

SCALP MICROBIOME, A NEW PLAYGROUND FOR COSMETIC INNOVATION

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1 INTRODUCTION

Skin/scalp microbiota has a strong impact on skin/scalp quality link to its power on the regulation of inflammation, on the protection against invaders and oxidants and on helping the barrier function recovery. [1, 2, 3, 4]

The disequilibrium of skin microbiota may contribute to facilitate skin disorders. Many factors such as environmental pollution, solar exposures, psychological stress or harsh skin care routine are reported to impact the skin microbiota homeostasis. [5, 6, 7, 8, 9, 10] The human skin including the scalp surface, serves as the body's first line of defense as well as a host to a myriad of microorganisms, which includes both bacteria and fungi. The application of high-throughput next-generation sequencing, and robust computational analysis has led to an in-depth understanding of the scalp microbiome in the recent years, providing novel clues on the scalp-related disorders and scalp health.

Global studies have revealed that the scalp microbiome is characterized by a rather low bacterial diversity, as compared to the other body sites, and is dominated by Cutibacterium spp., Staphylococcus spp. and Malassezia spp. The scalp microbiome acts as guardians of hair and scalp quality. [11, 12, 13] Various environmental and intrinsic factors are reported to be linked to the scalp barrier, sebum composition, scalp microbiome disequilibrium, thus it is important to propose adapted scalp cosmetic products. For this purpose, we developed a specific formula designed to act on scalp and its ecosystem.

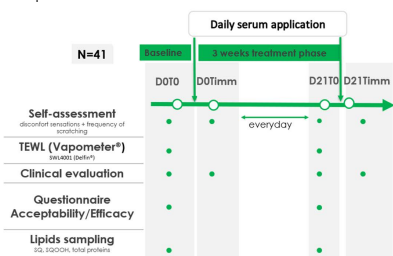
2 MATERIALS & METHODS

Clinical studies and clinical evaluation

The 2 open-label, single center, non-invasive and prospective studies were conducted between September 2020 and February 2021 at one investigational site in France according to the guidelines for the conduct of clinical trials in alignment with local and international regulations. All subjects provided written informed consent prior to their participation.

Study 1

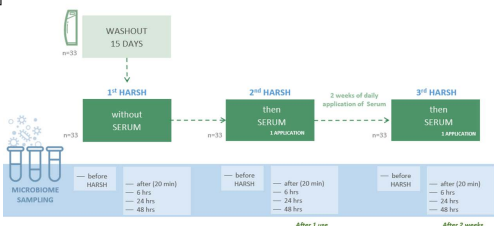
n=41
100% Sensitive scalp at D0T0



SQ and SQOOH were quantified by liquid chromatography (Ultimate 3000 HPLC system) combined with a single quadrupole spectrometer MSQ (Thermo) (LC-MS). Total proteins were also analyzed with Microplate reader Spark (Tecan) to normalize SQ and SQOOH results to limit the potential sampling difference influence. [14, 15]

Study 2

n=33 (9M, 24F)
100% normal scalp
No dandruff condition



Formula tested

The formula is a scalp serum containing vitamin CG, polysorbate 21 and a complex of 7 pre- and probiotics fractions including Bifidobacterium longum extract, Saccharomyces cerevisiae extract, two Lactobacillus extracts and two long polysaccharides and one short sugar. [16-17]

Microbiome evaluation

Cutibacterium spp., Staphylococcus spp. and Malassezia spp (quantitative) were evaluated by qPCR (region V1-V3 16S rRNA KAPA Biosystems kit with SYBER Green) and amplicon sequencing analysis of bacterial and fungal communities (qualitative) was conducted using Next Generation Sequencing (NGS) (Amplification V1-V3 on Illumina MiSeq platform).

