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HOW REGIONAL CULTURAL SKINCARE PRACTICES ON THE SKIN MICROBIOME AND DERMATOLOGICAL HEALTH OUTCOMES IN SOUTH ASIAN POPULATIONS

Zainab Munir[*1], Huma Afzal[*2], Momna Abdul Khaliq[3], Ahmad Ali[4], Ayesha Akram[5], Zahida Batool Abidi[6]

[*1, *2,3,4,5,6]*Department of Dermal Sciences, Riphah International University, Faisalabad, Punjab Pakistan, 44000*

[*1]zainabmunir677@gmail.com, [*2]humaafzal5757@gmail.com

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Corresponding Author: *
Zainab Munir
Huma Afzal

Abstract

Skin microbiomes in humans represent a dynamic and intricate ecosystem that serves as the cornerstone for skin physiology, immunity, and the potential for disease susceptibility. Within South Asian populations, traditional skincare products based on plants, oils, and rituals may serve as external regulators of skin microbiome composition and function. Nevertheless, the specific mechanism by which these factors modulate skin microflora remains poorly understood. This review aims to synthesize and evaluate the current scientific literature regarding the interaction between regional skincare habits and skin microbiomes, paying special attention to the effects on microbial diversity, functional modulation, and host-microbe interactions. Emerging studies have demonstrated the potential of phytochemicals and lipid compounds to promote microbial balance and enhance barrier function in the skin. On the other hand, inconsistency in preparation, usage frequency, and environmental exposure may adversely affect the balance and stability of the microbial community leading to dysbiosis. This review also highlights the existing knowledge gaps concerning region-specific, high-resolution analysis of the skin microbiome and its relationship to skincare habits, emphasizing South Asian populations. Filling this knowledge gap is necessary through an interdisciplinary approach that combines clinical trials and omics methods.

1. Introduction

The microbiome of the human skin represents an elaborate and localized ecosystem that plays an integral part in sustaining homeostasis of the skin, immune responses of the host, and resistance to pathogens. The microbiome community is determined by intrinsic parameters, such as host genotype, age, and physiology, alongside external factors, such as environmental exposure, personal hygiene habits, and topically applied substances. Disruption of microbial balance, referred to as dysbiosis, was found to be associated with many dermatological disorders, such as acne vulgaris, atopic dermatitis, and psoriasis(Youn, 2025).

Skin care routines among people from the South Asian subcontinent rely heavily on culture, tradition, and ethnobotany and frequently involve the application of formulations derived from plants, natural oils, and ritualistic cleansing practices(Goh, 2024). Curcuma longa, Azadirachta indica, and Santalum album are some common plant ingredients whose bioactivities include antimicrobial, anti-inflammatory, and antioxidant actions. Even though skincare

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traditions based on these ingredients are actively used for skin health maintenance and treatment of common skin diseases, little is known about their interaction with the skin microbiome.

The recent progress made in studying the microbiomes indicates that the application of skincare products may play a vital role in shaping skin microbiomes by changing their composition, diversity, and dynamics(Khmaladze, Leonardi, Fabre, Messaraa, & Mavon, 2020). Despite the abundance of available scientific evidence, it is predominantly generated by studies carried out among Western populations and thus does not apply to South Asians. For this reason, a careful analysis of how different skincare practices used in certain regions can affect skin microbiomes must be performed(Dubli et al., 2025). In this review, current evidence on the effects of cultural skincare practices on the skin microbiome will be discussed.

1.1 Background of Skin Microbiome

The skin microbiome consists of various microorganisms, namely bacteria, fungi, viruses, and arthropods, inhabiting specific skin niches of humans. These microorganisms differ greatly from one another in terms of habitat due to the differences in their living conditions, such as varying levels of sebum secretion, pH value, temperature, and moisture content(Olceroglu, Balci, & Kati, 2025). The most common bacterial species found in the skin microbiome of humans include Cutibacterium, Staphylococcus, and Corynebacterium, which provide indispensable functions related to maintaining skin stability and its defensive capacity.

In terms of function, the skin microbiome has an important role in regulating the immune response of the body, protecting the skin from infections caused by pathogenic microbes by inhibiting their colonization, and preserving the integrity of the epidermis(O'Brien, 2014). Nevertheless, it should be noted that this balance is extremely vulnerable to numerous external and internal changes in the organism's life, including the age-related changes, genetic characteristics, hormones, environment, and personal hygiene practices(Potbhare, RaviKumar, Munukka, Lahti, & Ashma, 2022).

The imbalance in the microbiota populations is known as dysbiosis and has been shown to be correlated with many dermatological diseases such as acne vulgaris, atopic dermatitis, psoriasis, and skin infections(Echeverry, 2026a). The use of high-throughput sequencing techniques and metagenomics has further improved our knowledge on the composition and function of skin microbiota, thus emphasizing its significance for dermatological studies.

1.2 Importance of Cultural Skincare Practices

The cultural skin care habits make an important part of everyday health activities and are influenced by traditions, environment, and ethnobotany. In many cultures, especially in South Asian ones, the cultural skin care habits incorporate frequent usage of natural products, herb formulas, and oil-based applications traditionally applied for skin care and dermatological problems. The frequency and techniques of the application may be influenced by various social and religious traditions, too. For dermatologists, the cultural skin care habits are significant since they constitute external regulators of the skin environment that may affect such factors as skin hydration, pH value, lipid content, and microbial colonization. Plant-based products applied for skin care in ethnically oriented habits include such biologically active substances as polyphenols, flavonoids, and essential oils, exhibiting antimicrobial, anti-inflammatory, and antioxidant properties(Leung, Wilkins, & Lee, 2015).

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Fig.1 ***Importance of Skin Care Practices***

1.3 Relevance to South Asian Populations

Not only do these procedures have a preventive function, but they are also often utilized in the management of skin diseases such as inflammatory conditions, hyperpigmentation, and infections. Specifically, in terms of its microbiological implications, the relationship between these cultural skin care practices and the skin microbiota is of special importance, as differences in hygiene practices, the use of cosmetics, and exposure in different regions might result in varying bacterial profiles than those seen in Western populations(Sachdev & Khunger, 2023). Nevertheless, existing research on the skin microbiome has been done on Western populations, causing an immense gap in knowledge about the specific bacteria profile in South Asians and how they respond to cultural skin care interventions(Pagac et al., 2025).

1.4 Research Gap

In spite of the fast development of knowledge regarding skin microbiomes in recent years, there still exists a considerable gap in the region-specific literature that would examine the role of cultural skincare traditions on the microbial communities(Renuka, Ameeta, Eveliina, Leo, & Richa). The majority of the studies concerning the issue come from Western countries and do not take into account genetic, climatic, behavioral, and skincare factors characteristic of the South Asian population. As a result, the information obtained does not seem to be applicable to this specific group of people.

Moreover, in spite of the number of studies that have examined the antimicrobial and anti-inflammatory properties of such plants as turmeric (Curcuma longa), neem (Azadirachta indica), and sandalwood (Santalum album), the role of these plants in skin microbiomes has not yet been studied sufficiently(Krzysztof Skowron et al., 2021). Another issue concerns oil-based skincare techniques widely applied in South Asia and their effects on microbial populations and barriers' functioning. The second important limitation relates to the dearth of integrative studies involving dermatological endpoints and high throughput sequencing or metagenomics to study

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

the impact of traditional skin care on host-microbiome dynamics. Methodological differences in defining skin care practices, the lack of standardization in methodologies used, and insufficient longitudinal studies pose limitations in drawing any causative inference(Echeverry, 2026b). It is essential to conduct region-specific dermatologic studies involving microbial evaluation to address the gaps in current literature and integrate traditional knowledge systems with evidence-based dermatology.

1.5 Aim and Objectives of the Review

The main purpose of this review is to examine the relationship between the effect of cultural skincare practices and changes in the skin microbiome with consequent outcomes on dermatology. This review will be able to bring together all the necessary information obtained through microbiology, dermatology, and ethnopharmacology in order to build the relationship between traditional knowledge about skincare practices and contemporary science about the skin microbiome. The goals of this review are the following:

1. To provide an overview of scientific knowledge on the skin microbiome and its influence on cutaneous health and disease prevention.
2. To describe and classify cultural skincare practices applied by people in South Asia, namely using herbs, oils, and ritual cleansing practices.
3. To assess the possible influence of these practices on skin microflora in terms of their diversity, composition, and activity.
4. To identify associations between the use of different traditional skincare practices and specific dermatological health outcomes such as acne, eczema, hyperpigmentation, and infections.

