34th Congress IFSCC BRAZIL Iguazu Falls 14-17 October | 2024

Biodiversity and Cosmetics: Reaching Sustainable Technology

Preclinical evaluations of the effects a foot-care formula on restoration and recovery of skin barrier integrity

Nunes da Silva, Kátia[1]; Ramos Dalseno, Carlos Eduardo[1]; Henrique da Silva, Gustavo[2]; da Silva Leite, Gabriela[2]; Tabarini Alves Pinheiro, Ana Lucia[2]; Facchini, Gustavo[2]; Eberlin, Samara[2]; **de Freitas Carli, Barbara[2]***

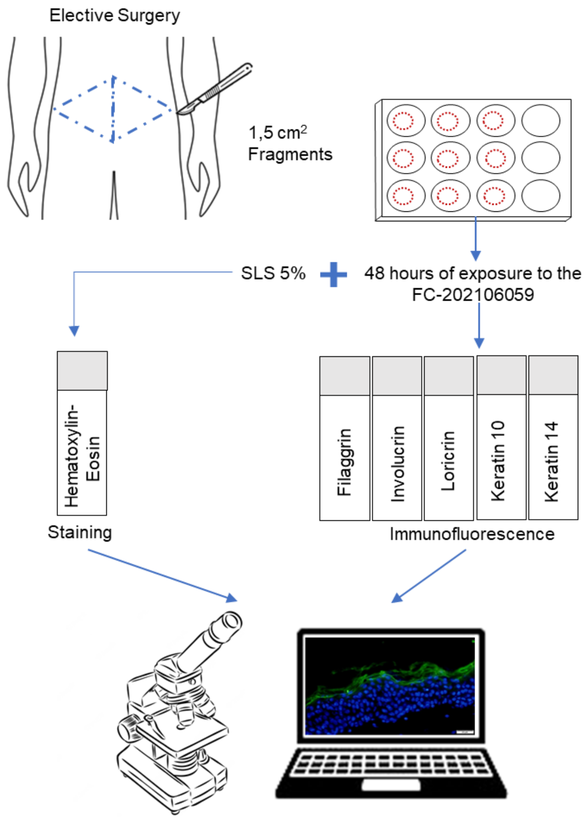
[1]Chimica Baruel Ltda, SP, Brazil; [2] Skin vitro, Kosmoscience Group, SP, Brazil.

Introduction

The skin barrier relies on key proteins like filaggrin, involucrin, loricrin and keratins for stratum corneum formation, improve cell stability and create a protective shield that ensures skin resilience against external threats. Dysfunction in these proteins can compromise the skin barrier, leading to various dermatological issues The purpose for this study was to evaluate the preclinical effects of a foot-care product 202106059 (FC202106059) on the production of biological markers involved in skin barrier integrity and epidermal repair through immunofluorescence analysis in skin explants.

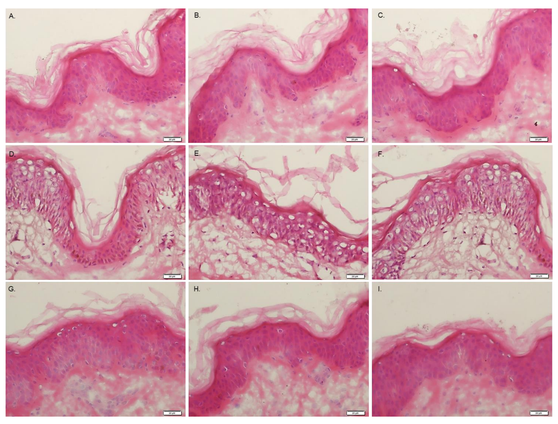
Materials & Methods

FC-202106059 was composed by skin conditioners such as Cycloprntasiloxane, Butyrospermum parkii butter, Ricinus communis seed oil, Bisabolol, Retinyl Palmitate and Arachis hypogaea oil and antioxidants such as Tocopheryl acetate and Tocopherol. We subjected ex-vivo skin fragments, form elective plastic surgery, to barrier disruption with sodium lauryl sulfate (SLS) and treated with FC-202106059 for 48 hours for histological evaluation of epidermal repair (Hematoxylin-Eosin staining) and semiquantification of filaggrin, involucrin, loricrin, keratin 10 (K10) and keratin 14 (K14), using the immunofluorescence technique. Fluorescence intensity was quantified using ImageJ software. ANOVA and Bonferroni post-test were applied (significance level of 5%).



