

- *Adverse hypersensitivity response:*

Absolutely. It's wise for individuals to be aware that some specific scrub ingredients may

trigger allergies. Conducting a patch test before introducing a new product is always advisable to evaluate and identify potential allergies or sensitivities..(Farage et al., 2010).

- *Increased Sensitivity to Sun:*

Exfoliating removes the outer layer of dead skin cells, potentially making the skin more susceptible to UV damage. It's crucial to use sunscreen after exfoliating to protect the skin from harmful UV rays. (Pagnoni et al., 1998).

- *Skin Dryness:*

Certain scrubs may strip the skin of its natural oils, leading to dryness. It's important to choose scrubs with moisturizing ingredients or follow up with a hydrating lotion.

(Loden and M. 2007).

- *Aggravation of Skin Conditions:*

People with certain skin conditions like eczema or psoriasis should consult with a dermatologist before using scrubs, as abrasive particles may worsen these conditions.

(Fisher et al., 1998).

- *Environmental Impact:*

Some scrubs contain microbeads, which are tiny plastic particles harmful to the environment. Choosing scrubs with natural exfoliants like sugar or salt is more eco-friendly.

(Rawlings et Al., 2003).

- *Incompatibility with Certain Products:*

Some skincare ingredients, like retinoids or alpha hydroxy acids, can increase skin sensitivity. Using a scrub in conjunction with these products may lead to irritation. Consult with a dermatologist for personalized advice.

(Mukherjee et al., 2011).

Based on the above discussed negative impacts of commercially available body scrubs, we are formulating Hypoallergic facial scrub, with natural bioactives/ their extract like oatmeal and fruit extracts which play a vital role in not only formulating scrubs with the desired gentle exfoliation but also with the properties such as soothing, calming properties of various bioactives to cater the needs of consumers with sensitive skin. Market trends indicate a

growing demand for sustainable and eco-friendly options, with biodegradable exfoliating particles and environmentally conscious packaging gaining popularity

When choosing a face scrub, it's crucial to consider your skin type. Individuals with sensitive skin may prefer gentler options, while those with oily skin may benefit from stronger formulations. Some scrubs address specific concerns such as acne or uneven skin tone. DIY face scrubs, made at home with ingredients like honey or yogurt, provide a customizable alternative. However, caution is necessary for individuals with certain skin conditions, as exfoliants can increase sensitivity. Sun protection is crucial post-exfoliation to prevent UV damage. So we aim to produce a scrub, which will not be harsh and sensitive to the skin, all the ingredients used here do not contain any harmful substance that will affect our skin

Research Objectives:

1. To extract bioactive ingredients from natural sources (like orange peel, lemon, and liquorice) for use in a hypoallergenic facial scrub.
2. To formulate and evaluate a natural facial scrub by studying its texture, stability, and effect on skin hydration and barrier function.
3. To assess skin compatibility and potential allergic reactions through basic patch testing and sensitivity analysis.

2. LITERATURE REVIEW

(Kim *et al.*, 2006). The Korean Journal of Herbology. The main focus of their research is based on the Cosmetic formulations enriched with extracts from red pine needles demonstrate skin-rejuvenating properties, contributing to anti-aging effects. Which spoke about the negative and positive impact of using cosmetic products for both surgical and surgical, and the measures or guidelines to abide by while using make ups.

(Szilvia *et al.*., 2023). Journal of applied microbiology. The research was made and focused on a Survey on microbial contamination of opened skin care product used for tattooing. It discussed the negative impact of it on our skin health such as surgical tattoo which will increase the risk of septicaemia (a disease that will affect our health by netering our body through blood vessels i.e blood cancer).

(León Flores *et al.*, 2023). It is an inflammatory condition (eczema) in skin which happen by by gettnng contact with specific substances or irritants. Cosmetics have been identified as a popular cause of eczema contact. In the research will review previous studies on the relationship between cosmetics and contact dermatitis. Research identifying the most common allergens and irritants present in cosmetic products will bean analysed, as well as patch tests used to detect possible allergic reactions. The results of studies that have demonstrated the presence of allergens and irritants in cosmetics, as well as the associated skin reactions, will be presented. Contact dermatitis prevention and management strategies will also be discussed, including identification and avoidance of specific allergens, patch testing, and skin care guidelines.

