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Democracy Dies in Darkness

How a healthy skin microbiome protects against chronic health issues

An imbalanced skin microbiome is linked to a number of chronic health conditions, including asthma and some types of arthritis, research shows.

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Epidermophyton floccosum, seen in a 3D illustration, is a fungus that causes conditions such as athlete's foot or a toenail infection. It is one example of the microbes that can live on our skin. (iStock)

By Amanda Morris

Antibacterial soap. Houseplants. Makeup.

Items that we touch or use on our skin every day could affect our health by changing our skin microbiome and making us more or less susceptible to chronic diseases.

What exactly a healthy skin microbiome looks like and how to maintain it is still under research. But some experts worry that a decrease in time spent outdoors, along with the overuse of harsh chemicals, antibiotics and even certain beauty products, could cause people to have suboptimal skin microbiomes. They theorize that these changes could be collectively contributing to the rise of chronic diseases worldwide.

Like the gut, the skin is home to millions of bacteria, viruses and fungi — tiny organisms called microbes that help our bodies function properly.

“We think that skin microbes are important because the skin has always been our first barrier of defense against the environment,” said José C. Clemente, an associate professor of genetics and genomic sciences at Icahn Mount Sinai and a researcher who focuses on the role of the microbiome in human health.

Though the gut is home to the largest number of microbes in the body and has been better studied, the skin’s role in keeping us healthy has been overlooked, some experts say.

What the skin comes into daily contact with can change the types of microbes living on it — making it harder for beneficial and harmless microbes to flourish, or easier for harmful ones to thrive. And an imbalanced microbiome (one with too few beneficial microbes or too many harmful microbes) has been linked to chronic diseases. Psoriasis and eczema, for example, are linked to imbalances in the skin microbiome. And growing evidence suggests that the skin microbiome plays an important role in regulating our immune system and could be linked to chronic conditions that aren’t on the skin, such as asthma, tooth decay, inflammatory bowel disease and specific types of arthritis.

“Multiple systemic inflammatory diseases have been identified to have links to an imbalanced skin microbiome,” said Julia Oh, a microbiome researcher and a dermatology professor at Duke University.

How the skin influences the immune system

Microbes break down oil on our skin and help maintain a barrier. Some skin microbes produce antibacterial or anti-inflammatory substances.

They also play an important role in training the body’s immune system and preventing chronic inflammation, said Julie Segre, a geneticist at the National Human Genome Research Institute who studies the skin microbiome.

“They teach our immune system what to tolerate and what to respond to,” she said.
The skin contains roughly 3 to 4 percent of the body’s immune cells, and exposure to naturally occurring and varied skin microbes teaches the immune system to tolerate beneficial or harmless bacteria, fungi and viruses, Segre said. Without this tolerance, the immune system can become overresponsive, increasing the risk for allergies or autoimmune conditions (in which the immune system starts to attack the body), she said.

This exposure also helps the immune system fight against potentially harmful pathogens.

In general, having a more diverse microbiome is associated with a lower risk of disease, Clemente said.

More contact with nature could be good for the skin

A growing body of research suggests that more contact with animals, plants and other parts of the natural world can help improve the diversity of the skin’s microbiome.

One small study of an isolated Yanomami Amerindian village that had no documented contact with Western society found that the inhabitants had more diverse skin microbiomes than people living in the United States.

“I think that’s partially due to lifestyle,” said Clemente, a co-author of the study. “What we’re seeing is a reflection of the fact that they spend more time outside with less coverings.”

This could also explain why groups that have high contact with nature, such as Amish people, experience lower rates of allergies, said Aki Sinkkonen, a principal scientist at the Natural Resources Institute Finland, a Finnish research institute.

Sinkkonen has worked on several studies on the effects of environmental exposure on the skin microbiome, including a 2020 study in which researchers added forest floor and sod materials to urban day-care centers and studied the effect on children’s skin and gut microbiomes. After 28 days, they found that children who had gone to the nature-enriched centers not only had more diverse skin microbes but also had fewer inflammatory substances in their blood and more regulatory immune cells.

Another study published earlier this year had similar findings. In this small placebo-controlled, double-blind study, researchers asked healthy, city-dwelling adults to do indoor gardening with various plants. However, one group received soil rich with many microbes, whereas another group received microbes-poor soil. After one month, Sinkkonen and his fellow researchers found that adults who had been in contact with the more microbes-rich soil had more diverse skin microbiomes and more anti-inflammatory substances in their blood.

More research is needed on exactly how long these effects last and whether having a diverse skin microbiome can truly lower disease risk, but Sinkkonen said that the research so far suggests that “it’s important to be in contact with microbiome diverse environments on a daily basis.”

Simply walking through a park may not do the trick though, he said. Instead, we should try to be in direct contact with plants, soil or animals (like our pets). “The more interactive it is, the better,” he said.

Harsh chemicals, antibiotics and beauty products can damage the skin

Protecting the skin from damage is also crucial to creating an environment favorable for good microbes. But some researchers worry that many products and cleaners could be harming our skin.

Drying out the skin too much with chemicals can damage it, allowing disease-causing organisms to pass through the skin’s barrier and go deeper into our tissues, said Cezmi Akdis, director of the Swiss Institute of Allergy and Asthma Research and professor at the University of Zurich in Davos, Switzerland. The body then responds with inflammation, which over time could become more systemic, Akdis said. Skin inflammation or diseases have been linked with issues such as joint inflammation, asthma or allergies.

In addition to drying out the skin, the chemicals in many cleaners or antibiotics cause many of the good microbes on the skin to die, Akdis added.

“If you lose good bacteria, it takes them a long time to come back,” he said.
A lack of beneficial microbes can also allow harmful microbes to grow in their place and promote the growth of chemical-resistant bacteria, fungi or viruses, he said.

People shouldn't stop cleaning or using antibiotics entirely, Akdis said, but should consider cleaning less often and use antibiotic products more sparingly.
To better protect the good microbes in the skin, switch to products that have fewer harsh chemicals such as surfactants (a cleaning substance that can break down the cell membrane and kill microbes), Akdis said. In particular, he suggested trying to avoid a surfactant called sodium lauryl sulfate, which is a known skin irritant found in many cleaning products.

The pH value of various beauty products and soaps can also affect the skin microbiome. The skin's natural pH value is slightly acidic, with an average value of 4.7. This acidity acts as an antimicrobial defense against harmful pathogens and helps the skin retain beneficial microbes, said Kit Wallen Russell, co-founder of the Skin Microbiome School, an Indiana-based company involved with education and research around the skin microbiome.

However, he said, some products such as some makeup, shampoos, sunscreens or soaps can have a pH value that is higher or lower than your skin's natural pH, "which can drastically change the pH of the skin."

"The skin is quite delicate and if you change these biochemical conditions, you can really decrease biodiversity and cause things like skin irritation, barrier defects and drying out the skin," Wallen Russell said.

Further research into the skin microbiome is needed

Research is still in early stages. Analyzing skin microbiome samples is complicated, in part because the skin microbiome could vary from person to person, or even from one place on the body to another.

"The skin microbiome is famously personalized and site specific," Oh said.

She said that the goal is to eventually figure out how to better treat imbalanced skin microbiomes or enhance the skin's health. But the science is still unclear on whether applying probiotic products to the skin is helpful, she said.

For now, she said, the best strategy is to do no harm to your skin, and expose yourself to a biodiverse environment.

"Enjoying the outdoors, having your kids get dirty and not going overboard with sanitizing everything is good for the proper development of the immune system," she said.