2. Literature Mapping for Skin Microbiome and Culture-Specific Skincare Habits

This systematic review was undertaken through the application of a structured narrative-integrative approach in identifying, analyzing, and synthesizing relevant scientific literature regarding the association between culture-specific skincare habits and the skin microbiome within South Asian communities(Mennitti et al., 2025). Such an approach allowed for the development of a rigorous process in reviewing the literature consistent with that seen in other biomedical reviews, given the interdisciplinary nature of microbiome and ethnodermatological research.

3. Scientific Databases and Evidence Sources for Skin–Microbiome Research

3.1 Core Biomedical Databases and Literature Repositories

The literature review covered a wide array of resources, among which were internationally renowned biomedical databases such as PubMed, Scopus, Web of Science, and Google Scholar. The choice was made based on the inclusion of numerous peer-reviewed and highly cited articles from leading dermatology, microbiology, and microbiome research journals indexed in the chosen databases(Jaenicke, Zhang, Proksch, Krutmann, & Luger, 2025).

3.2 Supplementary Ethnopharmacological and Region-Specific Sources

For the purpose of including culturally and regionally relevant literature, additional literature searches were done in ethnopharmacology, dermatology region-specific, and traditional medicine literature(Jaenicke et al., 2025). Literature was also reviewed by manually searching the reference sections of selected review papers for seminal articles related to the biology of skin microbiome and skincare practices among South Asians.

3.3 Structured Search Strategy Using Controlled Vocabulary

The literature search methodology utilized MeSH terms along with free-text key words to account for terminological variations within different disciplines(Wallen-Russell et al., 2023). The main search terms were “skin microbiome,” “skin barrier,” “traditional skin care,” “herbal dermatology,” “oil skin care,” and “South Asia.” Using this approach provided an efficient way to locate papers related to both microbial processes and cultural skin care approaches.

Frontier in Medical & Health Research

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Table 1. *Databases, keywords, and search strategy used for literature retrieval in skin microbiome–cultural skincare research*

Component	Details
Databases Used	PubMed, Scopus, Web of Science, Google Scholar
Time Frame	2005–2025
Keywords	Skin microbiome, cutaneous microbiota, herbal skincare, ethnodermatology, South Asia, oil-based skincare
Boolean Operators	AND, OR, NOT
MeSH Terms	Skin Microbiome, Dermatitis, Ethnopharmacology
Filters Applied	Human studies, English language, peer-reviewed journals

3.4 Boolean Search Optimization and Refinement

Boolean operators (such as AND, OR, and NOT) were rigorously used to help reduce the output of search results and make the findings more specific. Examples included searches with keywords like "skin microbiome AND herbal skincare AND South Asia," and "cutaneous microbiota AND oil-based applications." The use of these operators helped to identify literature relevant to the intersection of microbiology, dermatology, and ethnobotany(K Skowron et al., 2021).

3.5 Thematic Organization of Retrieved Literature

All of the studies discovered fell under three main categories: (1) the composition, diversity, and functionality of the skin microbiota, (2) traditional cultural skin care techniques, and (3) dermatological health and its association with skin-related diseases. The organization of this study in the above categories facilitated the integration of different types of information for analysis.

4. Eligibility Criteria for Evidence Selection

Inclusion criteria involved articles that were peer reviewed, written in English language, and dealt with human beings(Zhu et al., 2025). The eligible articles were those that provided information about composition of skin microbiome, dermatological effects, and indigenous methods of skincare for the South Asian population. Priority was given to articles published between the years 2005 and 2025, which would reflect the advancements in the field of microbiome sequencing and dermatology(Gervason et al., 2020).

4.1 Study Selection and Screening Process

All documents that were obtained underwent screening through titles and abstracts to eliminate duplications and unrelated studies(Akinsulie et al., 2024). The eligible documents were assessed according to their contributions to the structure of the microbiome, pathways, or dermatology outcomes associated with skin care practices. This helped ensure that the criteria met the research's theme on microbiomes, culture, and dermatology(Skotnicki & Shulgan, 2018).

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Table 2. *Inclusion and exclusion criteria for study selection in skin microbiome and cultural skincare review*

Inclusion Criteria		Exclusion Criteria	
Peer-reviewed studies		Non-peer-reviewed articles	
Human-based studies		Animal-only studies (no translational relevance)	
2005–2025 publications		Editorials, opinions, commentaries	
Skin microbiome research		Non-skin microbiome studies	
Cultural skincare relevance		Duplicate publications	
South Asian relevance preferred		Methodologically weak studies	

4.2 Study Classification and Synthesis Approach

The included studies were classified under themes such as skin microbiome dynamics, herbal and ethnobotanical use for skincare, oil-based treatments, and links between diseases and dermatology(Knaggs & Lephart, 2023). Qualitative analysis rather than quantitative meta-analysis was preferred because of the lack of homogeneity in methods such as sequencing technology and outcome measures.

.4.3 Analytical Framework for Interpretation

The synthesized information was then assessed in relation to three interrelated aspects:

i. The composition of the skin microbiome and its physiological functions in the regulation of immunity and the establishment of a biological barrier.

ii. The skin care regimen within a culture that alters microbial dynamics by way of natural ingredients like polyphenols and flavonoids.

iii. Skin conditions ranging from acne, eczema, hyperpigmentation, and infections.

4.4 Methodological Constraints and Evidence Limitations

The current evidence has limitations due to geographical and population bias because the majority of evidence has come from Western populations, who do not necessarily have the same microbiome as South Asians because of their different genetic makeup and climatic conditions as well as other factors, including skincare traditions(Lee, Chaudhary, & Agrawal, 2024). Other methodological limitations include heterogeneity of techniques used to sequence DNA as well as heterogeneity in outcomes measured. In addition, there is currently very little research that explores the causality of these skincare traditions and their impacts on the microbiome through longitudinal studies(Rocha et al., 2026).

5. Cutaneous Microbial Ecosystem: Composition, Function, and Clinical Relevance

The skin microbiome represents the complex and highly variable population of microorganisms residing on the skin surface, comprising various types of microorganisms such as bacteria, fungi, viruses, and mites, which participate in the physiological processes of the skin(Huuskonen, Anglenius, Tiihonen, & Ouwehand, 2021). In recent years, it has gained increasing attention as a fundamental aspect of cutaneous biology, involved in regulating cutaneous homeostasis, immunoregulation, and defense against pathogen infection. Skin microbiota differs widely among anatomical locations, which can be grouped into three main categories based on their distinct characteristics of sebum production, hydration, pH, and oxygen tension, namely sebaceous, moist, and dry microhabitats(Choudhary, Sadana, Sen, & Iyer, 2026). In terms of bacteria, the most common genera include Cutibacterium, Staphylococcus, and Corynebacterium, contributing to skin physiology by regulating microbial flora and preventing microbial invasion. Similarly, the fungal community mainly comprises Malassezia species, participating in skin homeostasis and health and disease conditions depending on the environmental context and host factors(Gao & Chen, 2025). The skin microbiome acts as a biological barrier by secreting

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

antimicrobial peptides, influencing immune reactions, and interacting with keratinocytes to improve epidermal integrity. Abnormality of skin microbiota, referred to as dysbiosis, is strongly implicated in several dermatological disorders such as acne vulgaris, atopic dermatitis, psoriasis, and seborrheic dermatitis(Duwarah, Ghosh, Sen, & Choudhary, 2024). Advances in high-throughput sequencing technologies and metagenomic analysis have significantly improved the understanding of microbial diversity and functional potential, revealing that the skin microbiome is not static but highly responsive to environmental exposures, hygiene practices, and topical interventions(Hamblin, 2021). In this context, external factors such as cultural skincare practices may act as important modulators of microbial composition and function, thereby influencing both skin health and disease susceptibility in different populations(Mpofana et al., 2023).