REFERENCES

- Stacy et al. Microbial guardians of skin health. *Science* 363: 6424-227-228 (2019)
- Eger, R. *Simmering and CU Road*, The Association of the Skin Microbiota with Health, Immunity, and Disease. *Clinical Pharmacology and Therapeutics*, 102: 1-62-69 (2017)
- Balshodan and Samra. *Tomodyssey*: The influence of skin microorganisms on cutaneous immunity. *Nature reviews Immunology*, 16: 353-366, 2016
- Balshodan et al. *Dialogue between skin microbiota and immunity*. *Science* 346: 6232- 954-959, 2014
- Mansur H. Y., Leung, Kinshu Y., Yang, Philippe B., Parent, Guyard, Arthur, Tannous, Bruce M. R., Appeneller, Richard J., Betts, Sabine, Meunier, Jing Li, Nizama, Burakovic, Lionel, Bretton, Cecile, Clouard, B. & Parnis, K. *Local Changes of the human skin microbiota upon exposure to ultraviolet radiation*. *Microbiome*, 8: 500, 1-7 (2020)
- Parnis, S. N. *Byrne, P. Wolf*. The Skin Microbiome: Is It Affected by UV-induced Immune Suppression? *Frontiers in Microbiology*, 7: 1255 (2016)
- Parnis, K. *Higgins, V. Andriantsoa, P. Wolf*. Skin Microbiome Modulates the Effects of Ultraviolet Radiation on Cellular Responses and Immune Function. *Science*, 15: 211-222 (2019)
- Parnis, A. *Perspectives on the Interplay of Ultraviolet Radiation, Skin Microbiome and Skin Barrier Memory*. *TCR+ Cells, Frontiers in Medicine*, 3:65 (2018)
- Hovan and P. *Value, Evaluation of the Effects of Stressful Life on Human Skin Microbiota*. *Appl Microbiol Open Access*, 4: 1-8 (2018)
- Holmes, C. J., Pritchard, K., Gomez, R., Bostel, A. *Dynamic roles of host stress responses in remodeling the cutaneous microbiome: implications for wound healing and infection*. *Adv Wound Care* 2015; 4: 24-37 (2015)
- Parnis, K., Gao, Z., Jourdain, R., Ramirez, J., Gony, F., Clouard, C., et al. *Body Site is a More Determinant Factor than Human Population Diversity in the Healthy Skin Microbiome*. *PLoS One*, 15(4): 015990 (2016)
- Clouard, C., Jourdain, R., Bor-Silen, A., Tiche, M., Bouchier, C., Proust, F., et al. *Dandruff is associated with disequilibrium in the proportion of the major bacterial and fungal populations colonizing the scalp*. *PLoS One*, 16(5): 025013 (2019)
- Grimshaw, S.S., Smith, A.M., Arnold, D.S., Xu, E., Hopcraft, M., Murphy, B. *The diversity and abundance of fungi and bacteria on the healthy and dandruff affected human scalp*. *PLoS One*, 2019; 14(2): 0221796 (2019)
- Nakagawa, K., Iwakaki, S., Suzuki, Y., Yamashita, S., Higuchi, O., Okawa, S., et al. *Ion-trap tandem mass spectrometric analysis of squalene monohydride isomers in sunlight-exposed human skin*. *J Lipid Res*, 2007; 48(12): 2779-87
- Witek-Klimkiewicz, K. *Measurement of oxidative stress parameters using liquid chromatography-tandem mass spectrometry (LC-MS/MS): Toxicol Appl Pharmacol*, 2008; 233(3): 300-6
- Guanche, Britton, L., Basian, P., Orjuela, J.M., Kerrel, M., Courchay, C., Chavalier, V., Castel, J. *Bifidobacterium longum* lysate, a novel ingredient for sensitive skin. *Exp Dermatol*, 19: 41-48 (2010)
- Santillo, Audrey, Sanchez, Oreste, Jaramaya, Juli, Sada, Puga, Corina, Blanchard, Néstor, Vazquez, Mariana, Andrés, Iñaki, Juárez, Lorena, Britton, Tomás, Sica, Bifidobacterium longum extract exerts pro-differentiating effects on human epidermal keratinocytes, in vitro. *Exp Dermatol*, Volume 26, Issue 1, Pages 92-94 (2017)

3 RESULTS & DISCUSSION

Global scalp discomfort

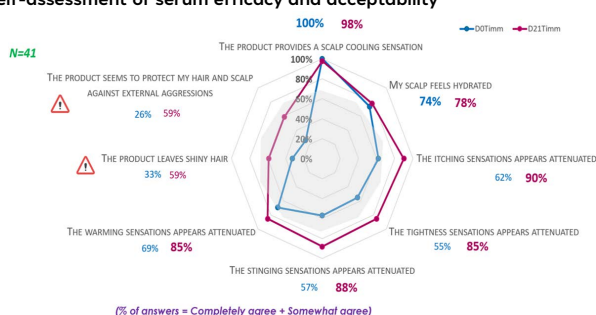
Global scalp discomfort score and scratching frequency significantly ($p < 0.0001$) improved immediately after first serum application (D0Timm) (respectively -52% and -67%) and lasted until the end of the study (D21Timm) compared to baseline.



SQ and SQOOH biomarkers results

No significant difference ($p = 0.1884$) on SQ content was observed between D0T0 and D21T0, no seoregulation activity was observed in this study. The SQOOH content is significantly reduced ($p = 0.0174$) between D0T0 and D21T0 (-15%) highlighting a reduction of oxidative stress of Squalene.

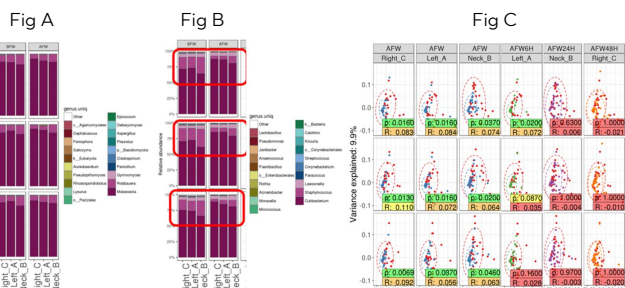
Self-assessment of serum efficacy and acceptability



Microbiome results

Scalp surface aggression (with harsh shampoo) decreased the bacterial and fungal load of the scalp microbiota.

Relative abundance of fungi and bacteria at the genus taxonomic level at D0, D7 and D26 shows that fungi is dominated by Malassezia at >98% (Fig A) so this specific shampoo shows no difference in fungi quality, in opposite an important change of bacteria diversity was shown (Fig B).



Application of the serum doesn't change the recovery of the bacteria and fungi quantity but promoted a faster recovery of scalp bacteria diversity compared to bare scalp after 15 days of application (Fig C). Indeed, very interestingly, based on the bacteria beta diversity, after 15 days of serum application, the scalp microbiome showed a significant faster recovery relative to bare scalp with a total recovery already at 6h compared to 24h at bare scalp.

4 CONCLUSIONS

These findings show that for the first time a specific designed cosmetic formula containing vitamin CG, polysorbate 21 and a combination of 7 pre- and probiotics fractions can bring a quicker and complete recovery of scalp microbiota after aggression and reduce global discomfort and symptoms in subjects with sensitive scalp, and as well as markers of oxidative stress.

These results bring a key milestone in scalp knowledge and paving the way for new products for healthy scalp bringing hair quality.