

Shiseido Discovers Sensitive Skin is Low in Skin Microbiome Diversity -Base formula containing new prebiotic ingredients improves skin moisture and texture-

Shiseido Company, Limited (“Shiseido”) has analyzed the facial skin microbiome*¹ of healthy Japanese women comprehensively, and found that skin with higher relative abundance of *Staphylococcus epidermidis* shows higher moisture content and lower redness level. Furthermore, through comparison between the skin microbiome of sensitive skin and non-sensitive skin, sensitive skin was revealed to possess unique skin microbiome composition with significantly lower bacterial diversity and have less *S. epidermidis* than non-sensitive skin. With repetitive use of a base containing newly developed prebiotic ingredients*², it was confirmed that the moisture level increased in all skin groups and skin texture was improved especially in the skin with low microbiome diversity.

Shiseido continues to pursue developing new skincare solutions through revising our understanding of the skin as an ecosystem that consists of not only host cells but also various microbes, and will apply these research findings to our skincare products.

*¹ Microbiome: A group of microorganisms living in a certain environment.

*² Prebiotic ingredients: A combination of ingredients including Saccharomyces extract. While it is expected to increase beneficial bacteria that have beneficial effects on the skin, it does not affect the growth of harmful bacteria.

Research background

For about 25 years, Shiseido has been conducting studies with particular interest in the relationship between healthy skin and skin-resident bacteria, and carried out activities including the development of active ingredients that improve the balance between *Staphylococcus aureus*, which is one of the aggravating factors in atopic dermatitis, and *Staphylococcus epidermidis*, which is resident in healthy skin.

By taking advantage of recent technology innovation in DNA sequencing, Shiseido has established its own method to stably analyze skin microbiomes and analyzed various types of face skin.

Relationship between skin microbiome and skin condition

- (1) We collected samples from the cheek skin of 41 healthy subjects in their 20s to 30s, and extracted DNA. Then, we analyzed their skin microbiome via 16S rRNA amplicon analysis using next-generation sequencers*³. By studying statistically the correlation between the relative abundance of each bacterium and various physiological parameters of the skin, it was found that higher relative abundance of *S. epidermidis* positively correlates with higher skin moisture content (Figure 1).

*³ 16S rRNA amplicon analysis: A method to determine the profile of bacterial composition in a sample by sequencing a part of 16S rRNA-coding DNA unique to each bacteria group.

- (2) Also in the test with 36 healthy subjects in their 20s to early 40s, the results obtained show that the higher the relative abundance of *S. epidermidis*, the lower the redness (Figure 2).

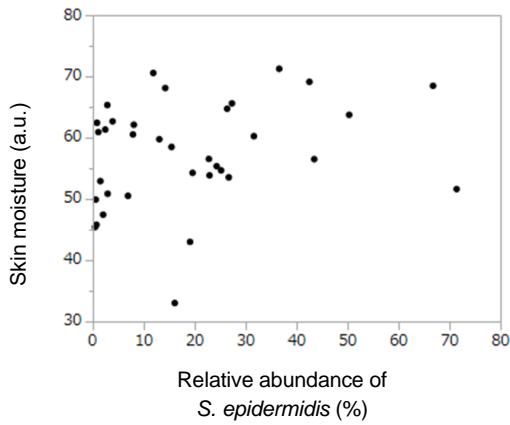


Figure 1. Relationship between skin moisture and relative abundance of *S. epidermidis*

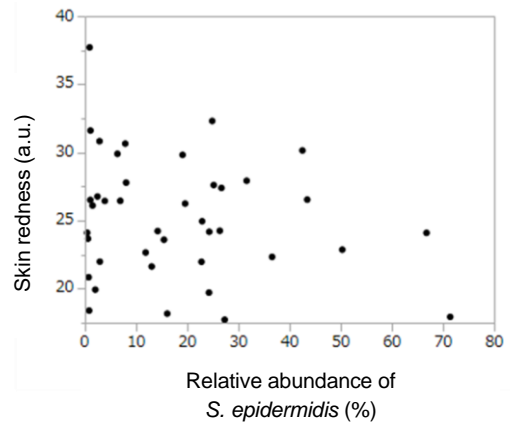


Figure 2. Relationship between skin redness and relative abundance of *S. epidermidis*

Difference in skin microbiome between sensitive and non-sensitive skin

We examined the skin microbiome in the cheeks of subjects with sensitive or non-sensitive skin. The subject number was 22 each and the subject selection was made based on their skin sensitivity to lactic acid. Sensitive skin was found to have significantly lower microbiome diversity compared to non-sensitive skin based on Shannon's diversity index (Figure 3), and lower proportion of *S. epidermidis* to *Propionibacterium acnes*, which is more commonly detected as skin-resident bacteria (Figure 4).

*4 Shannon's diversity index: An index that evaluates skin microbiome diversity, indicating the degree of deviation in terms of both variety of bacteria and abundance ratio.