(Syed *et al.*, 2018) Says “Hyaluronic acid (HA) plays a multifaceted role in regulating diverse biological processes, including skin repair, cancer diagnosis, wound healing, tissue regeneration, anti-inflammatory actions, and immunomodulation. Leveraging its substantial biomedical and tissue regeneration potential, HA has become a crucial component extensively utilized in cosmetic and nutricosmetic products. This review aims to offer a concise yet critical evaluation of recent developments and clinical investigations regarding the cosmetic and nutricosmetic efficacy of HA for skin rejuvenation.

A thorough examination of the literature reveals that formulations incorporating HA,

such as gels, creams, intra-dermal filler injections, dermal fillers, facial fillers, autologous fat gels, lotions, serums, and implants, have been widely employed in various applications. This includes addressing key areas such as anti-aging, nasolabial folds, dermal filler usage, anti-wrinkle treatments, and overall face rejuvenation. The review specifically delves into the nuanced aspects of Hyaluronic acid's role in these applications and its significance in the realm of nutricosmetics". (Kalicanin *et al.*, 2016). Reported that "In summary, the investigation on cosmetic products (lipsticks, lip glosses, eye shadows, and henna hair dyes) intended for cosmetic use revealed potential adverse effects on human health due to elevated lead levels, posing risks of cumulative toxicity. Notably, the presence of the The samples did not show the presence of the highly toxic metal cadmium. While zinc, an essential element, was present in the analyzed cosmetic products, its concentration exceeding recommended levels could result in adverse effects. Furthermore, the study suggests that henna hair dye, beyond its aesthetic impact, may have detrimental effects on both hair and overall health. Long-term use of henna dye was associated with A rise in the overall lead concentration found in hair samples. The PSA method developed in this research demonstrated high reproducibility, indicating its suitability for analyzing concentration of heavy metals (Pb, Cd, and Zn) in similar samples.

(Minas T *et al.*, 2006) stated that "Cosmetic products and procedures have the potential to cause negative impacts on the ocular surface, ranging from mild discomfort to conditions that pose a threat to vision. Issues related to skin and eye products often stem from allergic reactions or toxicity, frequently linked to the presence of perfumes. Complications arising from blepharoplasty may include overcorrection, scarring, or irregular contouring of the lid margins, leading to significant ocular surface disease until

corrective measures are taken. The use of botulinum toxin injections can result in dry eye syndromes and epiphora, with more severe complications being rare and dependent on factors such as dosage and injection location. Micropigmentation procedures can lead to pathological processes or unsatisfactory cosmetic outcomes. In certain subcultures, there is a growing trend of using special-effect contact lenses and decorative conjunctival implants, posing various risks often exacerbated by insufficient education on care and hygiene practices".

(Reinberg *et al.*, 2009) Reported that "Two groups comprising 24 healthy Caucasian women each, matched in terms of age classes spanning from 19 to 55 years and having fair and dark complexions of skin and hair, participated voluntarily in a 14-day trial using a conventional facial cream (active placebo: AP) and subsequently, in a 21-day trial using Noctosôme® (Noctos). Noctos is a novel generation of liposomes composed of non-ionic lipids that form microspheres containing glycopeptides in the aqueous compartment, α -tocopherol ester in the membrane-like structure, and sphingoceramides on the surface of the microspheres.

The study aimed to assess the positive effects of Noctos (compared to AP) with morning (7–9 am) and evening (9–11 pm) applications as facial ointments. Statistical validation of observed differences was conducted using various tests such as ANOVA and cosinor. Subjects adhered to a diurnal activity schedule from 7 am to 11 pm and a nocturnal rest. At fixed clock hours (7 am, 10 am, 8 pm, and 11 pm) each day, participants self-rated facial aspects using visual analogue scales.

Results indicated that the brilliance of complexion and skin texture exhibited a circadian rhythm, peaking at 10 am, with both AP and Noctos. Noctos demonstrated a beneficial effect compared to reference values (AP), and the evening application of Noctos proved more effective than the morning

application. However, the magnitude of this beneficial effect correlated with age (more significant for the age class 25–35 years compared to younger and older subjects) and skin complexion (more pronounced for fair-complexioned individuals than those with dark complexions).