Results & Discussion

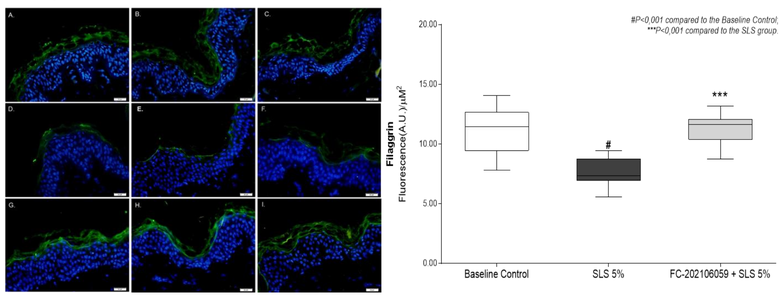
Figure 1 - Histological evaluation with Hematoxylin-Eosin staining of epidermal repair in cultured human skin subjected to barrier disruption with 5% SLS.



A-C - Histological section of ex vivo skin without treatment (Baseline Control). **D-F** - Histological section of ex vivo skin after barrier disruption with SLS. **G-I** - Ex vivo histological section of skin after barrier disruption with SLS and treatment with the evaluated product FC-202106059. The reference bar corresponds to 20 µm.

Regeneration mainly in the epidermal region observed by the increase in cohesion between keratinocytes.

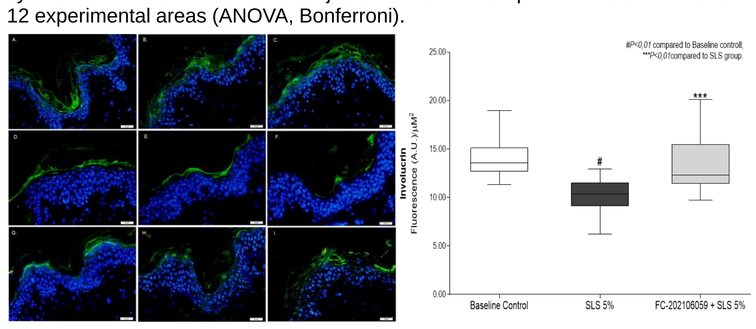
Figure 2 - Histological evaluation and semi-quantification of fluorescence intensity (Arbitrary Units - A.U.) of filaggrin synthesis in human skin culture subjected to barrier disruption with SLS 5%. Data represent the mean ± range of values of 12 experimental areas (ANOVA, Bonferroni).



↑ **Filaggrin *vs* SLS 5%**

A-C - Histological section of ex vivo skin without treatment (Baseline Control). **D-F** - Histological section of ex vivo skin after barrier disruption with SLS. **G-I** - Ex vivo histological section of skin after barrier disruption with SLS and treatment with the evaluated product FC-202106059. Filaggrin is marked in green and the blue marking represents the cell nucleus (DNA). Reference bar corresponds to 20 µm.

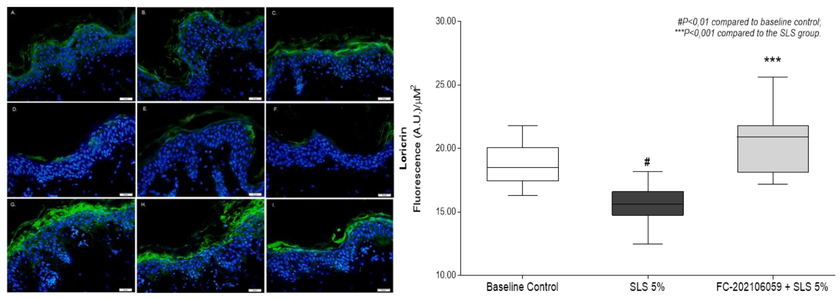
Figure 3 - Histological evaluation and semi-quantification of fluorescence intensity (Arbitrary Units - A.U.) of involucrin synthesis in human skin culture subjected to barrier disruption with SLS 5%. Data represent the mean ± range of values of 12 experimental areas (ANOVA, Bonferroni).