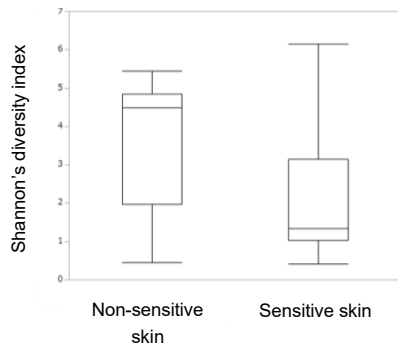


Figure 3. Comparison of microbiome diversity (Shannon's diversity index is significantly low in sensitive skin)

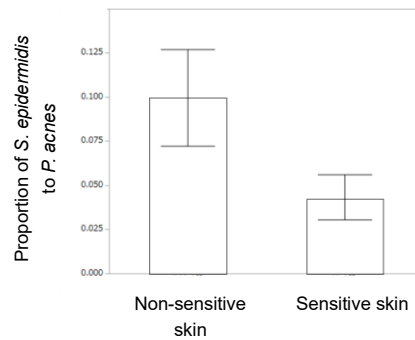


Figure 4. Proportion of *S. epidermidis* to *P. acnes* (Proportion of *S. epidermidis* to *P. acnes* is lower in sensitive skin than non-sensitive skin)

Development of prebiotic ingredients and skin improvement effect

- (1) We screened various ingredients in vitro for prebiotic activity that accelerates the proliferation of *S. epidermidis* and have no influence on the growth of *S. aureus*, and found effective compositions including Saccharomyces extract (Figure 5).
- (2) We formulated the prebiotic ingredients that were confirmed to be effective in the above experiment (1) to the base and performed the test to see the effect of continuous repetitive application of the base formula with 27 subjects. The physiological parameters of the skin were checked periodically and also skin samples were collected from forehead and cheek to analyze the skin microbiome. It was found that moisture level increased in all skin groups, and skin texture was improved especially in skin that was relatively low in skin microbiome diversity before repetitive application (Figure 6). In addition, it was also revealed that the number of non-pathogenic Staphylococcus including *S. epidermidis* increased with repetitive use (Figure 7).

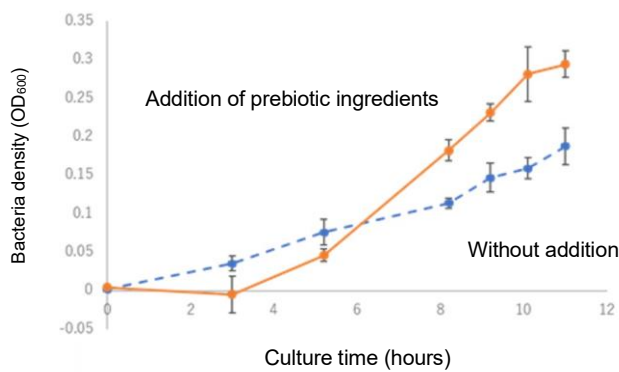


Figure 5. Proliferation-accelerating effect of prebiotic ingredients (Proliferation of *S. epidermidis* is accelerated compared to case without addition)

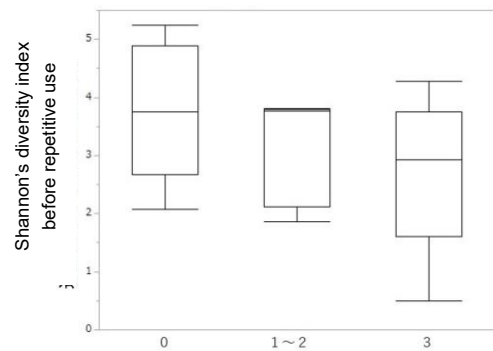


Figure 6. Relationship between degree of texture improvement and microbiome diversity (Horizontal axis is number of items that have improved among three items regarding quality of skin texture)

Based on the above results, deeper understanding of the skin as an ecosystem in which skin cells and microbes coexist interacting with each other will lead to the realization of new skincare solutions.

Shiseido will apply these research findings on skin-resident bacteria to our future skincare research more.

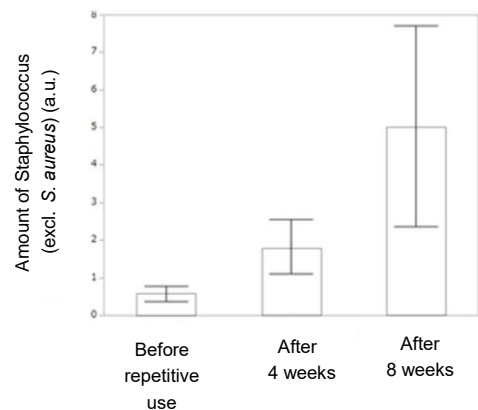


Figure 7. Amount of Staphylococcus after 4 and 8 weeks of repetitive use