bioAro

Skin Microbiome Report

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What is the skin microbiome, and why is it important for your health?

The skin microbiome refers to the diverse community of trillions of microorganisms that inhabit our skin, forming a complex ecosystem. This intricate network begins to establish itself from birth and continues to evolve throughout our lives. The skin microbiome plays a pivotal role in various aspects of our health and well-being.

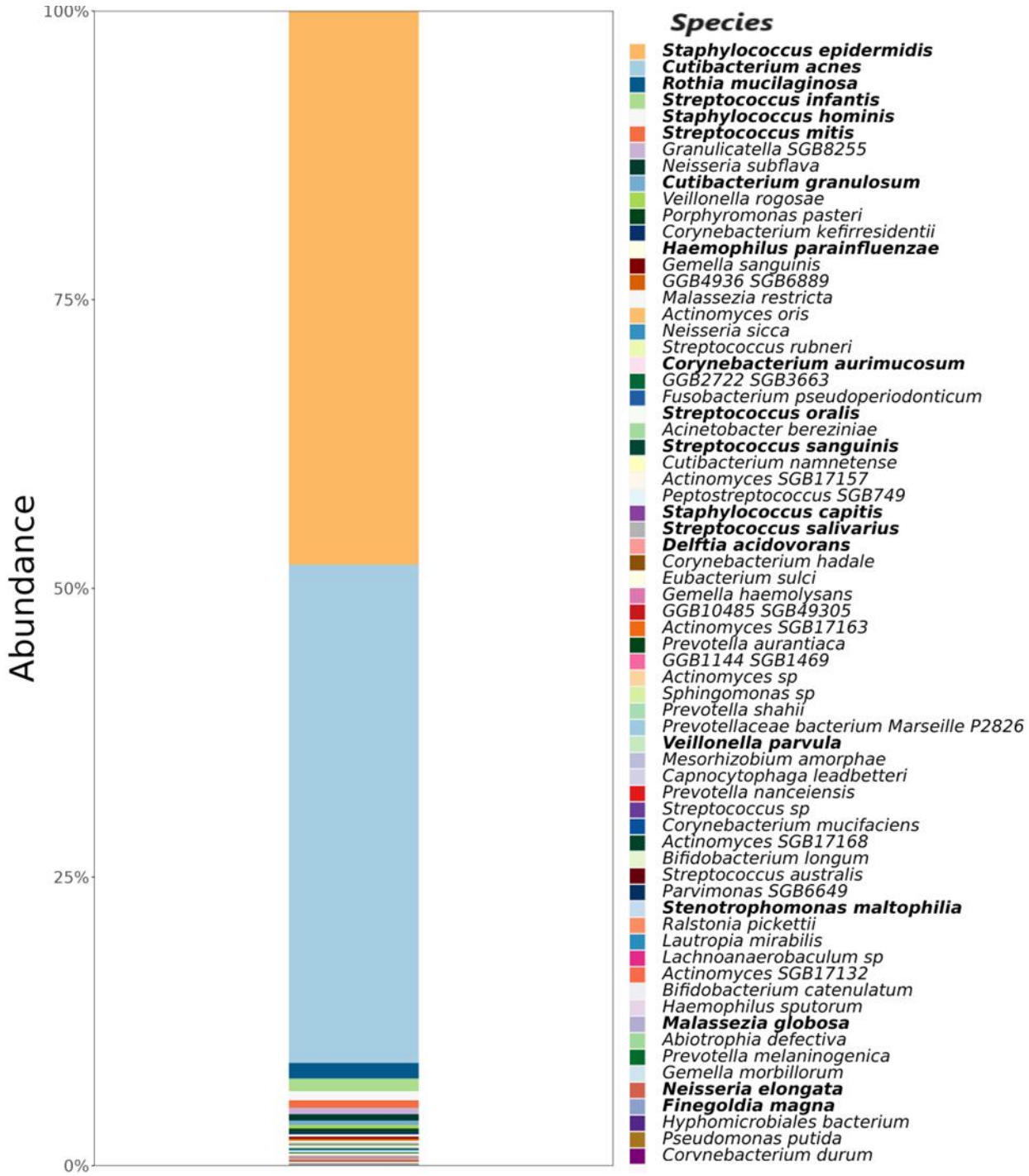
From a young age, the assembly of the skin microbiome begins, with these microorganisms contributing significantly to skin health. They play a crucial role in maintaining the skin's barrier function, influencing its hydration, and contributing to its overall resilience. Just as in the gut, the skin microbiome has a dynamic relationship with the immune system, helping to distinguish between beneficial and harmful microbes.