Crucially, the major positive effects of Noctos in the evening hours were found to be independent of the fatigue or mood of the women, as the circadian rhythms of these variables appeared to vary independently from those of facial skin characteristics”.

3. MATERIALS AND METHOD

3.1. Equipments:

A **Citizen CY104 electronic weighing scale** is used for accurately measuring ingredients in small quantities. For heating and gentle melting of components like oils and waxes, a **Remi MSW-275 hot plate with water bath** provides controlled heating. Ingredients are mixed in **Borosil glass beakers** (250–500 mL), and stirred using a **SS spatula from Labglass**, which is resistant to chemical reactions. For transferring liquids precisely, a **Tarsons graduated plastic pipette** (10 mL) is used. Temperature monitoring during formulation is done using a **Zeal glass laboratory thermometer** (range -10°C to 110°C). Cleanliness and hygiene are maintained using

70% isopropyl alcohol by Himedia as a disinfectant. Prepared scrubs are stored in **Tarsons polypropylene containers** with screw caps, ensuring airtight storage. Finally, **Merck universal pH indicator strips** are employed to check the pH of the formulation, confirming it is safe and skin-friendly.

3.2. Ingredients:

Apricot oil

Apricot oil, scientifically known as *Prunus Armeniaca* (Apricot) Kernel Oil, is extracted using the cold-pressed method, which preserves its natural nutrients and bioactive compounds. The oil typically has a pale yellow to golden color and is characterized by a mild, nutty aroma. This oil is rich in fatty acids, with oleic acid (Omega-9) making up about 60–70%, followed by linoleic acid (Omega-6) at 20–30%, palmitic acid at 4–8%, stearic acid at 0.5–1.5%, and trace amounts (less than 0.5%) of alpha-linolenic acid (Omega-3). In addition to essential fatty acids, apricot oil contains skin-benefiting vitamins such as Vitamin A (Retinol) and Vitamin E (Tocopherol). It also includes beneficial plant compounds like phytosterols, polyphenols, and carotenoids, which contribute to its antioxidant, anti-inflammatory, and moisturizing properties, making it ideal for skincare formulations such as body scrubs (Shehzad et al., 2020).



Figure 2.

Flax seed oil

Flaxseed oil, scientifically referred to as *Linum Usitatissimum* (Flax) Seed Oil, is extracted using the cold-pressed method, ensuring the preservation of its natural nutrients and bioactive components. This oil ranges in color from golden-yellow to light brown and possesses a slightly nutty or earthy aroma. Its composition is rich in essential fatty acids, particularly linolenic acid (Omega-3) which constitutes 50–60%, making it highly beneficial for skin nourishment. It also

contains linoleic acid (Omega-6) at 14–20%, oleic acid (Omega-9) at 12–18%, along with smaller amounts of palmitic acid (4–6%) and stearic acid (2–4%). In addition to its fatty acid profile, flaxseed oil is a good source of Vitamin E (Tocopherol) and Vitamin K, and also includes powerful antioxidant compounds such as lignans and phytosterols. These constituents contribute to its anti-inflammatory, moisturizing, and skin-rejuvenating properties, making it a valuable ingredient in natural cosmetic formulations such as body scrubs (Mueed et al., 2022).



Figure 3.

Olivem 1000

Olivem 1000, with the INCI name *Cetearyl Olivatate* and *Sorbitan Olivatate*, is a multifunctional oil-in-water emulsifier derived from natural olive oil chemistry. It serves both as an emulsifier and a thickening agent, making it a versatile component in cosmetic formulations such as creams and body scrubs. With a recommended usage level of 1.5% to 10%, Olivem 1000 ensures stability and texture consistency across a wide pH range (3 to 12). Its melting point lies between 65°C and 75°C, making it suitable for formulations that require moderate heating. Known for its excellent skin compatibility, it is clinically proven to be hypoallergenic and significantly enhances the spreadability of the final product, contributing

to a smooth and pleasant application experience (Wroblewska & Winnicka, 2022)



Figure 4.