↑ **Involucrin *vs* SLS 5%**

A-C - Histological section of ex vivo skin without treatment (Baseline Control). **D-F** - Histological section of ex vivo skin after barrier disruption with SLS. **G-I** - Ex vivo histological section of skin after barrier disruption with SLS and treatment with the evaluated product FC-202106059. Involucrin is marked in green and the blue marking represents the cell nucleus (DNA). Reference bar corresponds to 20 µm.

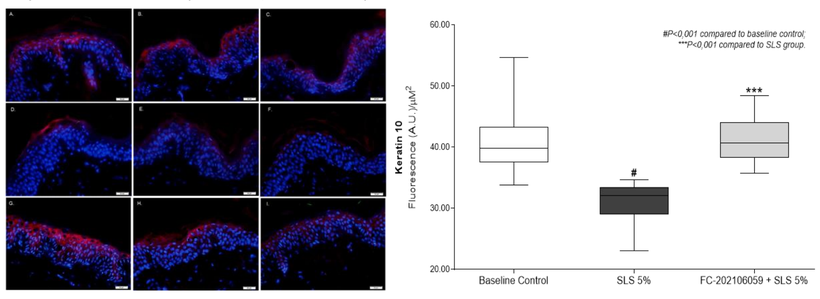
Figure 4 - Histological evaluation and semi-quantification of fluorescence intensity (Arbitrary Units - A.U.) of loricrin synthesis in human skin culture subjected to barrier disruption with SLS 5%. Data represent the mean ± range of values of 12 experimental areas (ANOVA, Bonferroni).



↑ **Loricrin *vs* SLS 5%**

A-C - Histological section of ex vivo skin without treatment (Baseline Control). **D-F** - Histological section of ex vivo skin after barrier disruption with SLS. **G-I** - Ex vivo histological section of skin after barrier disruption with SLS and treatment with the evaluated product FC-202106059. Loricrin is marked in green and the blue marking represents the cell nucleus (DNA). Reference bar corresponds to 20 µm.

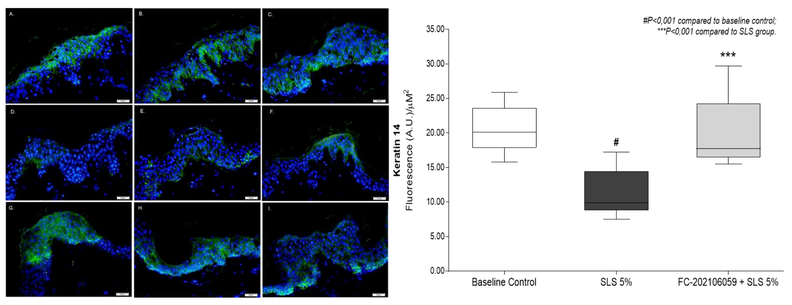
Figure 5 - Histological evaluation and semi-quantification of fluorescence intensity (Arbitrary Units - A.U.) of K10 synthesis in human skin culture subjected to barrier disruption with SLS 5%. Data represent the mean ± range of values of 12 experimental areas (ANOVA, Bonferroni).



↑ **K10 *vs* SLS 5%**

A-C - Histological section of ex vivo skin without treatment (Baseline Control). **D-F** - Histological section of ex vivo skin after barrier disruption with SLS. **G-I** - Ex vivo histological section of skin after barrier disruption with SLS and treatment with the evaluated product FC-202106059. K10 is marked in red and the blue marking represents the cell nucleus (DNA). Reference bar corresponds to 20 µm.

Figure 6 - Histological evaluation and semi-quantification of fluorescence intensity (Arbitrary Units - A.U.) of K14 synthesis in human skin culture subjected to barrier disruption with SLS 5%. Data represent the mean ± range of values of 12 experimental areas (ANOVA, Bonferroni).



↑ **K14 *vs* SLS 5%**

A-C - Histological section of ex vivo skin without treatment (Baseline Control). **D-F** - Histological section of ex vivo skin after barrier disruption with SLS. **G-I** - Ex vivo histological section of skin after barrier disruption with SLS and treatment with the evaluated product FC-202106059. K14 is marked in green and the blue marking represents the cell nucleus (DNA). Reference bar corresponds to 20 µm.