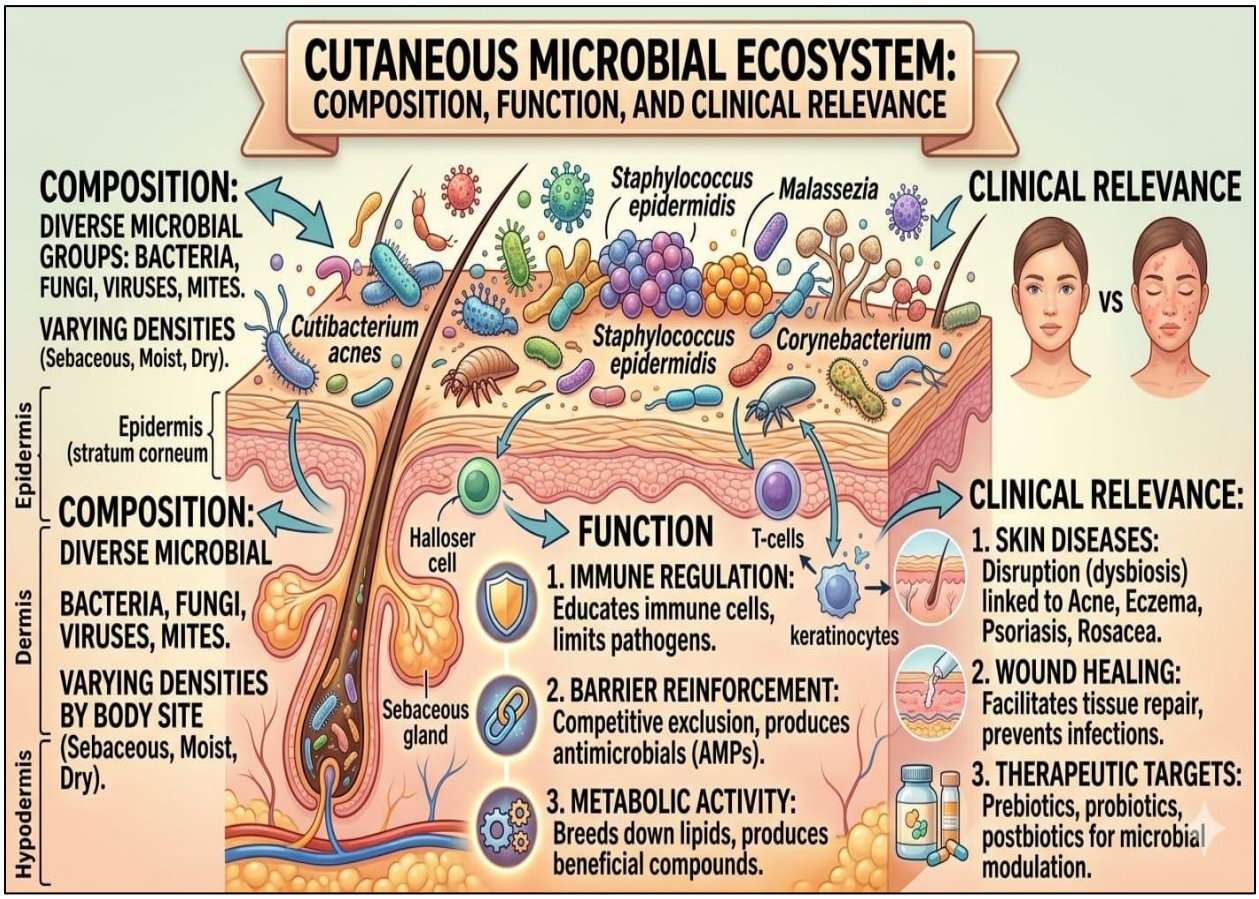

Fig. 2 ***Microbiome Composition and Physiological Function***

5.1 Taxonomic and Ecological Composition of the Skin Microbiota

The skin microbiome is characterized by structural diversity and specialization based on the habitat where bacteria, fungi, viruses, and micro-arthropods exist in a dynamic balance with the host body(Boutot et al.). The diversity of this community depends on its spatial specificity in regard to anatomic sites, which include sebaceous, wet, and dry habitats, characterized by differences in lipid content, moisture, temperature, and acidity levels, and thus creating different ecological niches that accommodate various microbial assemblages(Bohbot, Rebelo, & Nappi, 2025).

Bacteriologically speaking, the skin is inhabited by representatives of four main phyla, which include Actinobacteria, Firmicutes, Proteobacteria, and Bacteroidetes. Of particular importance is the

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

genus Cutibacterium (former Propionibacterium), known for being dominant in the sebaceous skin region because of its lipophilic nature(Schmid-Grendelmeier et al., 2019). Another important genus is Staphylococcus, which inhabits several sites within the skin, whereas Corynebacterium is common in the wet areas, especially the axillae and groin.

Fungi, on the other hand, are predominantly made up of Malassezia species, which constitute the bulk of the mycobiome in healthy humans(Verma et al., 2024). The lipid-dependent yeast species are especially abundant in sebaceous areas and have been involved in both commensal and pathogenic relationships dependent on the immunocompetence of the host and the surrounding environment (Grice & Segre, 2011). Moreover, the virome is comprised of numerous phages which serve as natural regulators of bacteria populations, while the potential impacts of skin mites, particularly Demodex, remain to be elucidated regarding their significance in health and disease. Generally, the microbiome of the skin is far from being stable, but is subject to significant fluctuations resulting from internal host characteristics and external environmental pressures(Fournier et al., 2025). Such fluctuations form the basis upon which external manipulations through culture-specific skincare regimens can alter microbial equilibria and affect dermatological outcomes.

5.2 Determinants Shaping the Skin Microbiome Dynamics

Skin microbiome represents a very active ecosystem that features considerable variation in its structure and functionality, driven by a number of host-related and environmental factors. This is an important consideration when interpreting the differences in skin microbial communities not only in terms of individual differences but also differences among various sites on one person's skin(Zhao, Zhen, Chen, & Zhang, 2025). It is therefore important to consider various factors influencing skin microbiota composition in order to understand health-related implications (Byrd et al., 2018). When it comes to host-related factors, genetics is one of the primary ones because they determine the immune system characteristics and integrity of the skin barrier. Another determinant is age as the skin microbiome goes through significant transformations from birth through the entire life cycle of a person, depending on changes in sebum secretion and hormonal and immune status(Pan et al., 2026). Moreover, hormonal changes, including those in puberty, pregnancy, and menopause, lead to a change in the microbial structure, especially at sebaceous skin sites (Sanford & Gallo, 2013). Finally, there are many factors that influence skin microbiome composition and functionality externally. Environmental conditions, such as temperature, moisture, and exposure to ultraviolet radiation, affect microbial survival and metabolism in the skin micro environment**.** Individuals living in tropical and humid climates tend to exhibit different microbial profiles compared to those in temperate regions due to variations in sweat production and skin hydration levels. Additionally, hygiene practices, including frequency of washing, use of soaps or cleansers, and application of topical products, can substantially modify microbial diversity and abundance by disrupting or selectively enriching specific microbial populations(Bohbot et al., 2025). Diet, lifestyle, and socioeconomic conditions also indirectly influence the skin microbiome through systemic effects on immunity and metabolic processes. Importantly, topical applications such as cosmetics, herbal preparations, and oil-based skincare products act as direct modulators of the skin surface environment(Bolatkyzy et al., 2025). In this context, culturally specific skincare practices in South Asian populations represent a particularly relevant external factor capable of reshaping microbial ecology and potentially influencing dermatological health outcomes.

5.3 Functional Role of the Skin Microbiome in Cutaneous Health and Disease

The skin microbiome is essential for the maintenance of cutaneous homeostasis through constant interactions with the host immune system, skin barrier, and local biochemical milieu. The skin microflora are not merely passive settlers

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

but play an active role in the physiology of the skin through their influence on barrier function, inflammation, and pathogen exclusion from colonization due to competition and antimicrobial compounds generated during metabolism. Maintenance of immune tolerance is one of the primary roles played by the skin microflora(Schoch, Anderson, Jones, Tollefson, & Section on Dermatology Wright Teresa MD, 2025). The skin commensal bacteria act as stimulators of immune signaling pathways responsible for controlled immune activation against pathogens without initiating excessive inflammation (Sanford & Gallo, 2013). This is achieved by the production of antimicrobial peptides by some strains of Staphylococcus epidermidis, which prevents colonization by other bacterial species like Staphylococcus aureus. Moreover, the skin microflora plays a significant role in the epidermal barrier's proper functioning(Zhao et al., 2025). Metabolites produced by microorganisms might affect keratinocytes' differentiation, lipid synthesis, and tight junctions' integrity – crucial processes responsible for preventing transepidermal water loss and maintaining skin hydration (Byrd et al., 2018). Impaired communication between these two processes might lead to the disruption of skin barrier function and increased sensitivity to irritants, allergens, and infections. Dysbiosis, that is an imbalance of microorganism populations inhabiting skin, was identified as a significant factor contributing to the development of various dermatological conditions(Mourelle, Gómez, & Legido, 2023). Acne vulgaris is frequently accompanied by shifts in Cutibacterium acnes strains that lead to the onset of inflammation and hyperkeratinization of hair follicles. Atopic dermatitis is usually connected with low diversity of skin microbiota and excessive growth of Staphylococcus aureus. Similar correlations were found between other conditions, such as psoriasis and seborrheic dermatitis, yet causality between them still requires further research . In sum, skin microflora works as an essential interface between a human and the environment. Both health-promoting and disease-causing properties of skin microflora might provide new opportunities for the use of it in dermatology as a therapeutic target(Akinsulie et al., 2024).