In addition to supporting the skin's protective functions, the microbiome on our skin plays a role in the synthesis of certain compounds that contribute to skin health. This microbial community can influence the skin's response to environmental factors, helping to shield against harmful substances and promoting overall skin well-being.

Analyzing the skin microbiome involves studying the genes of various microorganisms, including bacteria, fungi, viruses, and other microbes. This thorough examination provides insights into the composition of the skin microbiome, helping to identify specific microorganisms present. Beyond identification, such analysis can reveal information about genes related to factors like antimicrobial resistance, aiding healthcare professionals in choosing effective treatments for skin infections.

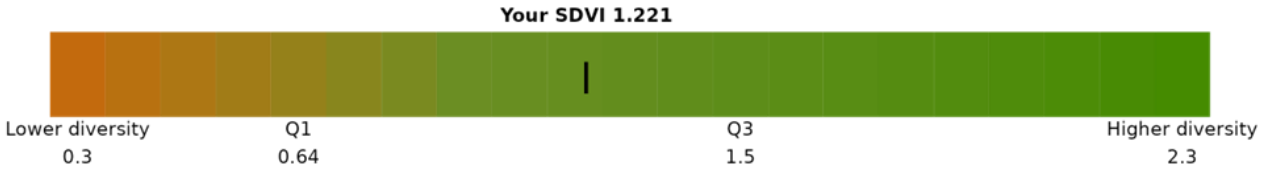
A detailed report on the skin microbiome not only lists the types of microbes present but also offers valuable information about potentially harmful ones. This comprehensive analysis provides insights into their identity and genetic traits, contributing to a better understanding of the diverse microbial community residing on our skin.

What is the composition of your microbiome?



Note: *The text in bold indicates skin-protecting species.*

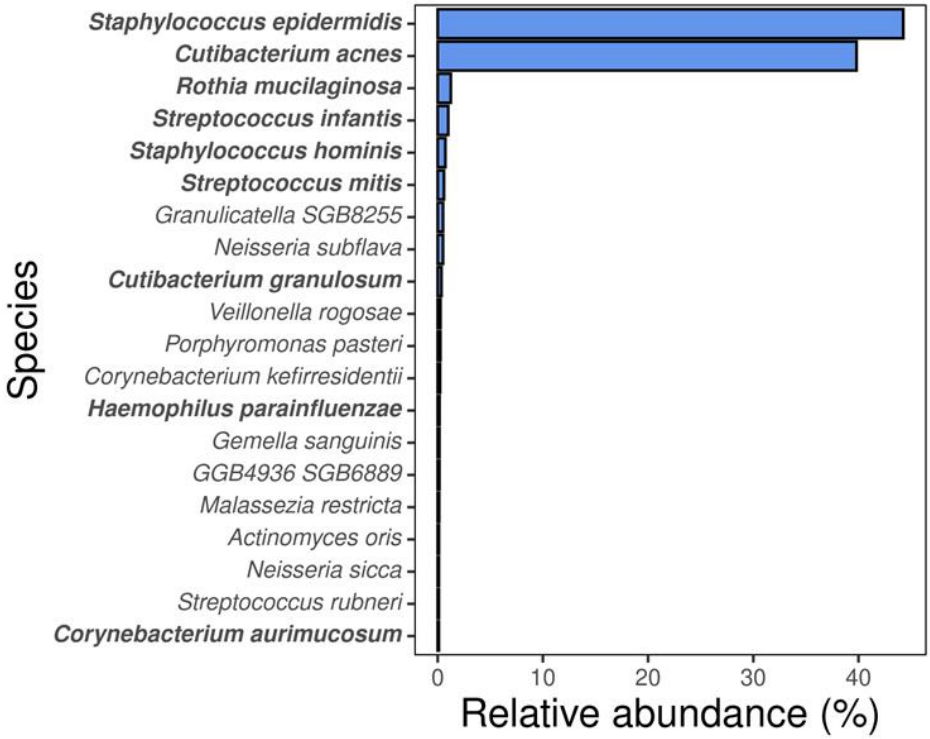
What is the diversity value for your skin microbiome? Why is it important?