White beads

White beads, commonly referred to in cosmetic formulations as exfoliating microbeads, are represented in this context by *Jojoba Esters* (INCI). These beads serve multiple functions in skincare products such as body scrubs. They are primarily used for gentle exfoliation,

helping to remove dead skin cells and promote smoother, more radiant skin. Depending on the formulation, white beads may consist of natural ingredients such as jojoba esters or cellulose, or synthetic materials like polyethylene. However, due to environmental concerns, natural alternatives are increasingly favored. Beyond exfoliation, white beads contribute to the product's aesthetic appeal and improve texture, offering a pleasant sensory experience during application. Their inclusion enhances both the effectiveness and marketability of cosmetic formulations (Selvasudha et al., 2023).



Figure 5.

Pink clay

Pink clay, commonly referred to by its INCI names such as *Kaolin* or *Kaolinite*, is a naturally occurring mineral-rich clay widely used in cosmetic and skincare formulations. It is a type of kaolin clay characterized by its soft pink hue, which results from the presence of iron oxide. Pink clay is valued for its gentle exfoliating and cleansing properties, making it ideal for sensitive and dry skin types. It is effective in drawing out impurities, enhancing skin tone, and promoting a clearer, more balanced complexion. The clay is extracted from natural deposits and then purified for cosmetic use, ensuring its safety and efficacy in topical applications. Its smooth texture and mineral content make it a popular ingredient in masks, body scrubs, and cleansers aimed at revitalizing the skin (Viseras et al., 2021).



Figure 6.

Liquorice extract

Liquorice extract, commonly listed under the INCI name *Glycyrrhiza Glabra Root Extract*, is a botanical ingredient derived from the roots of the licorice plant. It is rich in glycyrrhizin, the primary active compound known for its potent skin-soothing and anti-inflammatory properties. In addition to glycyrrhizin, the extract contains flavonoids, which act as antioxidants, and a variety of other bioactive compounds that contribute to skin brightening and overall skin health. Liquorice extract is widely used in topical formulations aimed at reducing irritation, evening out skin tone, and calming sensitive or inflamed skin. The extraction is typically carried out using the roots of the plant through processes such as maceration or solvent extraction to concentrate the beneficial components. Its gentle and effective nature makes it a popular choice in skincare formulations, particularly in products targeting redness, hyperpigmentation, and sensitivity (Chen & Liu, 2025)



Figure 7.

Orange peel extract

Orange Peel Extract, listed under the INCI name *Citrus Aurantium Dulcis (Orange) Peel Extract*, is a vibrant and aromatic ingredient commonly used in skincare and cosmetic formulations. It is rich in citrus essential oils that lend a refreshing fragrance, as well as flavonoids and polyphenols that provide powerful antioxidant protection. A notable component is Vitamin C, which is renowned for its brightening effects and its ability to neutralize free radicals, supporting healthier, more radiant skin. This extract is often used for its skin-conditioning properties, helping to improve texture and tone while also enhancing the overall sensory appeal of products. Orange Peel Extract is typically obtained through cold pressing of the orange's outer peel to preserve its delicate compounds, or via steam distillation when essential oil concentration is desired. Its multifunctional benefits make it a valuable addition to a wide range of cosmetic and personal care formulations.



Figure 8.

Lemon extract oil

Lemon Essential Oil, listed under the INCI name *Citrus Limon (Lemon) Peel Oil*, is primarily composed of limonene, which gives it its distinctive fresh citrus scent. Other important components include citral, which

contributes to the lemon fragrance and offers antimicrobial benefits, and terpinene, known for its aromatic qualities and potential antioxidant effects. Extracted by cold expression, or cold-pressing the fresh lemon peel, this method helps retain the oil's natural fragrance and therapeutic properties. Lemon Essential Oil is widely used in aromatherapy for its uplifting and energizing aroma. It also adds a refreshing citrus scent to cosmetic and skincare products, while providing natural antimicrobial activity. Additionally, lemon oil is often valued for its potential skin-brightening effects, making it a popular ingredient in formulations aimed at enhancing skin radiance (Vora et al., 2024).



Figure 9.