Conclusions

We concluded that the FC-202106059 positively influenced tissue repair by boosting the synthesis of essential proteins such as filaggrin, involucrin, loricrin, K10, and K14. This increase promoted skin hydration and facilitated barrier recovery, especially after stress exposure. The results underscore FC-202106059's role in restoring and fortifying the skin barrier, preventing water loss, and protecting against external threats, thereby supporting overall skin health and integrity.

References

1. Jackson SM, Elias PM. Epidermis as an organ of protection. In: Fitzpatrick TB, Eisen AZ, Wolff K, Freedberg IM, Austen KF, editors. Dermatology in General Medicine. 4th ed. New York: McGraw-Hill; 1993. **2.** Elias PM, Feingold KR. Permeability barrier homeostasis. In: Elias PM, Feingold KR, editors. Skin Barrier. New York: Taylor & Francis; 2006. p. 337-62. **3.** Wilkes GL, Brown IA, Wildnauer RH. The biomechanical properties of skin. CRC Crit Rev Bioeng. 1973;453-95. **4.** Kalinin A, Marekov LN, Steinert PM. Assembly of the epidermal cornified cell envelope. J Cell Sci. 2001;114:3069-70. **5.** Ishida-Yamamoto A, Iizuka H. Structural organization of cornified cell envelopes and alterations in inherited skin disorders. Exp Dermatol. 1998;7:1-10. **6.** Marekov LN, Steinert PM. Ceramides are bound to structural proteins of the human foreskin epidermal cornified cell envelope. J Biol Chem. 1998;273(28):17763-70. **7.** Gawa, M., & Tagami, H. (2008). Skin functional properties and molecular organization. Journal of Dermatological Science. **8.** Voegeli, R., Heiland, J., Doppler, S., Jünger, M., & Gloor, M. (2007). Effects of various moisturizers on the quality of the skin barrier. Skin Research and Technology. **9.** Loden, M. (2003). Role of topical emollients and moisturizers in the treatment of dry skin barrier disorders. American Journal of Clinical Dermatology. **10.** Proksch, E., & Jensen, J. M. (2006). Skin as an immune organ and its role in inflammatory diseases. Journal of Dermatological Science. **11.** Kuehl, B. L., Fyfe, K. S., & Shear, N. H. (2003). Cutaneous cleansers: Should they be evaluated by testing with and without water? Journal of Cutaneous Medicine and Surgery. **12.** Cork, M. J., Robinson, D. A., Vasilopoulos, Y., Ferguson, A., Moustafa, M., MacGowan, A., ... & Tazi-Ahnini, R. (2006). New perspectives on epidermal barrier dysfunction in atopic dermatitis: Gene-environment interactions. Journal of Allergy and Clinical Immunology. **13.** Danby, S. G., Al-Enezi, T., Sultan, A., Chittock, J., Kennedy, K., & Cork, M. J. (2013). The effect of a long-term moisturizing regimen on skin barrier function and the incidence of AD flares. Journal of Clinical and Experimental Dermatology. **14.** Nemes, Z., & Steinert, P. M. (1999). Bricks and mortar of the epidermal barrier. Experimental and Molecular Medicine. **15.** McAleer, M. A., & Irvine, A. D. (2013). The multifunctional role of filaggrin in allergic skin disease. Journal of Allergy and Clinical Immunology. **16.** Harding, C. R., & Scott, I. R. (2002). Filaggrin—the stratum corneum and beyond. International Journal of Cosmetic Science. **17.** Elias, P. M., & Feingold, K. R. (2001). Does the tail wag the dog? Role of the barrier in the pathogenesis of inflammatory dermatoses. Archives of Dermatology. **18.** Wolf, R., Parish, L. C., & Brenner, S. (2001). Barrier function and its restoration in atopic dermatitis. Dermatologic Clinics. **19.** Ghersetich, I., Lotti, T., Campanile, G., Grappone, C., & Dini, G. (1994). Hyaluronic acid in cutaneous intrinsic aging. International Journal of Dermatology. **20.** Krol, E. S., & Gruber, J. V. (2004). Oxidative stress and skin aging. Journal of Investigative Dermatology Symposium Proceedings. **21.** Watson, R. E., & Griffiths, C. E. (2005). Pathogenesis of photoaging. British Journal of Dermatology