Skin microbiome diversity is a crucial indicator of good skin health, influenced by factors such as diabetes, inflammation, liver function, and lifestyle. The Shannon Diversity Index Value (SDIV) is a metric used to evaluate this diversity, typically falling within a healthy range. A diverse skin microbiome is thought to be more resilient and adaptable to environmental changes. It helps create a robust barrier against potentially harmful pathogens by occupying available ecological niches, leaving less space for pathogenic organisms to thrive. This microbial balance on the skin is essential for preventing infections, maintaining immune system regulation, and supporting the skin's natural defense mechanisms. The Shannon value for your skin microbiome is 1.221, lower than the healthy range. The SDIV for a healthy skin microbiome reference cohort is in the range of 2.34 to 3.5.

What are the most abundant members of your skin microbiome?

The following graph depicts the top 20 organisms in your skin and their relative abundance.



This table provides important details about the **top 10 organisms** and beneficial species in your skin, including their roles, impact on health, and suggestions for lifestyle changes.

Skin Protecting Species are pivotal players among the multitude of microorganisms residing on our skin. These bacteria wield significant influence over how other microbes interact, contributing to tasks such as efficient digestion and overall skin health. A decline in these crucial bacteria can upset the skin's equilibrium, potentially leading to health concerns. Hence, they hold immense importance in sustaining a harmonious and functional environment. When your skin microbiome is out of balance (**dysbiosis**), these key species are found to be lower than normal.

Scientific name	Abundance in your profile	Reference IQR (%)	Significance
Staphylococcus epidermidis	44.26%	0.43%-8.63%	It is a Gram-positive commensal, clustered cocci bacteria which is part of normal epithelial flora predominantly occurs in the area around shoulders and face. This bacterium contributes to the host immune system by activating some components of both adaptive and innate immunity which induces production of antimicrobial proteins and contributes to homeostasis of skin barrier. *Staphylococcus epidermidis*-induced CD8+ T cells cause the skin to re-epithelize following damage, hastening the healing of wounds. The stimulation of innate and adaptive defenses against pathogens and the promotion of homeostasis are clearly key functions of S. epidermidis.
Cutibacterium acnes	39.81%	19.00%-65.70%	A Gram-positive facultative anaerobic commensal rod bacterium that is readily found in pilous follicles, sebaceous glands, and mucosal sites of oily skin located in upper shoulder zones and face. *C. acnes* is widespread on moist and oily area, but sometimes can be found on dry surfaces of skin. Although *C. acnes* not considered to be a pathogen, this bacterium is linked to the development of inflammatory acne and other skin conditions like progressive macular hypo melanosis (PMH). Studies have suggested that all the strains of *C. acnes* are responsible for acne formation. Certain phylotypes like IA can cause moderate to severe infections. While other strains like IB, II and III are linked with healthy skin/opportunistic deep skin infection. It is one of the key players in skin homeostasis. The skin's barrier function is enhanced by this bacterium in terms of antibacterial activity, paracellular diffusion and trans epidermal water loss.