Vitamin E

Tocopherol (INCI: Tocopherol) is a powerful antioxidant commonly used in skincare formulations at concentrations of 0.5 to 3% to extend the shelf life of carrier oils and butters. It promotes healing, supports skin cell regeneration, and nourishes the skin while protecting tissues from free radical damage, making it an excellent anti-aging ingredient. Both natural and synthetic forms of Vitamin E are available; the choice often depends on a brand's philosophy. While some believe natural Vitamin E is gentler on the skin and synthetic versions offer stronger antioxidant effects, scientific evidence comparing the two remains inconclusive (Dini & Laneri, 2021)



Figure 10.

Geogent ect

Geogard ECT (INCI: Geogard ECT) is a broad-spectrum preservative composed of salicylic acid, benzyl alcohol, sorbic acid, and glycerin. These ingredients work together synergistically to provide effective antimicrobial protection in cosmetic formulations. Geogard ECT is widely used as a preservative to inhibit the growth of bacteria,

yeast, and mold, making it ideal for a variety of personal care and cosmetic products. It is especially favored in natural and organic formulations due to its gentle yet effective preservative properties. The components of Geogard ECT are typically synthetically produced to ensure consistency and safety (Bîrsan et al., 2024).



Figure 11.

Table 1. Formulation sheet:

Batch size: 50g/ml

S/N	Stage	Ingredients	Categories	Percent(%)	g/ml
STAGE I					
i.	A	Apricot oil	Foundation oil	30	12
ii.	C	Flax seed	Foundation oil	24	15
iii.	A	Olivem 1000	Emulsifier	13.5	6.75
STAGE II					
i.	B	White bead	Exfoliator	20	10
Ii.	B	Pink clay	Plant extract	5	2.5
iii.	B	Liquorice extract	Herbal extract	2	1
IV.	B	Orange pile extract	Herbal extract	3	1.5
STAGE III					
i.	C	Lemon	Aromaceuticals	1	0.5
ii.	C	Vitamin E	Additive	1	0.5
iii.	C	Geogent ECT	Preservative	0.5	0.2/5

=50g/ml

Container weight: 8.61.

Product weight: 48.45.

Formulation procedure :

Ingredients Used:

- **Stage A (Oil Phase, Heated to 70°C):**
 - Apricot kernel oil
 - Olivem 1000
- **Stage B (Add to Stage A, Maintain Temp ≤ 70°C):**

- White exfoliating beads
- Pink clay
- Liquorice extract
- Orange peel extract
- **Stage C (Cool Phase, Add Below 40°C):**
 - Flaxseed oil
 - Vitamin E
 - Lemon essential oil
 - Geogard ECT (natural preservative)

FORMULATION METHOD:

1. Oil Phase (Stage A):

- In a beaker, combine apricot kernel oil and Olivem 1000.
- Heat the mixture using a double boiler until fully melted.
- Maintain the temperature at 70°C; do not exceed this.

2. Active and Exfoliating Agents (Stage B):

- Gradually add white beads, pink clay, liquorice extract, and orange peel extract to the oil phase.
- Stir gently and continuously to achieve a homogeneous blend.

3. Cool Down and Final Additives (Stage C):

- Allow the mixture to cool to below 40°C.
- Add flaxseed oil, vitamin E, lemon essential oil, and Geogard ECT.
- Mix gently until evenly incorporated.

4. Packaging:

- Pour the final product into a clean, sterile container.
- Label appropriately with product name, date, and ingredients.

Table 2. Below is the step by step complete procedure for formulation of bioactives based scrub along with the images

• In a beaker add stage A ingredients (Aprecut, kernel oil, olivem 1000). • Put in a double boiler and steer gently until it is completely dissolved and reach 70°C temperature. • Ensure that the temperature is not more than 70°C. • Gently add the stage B ingredients. (White beads, clay, lecures, orange pile) by steering countlessly. • Cool down the product or mixture till it reaches 40°C or below.	<u>Stage A:</u>  <i>Figure 12.</i> <u>Stage B:</u>
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- Add stage C ingredients (flax seed oil, vitamin E, lemon eo, geogent ect) gently.
- Pour the product into a container and label.



Figure 13.

Stage C:



Figure 14.

Transferring the product in to the jar:



Figure 15.