6. Traditional and Cultural Skincare Practices in South Asia: Ethnodermatological Perspectives

Skin care regimens among the South Asian population have always been deeply associated with traditional ethnobotanical knowledge bases, cultural practices, and indigenous medicine practices such as Ayurveda and Unani medicine(Kanwal, Osman, & Khiari, 2025). Such practices have always been passed from one generation to another, and they continue to be practiced even today by most rural and semi-urban people in the region. As opposed to the conventional methods of using cosmetics in skin care, traditional skincare practices are mainly centered on the use of natural resources, such as plant extracts, oils, mud, fermentation products, etc., which are known to provide health benefits for the skin and protect against diseases(Rusu, Farcaş, Oancea, & Tanase, 2025). Some of the most widely employed practices include the application of herbal extracts, in which materials obtained from plants, such as curcumin (turmeric-Curcuma longa), azadirachin (neem-Azadirachta indica), santalic acid (sandalwood-Santalum album), aloe-emodin (aloe vera-Aloe barbadensis) are used for their anti-microbial, anti-inflammatory, and wound healing effects. Another important part of skincare practices in South Asia involves the usage of oils. For example, coconut oil, mustard oil, and sesame oil are used for moisturizing, massages, and protection(Wójciak et al., 2025). This oily approach could change the skin microenvironment by changing the composition of the sebum layer as well as the level of hydration. As a result, there might be changes in the way the skin becomes colonized. Another aspect related to the skincare is the use of natural soaps, such as "ubtan" soap that is produced from ingredients such as gram flour, turmeric, and milk. Apart from cleansing, this type of skincare has also an exfoliating impact while being antibacterial as well(Alexis et al., 2024). Seasonal skincare and ritual cleansing are another aspect that plays a role in the variation in the skin microenvironment

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

because of differences in the way the environment and microbes interact with it due to those practices(Mathew & Menon, 2026). It should be emphasized that skincare practices differ greatly depending on the region (Pakistan, India, Bangladesh, Sri Lanka, Nepal). However, the influence of this practice on the microbiome remains unexplored scientifically

6.1 Herbal and Plant-Based Applications in South Asian Dermatological Traditions

Herbal and plant-based skincare formulations represent an important element of traditional dermatology in South Asia, based on Ayurvedic, Unani, and indigenous healing techniques, with extensive use and reliance on bioactive compounds produced by various plants and herbs(Verma et al., 2024). Among the most common herbs used for skincare, turmeric (Curcuma longa) represents a potent anti-inflammatory, antioxidant, and antimicrobial substance, mainly due to curcumin. Experimental research has demonstrated that curcumin can influence inflammatory processes and inhibit microbial growth, potentially contributing to skin microbial equilibrium(Mustafa, 2025). Neem (Azadirachta indica) represents another common plant with broad-spectrum antimicrobial activity, which has been widely used for treatment of acne, fungi-related infections, and skin irritation, owing to such bioactive substances as nimbidin and azadirachtin. Sandalwood (Santalum album) has a cooling and anti-inflammatory effect; therefore, sandalwood face masks and paste formulations are widely used for treating hyperpigmentation and irritations(Voiculescu, Nelson Twakor, Jerpelea, & Pantea Stoian, 2025). Aloe vera (Aloe barbadensis) has been widely used for its wound-healing capabilities, with scientific data suggesting that Aloe vera has beneficial effects on promoting epidermal tissue regeneration and regulating inflammation Microbiologically, such herbal substances could affect the microbiota of the skin by selectively suppressing pathogenic microbes while enhancing the growth of beneficial microorganisms that can maintain a microbial balance in the skin environment(Mahmoud, Yosipovitch, & Attia, 2023). The exact mechanisms of how such herbs affect the microbiota of the skin have not been well understood, especially for in vivo human trials. Nevertheless, these plant products are well accepted in many cultures, and they have been used in these societies for a long time without any significant scientific evidence(Ge et al., 2024).

6.2 Oil-Based Skincare Practices and Their Cutaneous Microbial Implications

Oil based compounds have been employed as a key ingredient in dermatological practices in South Asia for many years now; numerous oils obtained from different types of plants are being used to moisturize the skin, cleanse it, give massages to the skin, and maintain the integrity of the skin barrier(Dewanjee, Ghosh, Khatua, & Rapior, 2024). Oil based skincare practices are common in Ayurvedic medicines, and even in homemade skincare products, where the role of oils in skincare practices is used for treatment and prevention purposes in order to ensure the integrity of the skin and avoid complications related to dryness of the skin(Elias, Man, & Darmstadt, 2022). The most commonly used topical oil is coconut oil (Cocos nucifera) which has many antimicrobial, anti-inflammatory, and emollient properties(Miere, Vicas, & Mandal, 2025). Coconut oil contains medium chain fatty acids including lauric acid that is believed to have antimicrobial effects against various skin microbes and thus can impact the skin microbiota. Coconut oil is known to help in strengthening skin barrier by reducing water loss from the skinMustard Oil Application

Another common application of oils for skin in the South Asian region includes mustard oil (Brassica juncea). Mustard oil has been conventionally used for infant massage and skin therapy(Orsola et al., 2025). However, few scientific studies have found that mustard oil may have irritating properties, which may lead to altered skin health and changes in microbial composition due to disruption of the skin barrier. From the microbial point of view, oil applications on the skin may have a considerable impact on the microbiome of the skin due to its influence on lipids present in the skin, skin hydration, and skin

Frontier in Medical & Health Research

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pH. Such changes will benefit microbes depending on lipids and fats, such as Cutibacterium acnes and Malassezia species, and consequently alter the composition of microbes(Sarsaiya, Jain, Gong, Wu, & Shi, 2025). Nevertheless, improper use of oil can also lead to creation of occlusive environment that will cause microbe growth or imbalance. The potential long-term impacts of using oils in skincare and how they affect microbial diversity, strains, and functionalities require investigation(Gu et al., 2025).

6.3 Traditional Cleansing Rituals and Natural Soap-Based Formulations in South Asia

The act of cleansing plays an important role in traditional South Asian skin care practices. This practice goes beyond just the aspect of hygiene and involves cleansing rituals in relation to the ideas of purity, skin beautification, and protection against diseases(Tahtouh Zaatar et al., 2026). Cleansing agents in traditional skin care practices utilize plant-based formulations and do not use artificial surfactants that are commonly used in modern-day soaps. There are several traditional preparations that can be used in cleansing procedures, such as ubtan, a natural paste that contains ingredients like gram flour (Cicer arietinum), turmeric (Curcuma longa), milk, rose water, and many other powdered plants. It is often used in order to cleanse and lighten the skin due to its exfoliating properties(Kanak, Krzemińska, Berecka-Rycerz, Kopeć, & Dos Santos Szewczyk, 2025). Since ubtan is rich in natural abrasives and bioactive substances, it is likely that it influences the skin microflora by changing the characteristics of the skin lipids and keratin layer. Traditional soap alternatives in South Asia include preparations made from reetha (Sapindus mukorossi), shikakai (Acacia concinna), and neem-based agents(Acharya et al., 2025). They contain saponins and phytochemicals which act like detergents and have antimicrobial activity allowing the cleaning process to be conducted without using artificial surfactants. These types of cleaners have potential effects in lowering the microbial pathogen levels while preserving other organisms that depend on the frequency and level of the product used. In terms of microbiome, cleansing is one of the factors affecting skin microbiome stability externally. Washing frequently or with stronger cleansing products will affect the lipid membrane and result in reduction in diversity resulting in temporary dysbiosis(Batovska, Gerasimova, & Nikolova, 2024). On the other hand, milder herbal cleansers would promote microbiome balance by retaining the physiological skin pH and avoiding depletion of excessive microorganisms. However, in spite of its extensive usage, microbiological implications of this cleansing method have not been widely researched in South Asia with the use of modern day sequencing technology.