Scientific name	Abundance in your profile	Reference IQR (%)	Significance
Rothia mucilaginosa	1.25%	0.00%-0.00%	*Rothia mucilaginosa* (formerly *Staphylococcus salivarius*) is a Gram-positive commensal, aerobic cocci bacterium found in the mouth and upper respiratory tract. It forms biofilms due to its capsule, allowing it to attach to host mucous membranes. In immune-compromised individuals, it can cause blood infections, dental caries, and even invasive infections like meningitis. *R. mucilaginosa* has also been associated with skin and soft tissue infections in children. The majority of affected children have leukemia or a solid tumor with extreme neutropenia.
Streptococcus infantis	1.00%	0.00%-0.00%	It is a gram-positive streptococcus. This bacterium is associated with clear and elastic skin surfaces.
Staphylococcus hominis	*0.73%*	0.00%-0.00%	*S. hominis* is a second most abundant coagulase-negative staphylococcus of healthy human skin It is usually found on moist sebaceous regions of foot sites. Nowadays, it considered to be opportunistic pathogen due to appearance of multi drug resistant strains such as ZWB5 causing nosocomial infections in immunocompromised individuals. It also plays a role in skin protection by synthesizing bactericidal compounds against pathogens.
Streptococcus mitis	0.60%	0.00%-0.03%	It belongs to viridians group of streptococci. It is also associated with bacteremia.
Granulicatella SGB8255	0.51%	0.00%-0.00%	They are gram-positive cocci which are non-motile and non-sporulating in nature. They are found in oral cavity, intestinal tract and urogenital tract. They are linked with bactermia and infective endocarditis.
Neisseria subflava	0.51%	0.00%-0.00%	It is gram negative bacteria. It is associated with endocarditis, meningitis and septicemia.
Cutibacterium granulosum	0.36%	0.00%-7.22%	*Cutibacterium granulosum* (formerly Propionibacterium granulosum) is a part of normal skin microbiota found in sebum-rich areas including stratum corneum and hair follicles. It forms biofilms which is considered pathogenic due to its connection with the development of acne vulgaris. Studies have indicated there might be potential competitive relationships between C. granulosum and C. acnes besides ability to prevent growth of different probable pathogens.

Scientific name	Abundance in your profile	Reference IQR (%)	Significance
Veillonella rogosae	0.27%	0.00%-0.00%	They are anerobic gram negative cocci. They are commonly found in intestinal tract and oral cavity.

Note: *Blue color highlighted species are skin-protecting species*

Condition-specific microbial markers

What is a biomarker?

The FDA characterizes a biomarker as a measurable trait that provides insight into overall bodily well-being and health. It serves as a quantifiable indicator or characteristic that can be objectively evaluated, acting as a guidepost for biological processes, conditions, or diseases within the body.

In the context of skin microbiome analysis, microbial markers refer to specific molecules, genes, or organisms identified in the microbiome that can indicate various aspects of skin health, disease risk, or response to treatment.

Microbial markers in skin microbiome analysis fulfill several important roles:

- Health Assessment: Aid in assessing the overall health status of the skin. For instance, the presence or absence of certain microbes or microbial by-products can signify whether the skin environment is healthy or potentially associated with disease.
- Disease Identification: Specific microbial markers may be associated with particular skin diseases or conditions. Changes in the abundance or diversity of certain microbial species could serve as indicators for conditions such as dermatitis, acne, or other skin disorders.
- Treatment Efficacy: They can be utilized to assess how the skin microbiome responds to various treatments or interventions. Monitoring changes in these markers helps evaluate the effectiveness of therapeutic approaches.
- Predictive Indicators: They act as predictive markers, offering insights into an individual's susceptibility to certain skin diseases or their potential response to specific treatments based on their unique skin microbiome profile.

Microbial markers for Atopic dermatitis

Atopic dermatitis is dominated by an abundance of following microbial markers.

Microbial marker	*Abundance %*	*Reference Range*
Staphylococcus aureus	0.001%	0.00% - 26.90%

Microbial markers for psoriasis

Increased abundance of following microbes is positively correlated with psoriasis.

Microbial marker	*Abundance %*	*Reference Range*
Corynebacterium simulans	ND	ND
Corynebacterium kroppenstedtii	ND	0.00% - 0.62%

Microbial markers for seborrheic dermatitis

Increased abundance of the following microbes is positively correlated with seborrheic dermatitis.

Microbial marker	*Abundance %*	*Reference Range*
Malassezia restricta	0.13 %	0.18%-2.71%
Malassezia furfur	ND	ND
Malassezia globosa	0.003%	0.00% - 8.31%

Microbial markers for acne

Microbial marker	*Abundance %*	*Reference Range*
Cutibacterium acnes	39.81 %	19.00%-65.70%

Microbial markers for cancer

Studies conducted have shown that the dysbiosis of the microbiome of the skin is associated with various skin cancers. Different factors like activation of the primary barrier of immune system - skin, microbial metabolites and toxins production, disruption of skin barrier and UV exposure might be linked to changes in healthy skin microbiome, leading to skin cancer, its progression and response to treatment. Increased abundance of following markers is positively correlated with the disease.