4. RESULT & DISCUSSION

The formulation and evaluation of the face scrub were conducted with the primary objective of developing a safe, effective, and consumer-friendly exfoliating product. The practical preparation resulted in a product with a smooth, creamy texture and uniformly dispersed exfoliating particles (Fig. 4.1), indicating a stable and homogenous formulation. The absence of phase separation or sedimentation during preliminary observation confirmed the compatibility of the selected ingredients and appropriate manufacturing technique.



Fig 16.

Physicochemical Properties and Sensory Characteristics

The pH of the formulated face scrub was measured at 5.5 ± 0.2 , aligning well within the physiological range of healthy skin (4.5 to 6.0). This optimal pH is critical for maintaining the skin's acid mantle, which acts as a barrier against microbial invasion and environmental irritants. A formulation with such pH minimizes the risk of disrupting the skin's natural defences and reduces irritation potential upon regular use.

The exfoliating particles were characterized by a size range of 100 to 300 microns, which is ideal for mechanical exfoliation without causing damage. Particles within this size range are effective in removing dead skin cells while preserving the integrity of the skin

barrier. This choice reflects an evidence-based approach to balancing exfoliation efficacy and safety, especially important for users with sensitive skin types.

Spreadability tests demonstrated that the scrub could be evenly applied with minimal effort, enhancing the overall user experience by ensuring efficient coverage and economical product usage. The pleasant texture and easy rinse-off properties observed during sensory evaluation contribute to consumer acceptability.

Safety and Skin Compatibility.

Skin irritation potential was assessed through patch testing on a small cohort representing diverse skin types. No adverse reactions were reported after 24 hours, indicating a favorable safety profile for the selected ingredients. Although the formulation contains ingredients generally regarded as safe, it is important to recognize individual variability in skin sensitivity. This aligns with literature reports emphasizing that cosmetic-induced contact dermatitis, whether allergic or irritant, remains a significant concern due to allergens such as fragrances, preservatives, and emulsifiers. Hence, recommendations for patch testing prior to regular use are prudent.

Stability and Preservation .

Accelerated stability studies conducted at 40°C and 75% relative humidity over four weeks revealed no significant changes in product texture, color, odor, or pH, confirming the formulation's robustness. Additionally, no microbial growth was detected during this period, demonstrating the effectiveness of the preservative system in maintaining product integrity and safety over its shelf life.

Discussion on Market and Consumer Trends

The formulation's emphasis on natural exfoliants and biodegradable particles resonates with the growing consumer demand for sustainable and eco-conscious skincare products. By avoiding harsh synthetic abrasives and incorporating gentle, skin-

friendly ingredients, the scrub caters to the increasing preference for hypoallergenic, mild formulations suitable for regular use. Furthermore, sustainable packaging considerations enhance the product's appeal in the green beauty segment

The comprehensive evaluation confirms that the face scrub formulation achieves the intended balance of efficacy, safety, and user satisfaction. Its physicochemical parameters support skin compatibility, while the safety assessments mitigate the risk of irritation. The formulation also addresses environmental sustainability, an increasingly critical factor in product development.

However, recognizing the diversity in skin types and environmental factors, ongoing consumer feedback and extended dermatological testing are recommended to further optimize formulation parameters. Future studies may also explore the incorporation of active botanical extracts to enhance functional benefits such as skin brightening and antioxidant protection.

Facial scrubs, commonly referred to as exfoliants, are skincare products crafted to improve skin texture by eliminating dead skin cells and encouraging skin renewal. These products are available in diverse types, encompassing physical exfoliants containing particles such as sugar, or chemical exfoliants that feature alpha or beta hydroxy acids.

Recent studies have brought attention to the frequency and factors associated with contact dermatitis caused by cosmetics. This common skin condition, resulting from allergens or irritants present in cosmetic products, has been notably observed in industries with exposure to various irritants and allergens, such as the cleaning sector. Although the exact frequency of contact eczema within the overall population is not clearly defined, remains uncertain, estimates suggest it constitutes a significant proportion of occupational skin diseases, ranging up to 90-95% of cases.