6.4 Religious and Seasonal Influences on Skincare Practices in South Asia

The belief system and changes in seasons have a great effect on the skincare practices of various South Asian cultures, who incorporate religious, cultural, and environmental factors into their dermatological activities. The impact goes far beyond beauty considerations, encompassing broader ideas of purification, health, and synchronization with nature, and thus indirectly affecting the skin microbiome and physiology(Anil Kumar et al., 2023). Many religious practices include cleansing and smearing of natural products onto the skin as part of the purification process. For instance, water ablutions practiced in Islam and ceremonial baths in Hinduism can be viewed as an integral part of the skin cleansing routine that affects the dynamics of colonization of skin by bacteria and other microbes. Another important factor that shapes the skin microbiota and the immune response is the use of sacred items, such as sandalwood paste and other plants during religious practices... The influence of seasonal variations on skin care routines is also prominent in South Asia owing to significant climate variation, such as hot summers, humid monsoons, and cold winters(Ekakitie, 2024). Humid climates will increase sweating and sebum formation in the body, which may affect the pH and hydration of the skin, resulting in variations in the development and composition of microbes. Cold and dry winters may decrease skin hydration and disrupt the skin barrier, causing people to use

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

oilier skin products, thereby altering the skin microenvironment. Therefore, these periodic changes in skin exposure and skin care practices generate continuous changes in skin microbiome composition. Nevertheless, there is limited research on how seasonal skincare adjustments affect microbiome composition in the presence of religious practices(Vitalone, D'Andrea, Di Sotto, Caruso, & Parente, 2025).

6.5 Regional Variations in Skincare Practices Across South Asia

The skincare practices in South Asia are significantly diverse owing to the variation in climatic conditions, biotic environment, cultural traditions, socio-economic status, and indigenous healthcare systems in each of these countries(Zieneldien et al., 2025). Despite similar ethnobotanical origins of skincare in the region, there are significant variations in the skincare practices observed in each of the countries in terms of ingredients used, methods of formulation and application, and the resultant impact on skin structure and microbiology. In India, the dominant skincare practices are derived from the Ayurveda system, with frequent usage of turmeric, neem, sandalwood, and ubtan (an herbal formulation). Skincare products and procedures are deeply embedded into daily activities and rituals(Oargă, Cornea-Cipcigan, Nemeş, & Cordea, 2025). In Pakistan, skincare is influenced by both the Unani and Ayurveda systems of health care, with the frequent usage of herbal pastes, rose water and oil based formulations, especially mustard and almond oils. The most common practice in Bangladesh includes the utilization of locally available ingredients such as neem leaf, aloe vera, and rice cleansers, adapted for use under high humidity.Sri Ayurveda is strongly represented in Lanka as well, where coconut oil is used extensively as the most common skin moisturizing substance owing to the abundance of coconuts as well as favorable climate conditions. It can be stated that coconut-based products are often utilized as both therapy and prevention of skin issues. Nepal, which is characterized by different climates depending on altitude, displays varied skincare practices depending on whether the population lives at high altitudes or on plains. In particular, skin care involving Himalayan herbal compounds and oil moisturizers is common when dealing with dry skin due to cold weather conditions. The presence of these geographical variations implies that populations of South Asia face unique sets of environmental, cultural, and biological determinants potentially affecting skin microbiomes.

Volume 4, Issue 6, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

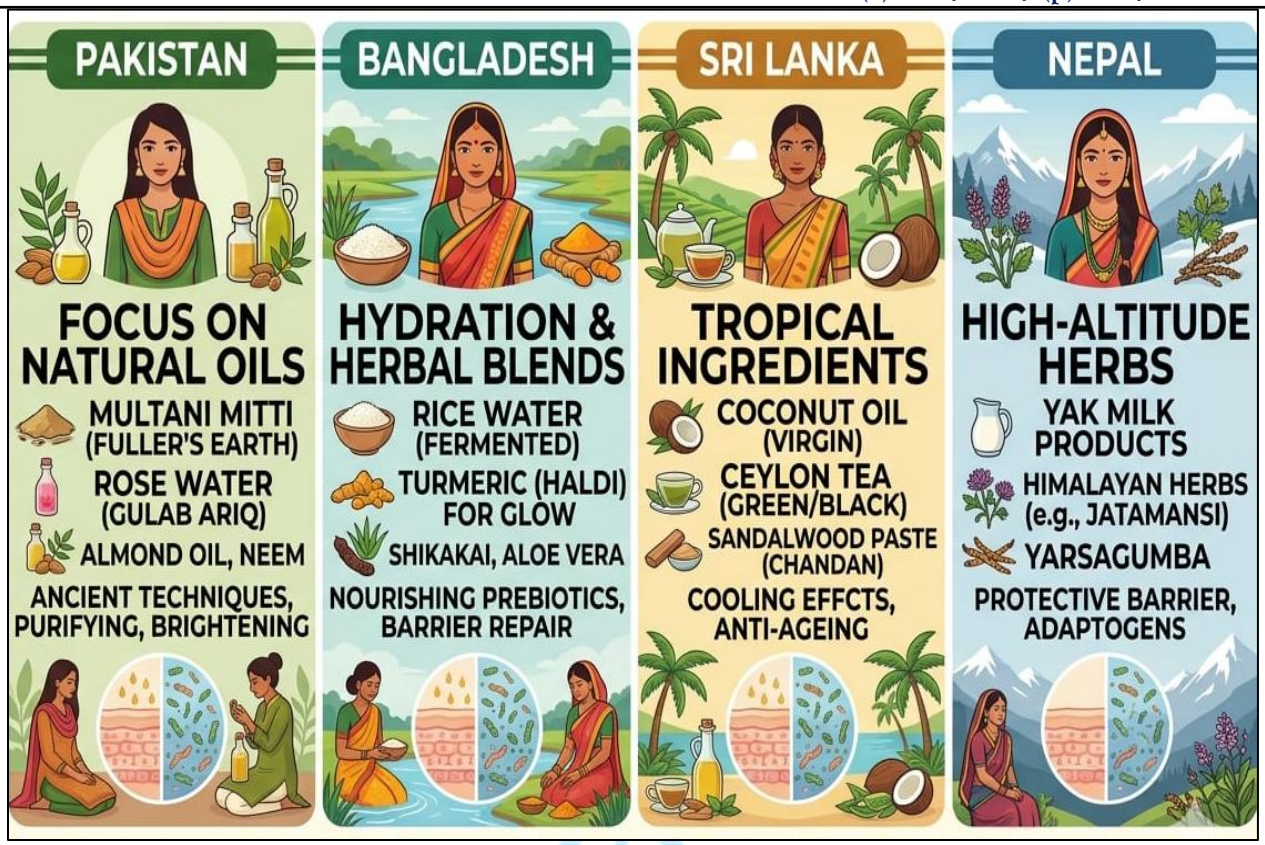

Fig. 3 ***Ethnobotanical Diversity and Regional Skincare Paradigms in South Asia***

7. Impact of Cultural Skincare Practices on the Skin Microbiome

Skincare methods in South Asia serve as ongoing environmental external stimuli that could drastically affect skin microbiome components and its functionality. As compared to a more standardized procedure of cosmetic interventions, skincare practices incorporate heterogeneous formulations of botanicals, oils, and cleansers that have various interactions with skin physicochemical properties and its microbial composition(Myers et al., 2025). The microbiological effect of herbal remedies is mediated by a range of natural compounds including polyphenols, flavonoids, and essential oils. They possess antimicrobial properties that could affect specific pathogens but not all microorganisms. It could promote microbial balance by selectively eliminating pathogens but retaining commensal organisms within an individual's skin microbiome. Still, it is important to note that their degree of effect is dependent on concentrations, frequencies, and personal skin conditions(Al-Worafi, Oo, & Ramamurthy). Oils applied during skincare practices could alter skin moisture and occlusion. As a result, they could stimulate the growth of certain microorganisms such as lipid-dependent Cutibacterium acnes and Malassezia species. In certain conditions, they could facilitate the integrity of the epidermal barrier function; however, in other cases, these practices could contribute to dysbiosis. Cleansing is another element that affects the skin microbiome in various ways by reducing microbial loads(C. X. Liu, Li, & Zeng, 2025). The use of different cleansers may affect the microbial composition in a positive manner or cause temporary decrease in the number of commensal microbes, which will in turn influence microbial resilience. Notably, the overall effect that is caused by these cultures depends on many aspects including environmental influences, genetic factors, the frequency of hygienic practice and simultaneous exposure to cosmetics currently

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

available on the market. However, although there is a high degree of awareness about the susceptibility of the microbiome to external factors, there is still no scientific evidence on how cultural skincare practices in South Asia affect it.

7.1 Effects of Herbal Ingredients on Skin Microbial Diversity and Ecological Balance

The use of herbal ingredients in skincare products in South Asia may have an impact on the skin microbiome due to the presence of active ingredients in these herbs. These phytochemicals, such as polyphenols, flavonoids, tannins, and terpenoids, may have antimicrobial and anti-inflammatory effects that could affect the bacterial population on the skin(Birmpili, Heeren, Vreeken, & Cuypers, 2025). In the case of turmeric (Curcuma longa), curcumin found in this herb has anti-bacterial activity against a wide range of disease-causing bacteria along with inhibition of inflammatory pathways in skin cells, promoting a balanced environment. In the same manner, the use of neem (Azadirachta indica) can also be effective in inhibiting the proliferation of both bacteria and fungi. The sandalwood (Santalum album) extract, for example, harbors aromatic compounds with anti-inflammatory properties that have been shown to reduce skin irritation, thus indirectly contributing to microbial stability by keeping the skin free from inflammation. Additionally, aloe vera (Aloe barbadensis) contributes to the modulation of the microbe population by facilitating wound healing and epidermis repair, hence restoring any imbalances and allowing beneficial microbes to recolonize(Syafarina et al., 2024). In terms of the effect of the two herbal treatments on the skin's microbiome, they neither serve as universal sterilizers nor disrupters. Rather, they selectively promote the growth of some microbial populations while suppressing others. The application of these two herbs either increases microbial diversity by eliminating pathogen dominance or reduces microbial diversity through overapplication. It is clear that both positive and negative effects depend on the frequency and concentrations of the treatment. Despite being widely applied across diverse cultures, only few high throughput sequencing studies have explored the impact of these herbal treatments on microbial richness, evenness, and diversity at the strain level in humans(Hantour, Benabdesslem, Diaf, Hachem, & Ghomari, 2026).

7.2 Influence of Oil-Based Applications on Skin Barrier Function and Microflora Dynamics

Use of oils in skin care affects skin barrier properties and composition of skin microbiota. In the South Asian community, use of vegetable oils such as coconut oil, mustard oil, and sesame oil in skin care is applied with the aim of retaining moisture within the skin, maintaining elasticity of the skin and avoiding any skin issues related to dry skin(Cho et al., 2025). The key purpose of these oils is formation of the occlusive lipid layer that protects stratum corneum from excessive loss of water and maintains structural integrity of stratum corneum. However, the abundance of lipids in the lipid film may influence skin microbiota composition. Specifically, lipophilic bacteria and yeast like Cutibacterium acnes and Malassezia spp. may benefit from the abundance of lipids in the skin environment, utilizing lipids contained in oils as sources of nutrients. Coconut oil, containing significant amounts of medium chain fatty acids such as lauric acid, possesses antimicrobial activity against pathogens such as pathogenic bacteria and fungi. Therefore, apart from being protective agent in relation to lipid layer of stratum corneum, oils, especially coconut oil, also affect microbial diversity and skin microbiota composition. In certain instances, excessive use of oils can cause the development of an environment that is too occlusive, hence allowing for imbalances or congestion of the hair follicles due to bacteria. Mustard and sesame oils, despite containing unsaturated fatty acids and having healthy lipids, might have varied impacts on skin inflammation and microbial flora, depending on the degree of purity and manufacturing processes. It becomes clear how complicated these oil-microbiome relations can become. Oil use in skincare serves as a way to support the barrier properties as well as manipulate the microbiome(Navarro Triviño, Velasco Amador, & Rivera Ruiz, 2025).

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

7.3 Environmental and Lifestyle Interactions Shaping Skin Microbiome Modulation

The environment and the lifestyle choices are considered two of the primary external factors influencing the skin microbiome composition and functionality of individuals residing within South Asia. In particular, the region's climatic conditions, urban development, and varied socio-economic settings have a considerable effect on daily exposure to different external factors. In addition, they interact constantly with cultural skincare practices to result in microbial colonization and skin stability. Among the critical environmental factors that affect skin microbiome composition, climate plays an important role. Most areas within South Asia have hot and humid conditions that lead to perspiration and increased sebum production(Navarro Triviño et al., 2025). This creates a moist environment that supports microbial growth, such as the Corynebacterium and Staphylococcus genera. In addition, variations of seasons due to seasonal humidity and dry conditions may result in changes within the skin microbiome. Another environmental factor worth considering is urbanization and pollution, both of which have a significant impact on the skin microbiome. Specifically, the presence of pollution in air, industrial pollutants, and vehicle exhaust fumes can cause disruption of the skin barrier and oxidative stress(Shahrajabian & Sun, 2025). Hence, individuals living in highly urbanized areas will likely have different microbial profiles when compared with those in rural areas based on differences in environmental microbial exposure and pollution loads. Other lifestyle variables like dietary patterns, physical activity levels, clothes preferences, and hygiene routines can also vary between individuals, thus contributing to individual differences in microbiomes. Diets with high carbohydrate content, fats, and spices that predominate South Asian cuisine can affect systemic inflammation and the composition of the sebum, which will eventually impact microbial populations on the skin.

However, besides having an independent effect on skin microbiomes, environment and lifestyle can synergize with traditional skincare procedures to yield diverse effects. For instance, the application of oils in humid environments is expected to have a different impact on the microbiome when compared with application in dry or polluted environments(Yi et al., 2022). Unfortunately, despite all these interacting factors, studies looking at the relationship between skin microbiomes and environment, lifestyle, and cultural factors are sparse.

7.4 Comparative Analysis of South Asian and Western Skincare Practices on the Skin Microbiome

There exist differences between skincare products used by South Asian and Western individuals regarding composition, frequency, and conceptual basis that might have different impacts on the function and stability of the skin microbiota. South Asian skincare utilizes mostly natural products made from plants and oil, including systems of medicine based on the principles of Ayurveda and Unani medicine. On the other hand, Western skincare makes use of synthetic skincare product whose formula is tailored toward specific dermatological objectives. In particular, South Asian skincare involves the use of herbal elements like turmeric, neem, and sandalwood as active substances in skincare products due to their assumed anti-inflammatory, antimicrobial, and skin-lightening features(Ncube, Modiba, Mpofu, Nephawe, & Mtileni, 2025). Such active compounds create pressure on microorganisms, leading to the reduction of pathogenic organisms as well as preservation or indirect promotion of commensals, based on frequency of use. Besides, the frequent use of natural oils, such as coconut and mustard oil, creates lipid-abundant skin surfaces conducive to the growth of lipophilic microorganisms such as Cutibacterium acnes and Malassezia species. However, while such treatments can be effective from a medical perspective, there can be a temporary disturbance of the skin barrier integrity and microbiota caused by their broader antimicrobial or keratolytic properties(Alam, 2021).

Moreover, differences in cleansing frequency and lack of standardization in products may explain why different results are achieved in terms of

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

microbiome composition. While Western approaches to skincare focus on standardized regimes, South Asian practices tend to be more flexible and environmentally dependent. This may mean that different levels of microbial stability and diversity can be observed depending on culture and environment(Javed et al., 2024). Nevertheless, despite some clear differences, the goals of both skincare routines are the same, and their impact on the microbiome varies. Yet, there are very few comparative studies available comparing the impact of these skincare regimens on the skin microbiome.

8. Dermatological Health Outcomes Associated with Skin Microbiome Modulation in South Asian Contexts

The impact of skin microbiome on dermatological outcomes has been widely reported. Dysbiosis of the skin microbiome has been shown to affect the skin's inflammatory response, barrier function, and predisposition to various infectious and non-infectious skin diseases. In South Asian populations, where skin care practices are highly prevalent, skin outcomes are influenced by the interplay between the skin microbiome, environment, and traditional topical agents. The most common condition that has been associated with dysbiosis is acne vulgaris(Shahrivari-Baviloliaei, Orhan, Plenis, & Viapiana, 2026). This condition is often triggered by modifications of the Cutibacterium acnes strains, with an increase in inflammation within the hair follicles. Although some C. acnes strains are harmless, others have pathogenic potential and contribute to inflammation caused by sebum production and the formation of comedones. Traditional use of neem and turmeric may have an effect on acne outcomes by virtue of their anti-microbial and anti-inflammatory effects, thereby modifying the skin microbiome and minimizing inflammatory lesions(Ingale, Rathored, Wankhade, & Nibude, 2025). Atopic dermatitis is another skin disease that has been reported to be associated with dysbiosis.. The disruption of the skin barrier in the condition leads to pathogen dominance and immune dysregulation. Oil-based skincare with a high concentration of emollients that is typical of South Asians may enhance barrier function, leading to indirect benefits with respect to microbial equilibrium, but there may be variations with the formulation and frequency of application. Hyperpigmentation, which is quite common among South Asians, is caused by both inflammatory processes and environmental factors. Turmeric and sandalwood are examples of traditional herbal ingredients that have been known to help with lightening the skin and reducing inflammation. This has led to an indirect positive effect on the appearance of the skin because of microbial interactions within the inflammatory process. Finally, infectious diseases such as bacterial and fungal infections are associated with the composition of the microbe flora(Y. Liu, Shang, Chen, & Feng, 2025). Dysbiosis can lead to low colonization resistance, leading to greater susceptibility to pathogenic microbes.

Table 3. ***Association between skin microbiome dysbiosis and dermatological conditions in relation to cultural skincare practices***

Condition	Microbiome Association	Key Organisms Involved	Cultural Skincare Link
Acne Vulgaris	Dysbiosis & inflammation	*Cutibacterium acnes*	Neem, turmeric use
Atopic Dermatitis	Reduced diversity	*Staphylococcus aureus*	Coconut oil emollient use
Seborrheic Dermatitis	Lipid imbalance	*Malassezia* spp.	Oil-based applications

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Skin Infections	Barrier disruption	*S. aureus*, fungi	Hygiene & herbal antiseptics

8.1 Acne and Seborrheic Skin Conditions

Acne vulgaris and seborrheic disorders show a strong correlation with disruptions in the skin's microbiome, which includes variations in C. acnes strain types and follicular inflammation. In individuals with acne-prone skin, microbial dysbiosis is manifested not only by microbial proliferation but also through modifications to bacterial functions aimed at sebum degradation and secretion of inflammatory mediators(Layton et al., 2023). Seborrheic disorders, which include seborrheic dermatitis, often involve the proliferation of Malassezia fungi, which flourish in environments rich in lipids. In South Asian patients, culturally based skincare strategies can affect seborrheic disorders through protective and exacerbating routes. Herbal preparations like neem and turmeric have antiseptic and anti-inflammatory effects that can limit lesion development and minimize the number of microorganisms(Waiswa, 2024). On the other hand, the frequent application of oily formulations can lead to follicular occlusion and favor microbial proliferation, thus exacerbating acne among predisposed subjects.

8.2 Infections (Bacterial and Fungal Skin Infections)

The causative factors for skin infections have been noted to be related to disturbances in the normal microbiome leading to a loss in colonization resistance against pathogens. Bacterial skin infections like impetigo and folliculitis have been noted to involve Staphylococcus aureus overgrowth, whereas fungal infections have been noted to involve Candida and Malassezia organisms in predisposed cases(Wu et al., 2025). The traditional practice of applying oils like neem and turmeric on the skin in South Asia can potentially lower the number of pathogens due to the presence of antibacterial and antifungal phytochemicals.

8.3 Pigmentation Disorders

Post-inflammatory hyperpigmentation falls under the broad category of pigmentation disorders, which have been found to occur very frequently among South Asians due to the high amount of melanin production and skin inflammation reactions(Akbarnejad, 2025). Pigmentation problems have been found to be caused by inflammation that is driven by micro-organisms; these could further result in increased release of cytokines as well as stimulation of the melanocytes. Various natural substances, including sandalwood and turmeric, have been traditionally used to treat inflammation and thus improve pigmentation results(Rodríguez et al., 2026).

8.4 Anti-aging Effects and Skin Barrier Function

As aging occurs, there is an increased loss in barrier function, decreased microbial diversity, and increased risk to oxidative damage. Anti-aging benefits provided by the skin microbiome include restoration of the skin's barrier, regulation of inflammation, and balance of moisture retention. As per skincare practices in south Asia, the use of oils such as coconut oil and sesame oil for moisturizing skin can be effective. Additionally, herbal antioxidants can help in the process of lowering oxidative damage(Jan et al., 2024). Studies on the role of microbiome in the anti-aging benefits provided by these skincare practices are limited.

9. Scientific Evidence and Clinical Studies on Skin Microbiome and Cultural Skincare Practices

Scientific focus on the interaction of the skin microbiome and cultural skincare techniques is growing, but there is still not enough information to establish a connection due to limited research on these topics in in vitro, in vivo, and clinical settings(Afshari, Kolackova, Rosecka, Čelakovská, & Krejsek, 2024). The majority of the current research focuses on individual compounds rather

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

than overall skincare routines practiced in cultures.

9.1 In vitro and in vivo Studies

The anti-bacterial, anti-inflammatory, and antioxidant potential of common South Asian herbal ingredients, including turmeric (Curcuma longa), neem (Azadirachta indica), and sandalwood (Santalum album), have been well established through in vitro experiments. For instance, curcumin has exhibited anti-microbial potential through the inhibition of bacterial growth and inflammation pathway modulation in laboratory environments. Likewise, neem extract possesses wide-ranging anti-microbial activity against bacteria and fungi, reinforcing its historical application in the treatment of infectious skin ailments(Satapathy et al., 2025).

However, in vivo research studies, despite being less in number, indicate the capacity of plant oils like coconut oil to boost skin integrity by lowering transepidermal water loss, consequently improving microorganism stability. Nevertheless, most in vivo tests are constrained by their short experimental period, small sample population, and absence of microbiome sequencing as an endpoint(Dias, Vieira, Paiva-Santos, Veiga, & Costa, 2026).

9.2 Clinical Trials and Observational Studies

Studies on traditional skincare techniques concerning the skin microbiota have been relatively few. Most of the previous studies have concentrated more on clinical effects, such as acne reduction, wound healing, or treatment of dermatitis, rather than microbiome analysis(Rolfes, Singh, Haarmann-Stemmann, & Krutmann, 2025). There is some research based on observations suggesting that regular application of herbal medicines might result in fewer inflammatory skin lesions and better skin status, perhaps because of microbe regulation. Nevertheless, there is very little scientific evidence on traditional skin care culture due to the absence of a unified protocol, controlled experiment conditions, and high-throughput sequencing information. In addition, clinical trials in South Asia are rare(Oludipe et al., 2023).

10. Potential Benefits and Risks of Traditional Skincare Practices on the Skin Microbiome

South Asian skincare rituals exhibit a double-edged biological effect in that skin benefits can be achieved from culturally determined measures, though there are certain dangers associated with them based on conditions such as preparation, administration, and surrounding environment(Wang, Zhang, Wang, Gao, & Zhang, 2025). The effects of such methods on the skin microbiota are thus situation-dependent.

10.1 Beneficial Microbiome Modulation

Conventional herbal and oil treatment methods might positively affect the skin microbiome through their role in creating microbial balance and strengthening the skin barrier. Plant compounds such as those found in turmeric (Curcuma longa), neem (Azadirachta indica), and sandalwood (Santalum album) have antibacterial, anti-inflammatory, and antioxidant characteristics that allow for selective inhibition of harmful microbes while maintaining or enhancing commensal microbial populations(Peng, Gao, Fan, Yi, & Teng, 2025). Oil treatments using coconut and sesame oils may further strengthen lipid barriers, lower trans-epidermal water loss, and create a stable environment conducive to microbial balance.

Volume 4, Issue 6, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

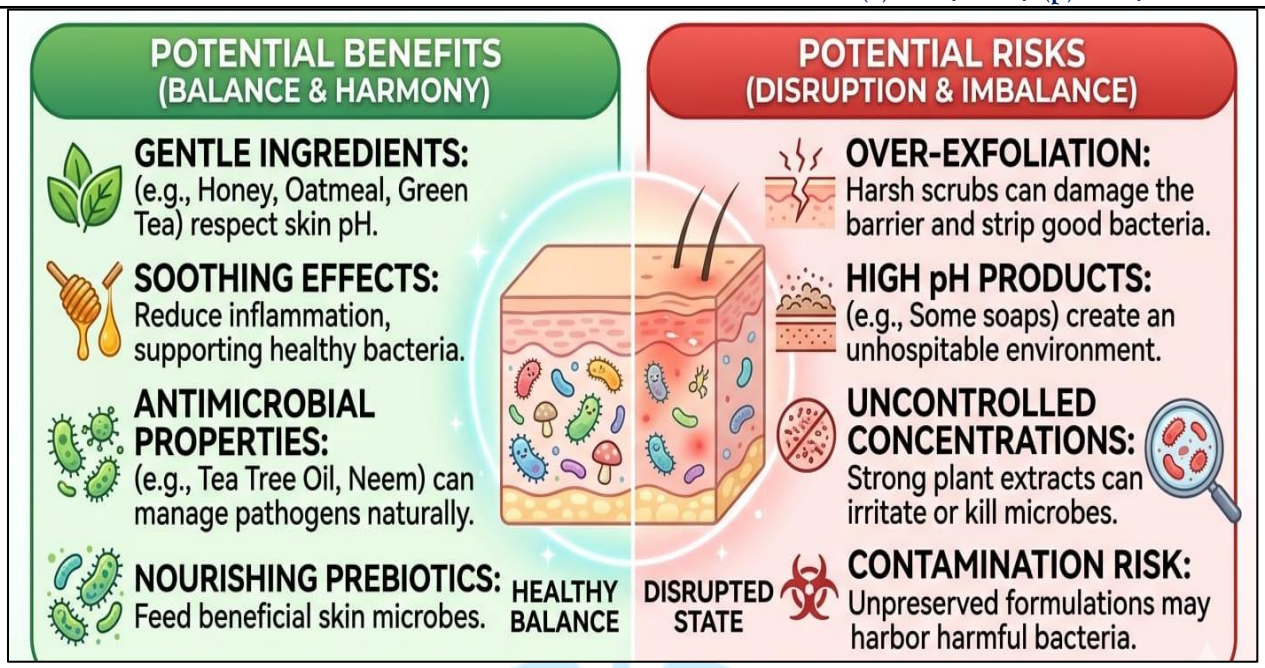

Fig.3 *The dual impact of Traditional skincare on the Skin Microbiome*

10.2 Safety and Standardization Issues

One of the major drawbacks in the application of traditional skincare methods is that there is no standardization in the composition, dosage, and administration of these remedies. There are wide variations in the concentrations of herbal compounds, preparation techniques, and purity of formulations, causing differences in the biological impact on the skin microbiome. Furthermore, contamination, adulteration, and quality control issues pose potential threats to the safety of traditional skincare methods(Sullivan, Gonzalez Obezo, Lipsky, Panchal, & Jensen, 2025). Finally, there is a need for the development of guidelines for clinical application since most traditional formulations are not regulated. Thus, despite the benefits associated with traditional skincare practices, there is a need for standardization and evaluation to ensure safety and efficacy.

11. Integration of Cultural Knowledge with Modern Dermatology

The traditional South Asian systems of skincare, such as Ayurveda, offer an empirical basis for dealing with the problems associated with skin management through the use of available natural resources. On the other hand, modern dermatology is based on scientific methods. The combination of these two types of medicine can help in bridging the gap between the empirical traditional approach and the scientific basis of modern medicine. In this regard, herbal substances like turmeric, neem, and sandalwood have been found to exhibit pharmacological features similar to those used by modern medicines(Chopra, Tsagkaris, Matthews, Gautam, & Kamal, 2023).

11.1 Microbiome-Based Interpretation of Traditional Practices

Taking a microbiome approach, a great deal of traditional skincare could be seen as a way of manipulating microbiome ecology from outside the body, rather than just addressing symptoms. For example, herbal products may have selective antimicrobial properties that affect microbial populations and reduce pathogen presence while possibly maintaining commensal microbes(Ghosh et al., 2026). In a similar fashion, oils might affect lipids and moisture at the skin's surface and thus the microbial habitat and metabolic pathways therein. Ritual cleansing and seasonal changes add to the dynamic variability of the microbiome,

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ISSN: (e) 3007-1607 (p) 3007-1593

indicating that cultural behavior is intertwined with microbiome stability.

11.2 Gaps in Current Research

However, although there is increasing scientific and medical interest in skin microbiome research as well as ethnodermatology, there are still substantial research gaps that must be filled. The primary one is a paucity of region-specific studies involving South Asians, whose culture is replete with skincare practices. Moreover, most literature is centered on Western groups, making it challenging to generalize findings to other genetically, environmentally, and culturally different groups.

Moreover, there is a shortage of studies using advanced methodologies like next-generation sequencing to directly analyze the impact of skincare practices on microbial composition and activity. Most studies are still indirect, analyzing clinical results without providing mechanistic insights into changes in microbiota. Also, there are almost no longitudinal investigations on skincare practices' long-term consequences. It is essential to conduct multi-disciplinary research involving dermatology, microbiology, ethnopharmacology, and systems biology to fill these research gaps.

12. Future Perspectives and Recommendations

The current insights on the skin microbiome present a number of possibilities for reconsidering conventional skin care from a modern scientific perspective(Cheng & Chen, 2025). In the South Asian subcontinent, where ethnodermatology is quite common, future studies should focus on the convergence of these two disciplines to formulate skincare regimes based on scientific findings.

.12.1 Need for Microbiome-Focused Research in South Asia

There is an immediate requirement for extensive and regional-level microbiome investigations among the South Asian population to rectify their current absence from global databases. Future work must make use of advanced sequencing techniques, metagenomic analysis, and metabolomics to elucidate the baseline skin microbiome in diverse environmental, genetic, and cultural milieus(Komane & Kaye, 2025). It is crucial that any investigation examines the effect of indigenous skincare regimens, such as the use of herbs, oils, and cleansing procedures, on the skin microbiome.

12.2 Implications for Dermatological Practice

The fusion of microbiome science and cultural skincare practices is relevant to the field of clinical dermatology in many ways. For example, dermatologists should consider their patients' skincare practices when treating skin-related issues since these factors play an important role in achieving proper microbial balance and in the success of such treatments(Mahendra et al., 2022). Moreover, using an evidence-based approach to validate herbal and oily concoctions will allow dermatologists to create new microbiome-friendly therapies based on traditional practices used in South Asia. However, the combination of both fields demands a multidisciplinary approach to be taken into consideration by dermatologists(Myo, Liana, & Phanumartwiwath, 2023).

Table 4. ***Effects of traditional South Asian skincare practices on skin microbiome and dermatological outcomes***

Practice Type	Common Ingredients	Microbiome Effect	Dermatological Outcome
Herbal Applications	Neem, turmeric, sandalwood	Antimicrobial, diversity modulation	Reduced acne, inflammation
Oil-Based Treatments	Coconut oil, mustard oil	Barrier enhancement, lipid shift	Hydration, possible occlusion

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Cleansing Rituals	Herbal soaps, natural cleansers	Microbial reduction	Cleaner skin, risk of dryness
Seasonal Practices	Climate-based skincare changes	Microbial adaptation	Stability in different climates

13. Conclusion

The skin microbiome is a complex and biologically functional ecosystem that serves as an important means for sustaining skin health, immune homeostasis, and preventing the onset of dermatological disorders. The objective of this paper is to demonstrate that cultural skin care procedures adopted in South Asia, such as using herbs, oils, cleansing practices, and season-specific routines, are not only cultural norms but are also biologically relevant activities that may have an impact on skin microbiota and skin function. In general, it appears that cultural skin care activities may be associated with a positive impact on skin condition through improved barrier functions, anti-inflammatory properties, and targeted impact on skin microbiota. Nevertheless, there are situations when these approaches do not lead to desirable results. One of the most important conclusions from this review is the wide disparity between the traditional knowledge systems and the scientific knowledge systems that have been developed using the microbiome approach to dermatological studies in South Asia

It can be concluded from the study that the integration of the two areas, that of microbiomes and traditional knowledge of skincare can prove to be extremely beneficial for developing new and holistic skin care techniques.

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