Microbial marker	*Abundance %*	*Reference Range*
Staphylococcus aureus	0.001%	0.00% - 26.90%
beta-haemolytic Streptococcus	ND	ND
Ralstonia pickettii	0.007%	ND
Staphylococcus argenteus	ND	ND
Chlamydophila pneumoniae	ND	ND
Borrelia burgdorferi	ND	ND
Fusobacterium nucleatum	ND	0.00% - 0.05%

Did you find any pathogens in my profile?

In our examination of the skin microbiome, we focused on identifying potentially harmful or pathogenic microorganisms. These types of microbes have the potential to contribute to skin-related issues, leading to problems such as dermatitis, acne, skin infections, unpleasant odors, and systemic health risks. There is growing evidence suggesting potential links between an imbalanced skin microbiome and various health concerns, including inflammatory skin conditions, immune

system dysregulation, and systemic diseases like cardiovascular issues and diabetes. Understanding the presence and characteristics of these microbes on the skin is crucial for addressing and preventing potential health risks associated with an unbalanced skin microbiome.

Disease	*Microorganisms associated*	*Abundance %*	*Reference Range*
Pityriasis versicolor	*Malassezia spp.*	0.13%	0.18% - 11.03
Diabetic foot ulcer	*Staphylococcus aureus*	ND	0.00% - 26.90%
Lupus erythematosus	*Staphylococcus aureus*	ND	0.00% - 26.90%

Overall lifestyle recommendations

Maintaining a healthy skin microbiome is crucial for overall skin health. Here are lifestyle recommendations to promote a healthy skin microbiome and prevent dysbiosis:

- Practice Good Skin Hygiene: Cleanse your skin regularly using mild, pH-balanced cleansers. Avoid over washing, as it may strip the skin of beneficial microbes.
- Limit Antimicrobial Products: While certain skin care products can help manage bacteria, excessive use may disrupt the natural balance of the skin microbiome.
- Consume a Balanced Diet: Eat a diet rich in fruits, vegetables, whole grains, and lean proteins. Limit the intake of sugary and processed foods, as they can impact the growth of beneficial skin microbes.
- Stay Hydrated: Adequate water intake helps maintain skin hydration and supports a healthy environment for the skin microbiome.
- Choose Skin-Friendly Products: Opt for skincare products that are gentle, fragrance-free, and suitable for your skin type. Harsh chemicals and fragrances can disturb the skin microbiome.
- Avoid Excessive Sun Exposure: Prolonged exposure to the sun's harmful rays can affect the skin microbiome. Use sunscreen to protect your skin when outdoors.
- Manage Stress: Practice stress-reducing techniques such as meditation, deep breathing, or yoga. Chronic stress can impact the skin microbiome and contribute to skin issues.
- Limit Antibiotic Use: Only take antibiotics as prescribed by a healthcare professional and complete the full course. Antibiotics can affect the balance of the skin microbiome.
- Regular Skin Check-ups: Consult with skincare professionals for regular skin check-ups and assessments. This helps address any emerging issues and ensures optimal skin health.
- Address Skin Conditions: If you have specific skin conditions, seek professional advice for appropriate treatments. Certain skin conditions can disrupt the balance of the skin microbiome.
- Choose Clothing Wisely: Wear breathable fabrics and avoid tight clothing that may trap moisture, creating an environment conducive to microbial imbalance.

Note: This analysis is based on the results generated by MetaPhlAn4 (Metagenomic Phylogenetic Analysis). All the reference thresholds were calculated based on the healthy subjects from the Human Microbiome Project. It is not suitable for diagnostic use. Kindly consult a physician or dermatologist. All results and inferences should be clinically correlated with the signs and symptoms to arrive at meaningful conclusions. Additionally,

there might be pathogenic bacteria or other organisms not detected or tested in this analysis but might be present as part of your microbiome. Most of the bacterial species mentioned above are commensal species and cause harm to the health in case of dysbiosis.

References: