

A journey into the skin microbiota: What can we expect from topical pre- or postbiotics?

SKIN & MICROBIOTA

BASIC

Research has demonstrated that managing skin microbiota is an effective new way to tackle some skin conditions such as atopic dermatitis, acne, and psoriasis.

Applying

Atopic dermatitis is a complex condition with common features: very dry itchy skin and abnormalities of the immune, skin and microbial barrier, including a deficiency in the epithelial barrier protein filaggrin, colonization by *S. aureus*, and immune hypersensitivity.⁴

Prebiotics
(i.e. ingredients that selectively stimulate the growth and/or activity of indigenous bacteria)

Postbiotics
(i.e. nonliving extracts from nonpathogenic bacteria)

Onto the skin

as it has been reported for some acute intestinal diseases and based on previous publications, has been suggested as an **interesting therapeutic approach to modulate or balance the immune system and manipulate the different populations of cutaneous microbiota**.^{1,2}

Note

- Prebiotics: nondigestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria
- Postbiotics: non-viable bacterial products or metabolic byproducts from probiotic microorganisms that have biologic activity in the host.^{1,2}

Why did we focus on a *Vitreoscilla filiformis* biomass?

Vitreoscilla filiformis (Vf) is an :

- Aerobic Gram-negative
- Nonpathogenic
- Nonphotosynthetic
- Nonfruiting gliding bacterium belonging to the order of Beggiatoales^{3,4}
- Colorless filamentous bacterium – its name comes from its morphology – isolated from Lake Erie, an oligotrophic lake in North America³⁻⁵

It belongs to a group of bacterial species that occurs naturally in thermal spa waters and which have been used historically in the management of chronic inflammatory skin diseases.⁴ Subsequently Vf was cultivated on an industrial scale for over twenty five years to generate a bacterial lysate introduced into skincare products i.e. emollients.^{4,5}

The interest of a Vf biomass has been investigated in several clinical studies.

In 2006, a first clinical study showed that **treatment with an ointment containing 5% Vf extract significantly improved atopic dermatitis symptoms**.⁶

In 2008, a study carried out on 75 men and women aged 6 to 70 with mild AD showed a tendency towards a **sharp decline in *S. aureus* (-29.6%) and *Streptococci* species and *E. coli* strains (-14.8%) after twice-a-day application of a cream containing 5% Vf lysate**.³

Vf biomass: how does it work?

In 2013, a study was conducted to investigate the underlying mechanisms of a Vf biomass efficacy in a model of atopic dermatitis. It showed that the Vf signal was transmitted successfully to cells below the skin surface, an observation at odds with conventional concepts about the tight barrier properties of the epidermis, but consistent with recent observations that influence from the microbiota penetration into the dermis and exist in equilibrium across an epidermal barrier. In addition, the authors showed that it induces maturation of IL-10+ dendritic cells, the mechanism requiring Toll-Like Receptors 2 (TLR2) for IL-10 production.^{7,8}

Both *in vitro* and *in vivo* testing have shown that Vf biomass stimulates endogenous antioxidant defenses in the skin:

IN VITRO
it stimulated keratinocyte mitochondrial superoxide dismutase activity at both mRNA and protein levels through a still-unknown mechanism.^{4,5}

IN VIVO
it decreased the number of ultraviolet-induced sunburn cells in human skin.^{4,5}

Interestingly, Vf biomass not only stimulates endogenous mitochondrial antioxidant defenses but also endogenous antimicrobial defenses.⁴

All in all, it acts as an exogenous bacterial trigger, inducing a homeostatic defense reaction and providing a protective biological shield, which reinforces cutaneous resistance and defense mechanisms.⁴

Aqua Posae filiformis: seeking greater efficacy on skin microbiota

Aqua Posae filiformis is a lysate of Vf (Vf biomass) grown in La Roche Posay Thermal Spring Water (LRP-TSW), which contains **2 exclusive and rare elements (selenium and strontium) acting as catalysers of bacterial enzymes**.

Beyond the efficacy of a Vf biomass, several publications have highlighted the effects of selenium-rich water on the skin, which protects against the short- and long-term effects of reactive oxygen species induced by ultraviolet radiation as well as inflammation and irritation.⁴

In addition, LRP-TSW contains its own bacterial profile and has demonstrated its ability to increase some bacterial concentration directly and/or to maintain a specific mineral balance promoting certain bacteria metabolism and development; it can be called “the LRP-TSW prebiotic effect”.⁹

Adding a selenium- and strontium-rich thermal spring water to the Vf culture medium led to a biomass with a similar, but boosted, mitochondrial superoxide dismutase activation capacity. The new biomass stimulated mRNA expression more powerfully for antimicrobial peptides and other innate immune defense mechanisms through activation of TLR2 in reconstructed epidermis.^{2,4,5}

Furthermore, a specific carbon source, mannose, known to boost the growth of *Xanthomonadaceae* family, was associated to APF to enhance its efficacy.¹

Interest of APF: recent clinical evidence in AD

The results of a double-blind, randomized, comparative study carried out on 60 patients with moderate AD (SCORAD = 21± 8) and comparing an emollient containing APF with an emollient without APF were published in 2017.¹

They showed that **APF is able to normalize the cutaneous microbiota and reduce AD symptoms for at least one month after the end of treatment more efficiently than another emollient**.¹

For the first time, the study demonstrated that **the topical application of a postbiotic (i.e. nonliving extracts from nonpathogenic bacteria) associated with prebiotics is an interesting therapeutic approach to modulate or balance the immune system**. Therefore, enabling normalization of the cutaneous microbiota could be beneficial in various immune-mediated skin diseases, AD and potentially other chronic inflammatory skin diseases such as acne, rosacea, and psoriasis.¹

Bibliography

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