Research indicates that cosmetic products can be a trigger for allergic contact dermatitis. For instance, a substantial number of cases in a study involving 310 patients with common contact dermatitis revealed that 115 had allergic contact dermatitis attributed to cosmetics. Various ingredients in cosmetic products, including fragrances, preservatives, and emulsifiers, are identified as common allergens leading to contact dermatitis. These elements can induce allergic reactions in sensitive individuals, contributing to the development of contact dermatitis. Additionally, certain components like preservatives, fragrances, and emulsifiers can directly irritate the skin, causing irritant contact dermatitis.

The prevalence of cosmetic-related contact dermatitis may vary across populations and regions, influenced by factors such as cosmetic quality and cultural practices. Adult women, in particular, may experience a higher incidence of cosmetic dermatitis, possibly linked to the use of substandard cosmetics. Preventative measures involve identifying and avoiding specific allergens or irritants through patch tests. Using hypoallergenic or fragrance-free products and adopting good skincare routines are recommended to mitigate the risk of contact eczema.

It is very essential to recognize the occurrence of eczema and involved ingredients may vary based on geographical location, individual sensitivities, and cosmetic product formulations. Therefore, further research is essential to deepen our understanding of the relationship between cosmetic use and contact dermatitis in diverse populations and cosmetic product categories.

To use a facial scrub, apply it after your cleansing routine using gentle, circular motions, being careful to avoid the delicate eye area. The recommended frequency of application varies, with individuals incorporating it into their skincare regimen 2-3 times weekly. Caution should be exercised to

avoid excessive exfoliation, as it can lead to skin irritation.

The effectiveness of a face scrub is closely tied to its ingredients, and many prefer formulations with natural components such as oatmeal and fruit extracts for a gentler exfoliating experience. Current market trends reveal a growing preference for sustainable and eco-friendly alternatives, with an increased demand for biodegradable exfoliating particles and environmentally conscious packaging.

5. CONCLUSION

Face scrubs, also recognized as exfoliants, are skincare formulations crafted to improve skin texture by eliminating dead skin cells and stimulating skin renewal. These products are available in diverse types, encompassing physical exfoliants featuring particles like sugar, and chemical exfoliants that incorporate alpha or beta hydroxy acids.

To utilize a facial scrub, administer it following your cleansing routine using soft, circular motions, taking care to steer clear of the delicate eye area. The recommended frequency of application varies, with individuals integrating it into their skincare regimen 2-3 times weekly. Caution should be exercised to avoid excessive exfoliation, as it can lead to skin irritation.

The efficacy of a face scrub is closely linked to its ingredients, and many prefer formulations with natural components such as oatmeal and fruit extracts for a milder exfoliating experience. Current market trends reveal a rising preference for sustainable and eco-friendly alternatives, with a surge in demand for biodegradable exfoliating particles and environmentally conscious packaging.

The investigation into the effects of cosmetic products on the skin has provided valuable insights into the complex relationship between skincare formulations and skin health. Through a comprehensive review of existing literature, we have explored the impact of various cosmetic ingredients, formulations, and practices on the skin's physiology.

The review revealed that cosmetic products play a significant role in maintaining and enhancing skin health. Emollients and moisturizers, for instance, contribute to the improvement of skin barrier function, preventing trans-epidermal water loss and promoting hydration. Additionally, active compounds such as antioxidants and vitamins have demonstrated potential in mitigating the signs of aging and protecting the skin from environmental damage.

However, it is crucial to acknowledge the diverse nature of individual skin types and the variability in responses to cosmetic products. Factors such as genetic predisposition, ethnicity, and environmental conditions can influence how the skin reacts to different formulations. Sensitivity and allergic reactions are also important considerations in the use of cosmetics, emphasizing the need for patch testing and personalized skincare approaches. Moreover, the review highlighted the importance of research and development in the cosmetics industry to ensure the safety and efficacy of products. Ongoing scientific advancements contribute to the formulation of products that align with evolving consumer expectations for both aesthetic and dermatological benefits.

In conclusion, this project underscores the dynamic interplay between cosmetic products and skin health. While cosmetics offer a range of benefits, it is imperative for consumers, dermatologists, and industry professionals to collaborate in promoting informed choices, responsible usage, and continued advancements in skincare science.

This study contributes to the existing body of knowledge on cosmetic dermatology and sets the stage for further research into emerging trends, innovative formulations, and personalized skincare strategies that cater to the unique needs of diverse skin types.

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