



Targeting inflammation and pro-resolving mediators: a new pathway to improve scalp condition?

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Introduction of research

A critical and often-overlooked factor that may give rise to dandruff and oily hair is the intrinsic quality of the scalp stratum corneum (SC), which is often unbalanced and susceptible to external aggressions. The SC on the scalp is of prime importance, serving as barrier against trans-epidermal water loss and entry of toxic materials for instance. Scalp condition is also important for hair quality and structure as well as for reducing dandruff [1]. Oxidative stress and inflammation are prevalent in all these skin conditions. To stop inflammation and avoid chronic inflammation, the production of specialized pro-resolving mediators (SPMs) is essential. Some precursors of pro-resolving mediators have already been found in skin in the basal state, likely contributing to homeostasis maintenance [2]. However, these lipids have never been studied in the scalp. Therefore, we studied SPMs expression and its role in reinforcing the scalp and consequently improving hair appearance.

Body

In this way and based on *in-vitro* screenings, a native plant from Australia, the *Anetholea anisita* extract was selected. Indeed, in a culture of human follicle dermal papilla cells (HFDPC), this extract (0.2%) showed strong antioxidant properties with 73% ($p<0.001$) decrease of ROS production after induction with pyocyanin. Moreover, a decrease of IL-8 production by 98% ($p<0.001$) was observed after IL1 α induction. These properties can be attributed to its rich polyphenolic and flavonoids composition, including derivatives of ellagic acid and quercetin, two molecules known to decrease inflammation [3].

This positive effect of the *Anetholea anisita* extract (1%) was confirmed *in-vivo* on a cohort of 40 volunteers, aged 18-40 and presenting greasy hair and dandruff. Results were compared to placebo group. Volunteers applied the products 3 times a week for 28 days on wet hair, leaving them on for at least 1 minute before rinsing off. We were able to measure in volunteers' sebum a decrease of IL-8 (-48%; $p<0.1$),



found to be higher in volunteers with oily dandruff compared to healthy volunteers [4], to confirm *in-vitro* results. *Anetholea anisita* extract also decreased expression of two additional markers, namely Leukotrien B4 (LTB4) and Prostaglandin E2 (PGE2), involved in itch and inflammation [5], by 39% ($p < 0.1$) and 44%, respectively.

The presence of SPMs in volunteers' sebum was also evaluated (Figure 1). LC-MS/MS analysis revealed for the first time the presence of all targeted SPMs in the scalp, with different levels of expression. Interestingly, we observed that the *Anetholea anisita* extract was able to increase the expression of Lipoxin B4 (LxB4), a metabolite of the arachidonic acid, and two Resolvins D (RvD1 and RvD2) derived from the metabolism of docosahexaenoic acid. An increase by 98% ($p < 0.1$), 62% ($p < 0.1$) and 72% ($p < 0.1$) were obtained, respectively.

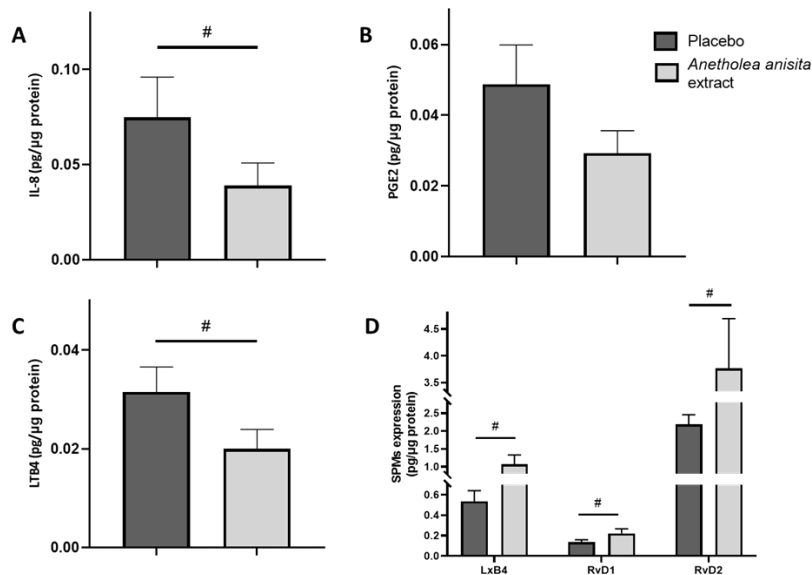


Figure 1: *In-vivo* effect of *Anetholea anisita* extract on inflammatory markers IL-8 (A), PGE2 (B), and LTB4 (C). Effect of *Anetholea anisita* on LxB4, RvD1 and RvD2 expression (D). Data are presented as mean \pm SEM values, ($n = 17$). Statistical analysis was performed using t-test (# $p < 0.1$).

Tabling on the documented positive effect of SPMs in the skin to reduce inflammation and promote tissue homeostasis, we decided to study the impact of the *Anetholea anisita* in the SC of the scalp. Our pro-resolving extract showed its capacity to reinforce SC permeability compared to placebo, as observed in a decrease of TEWL (-6%, $p < 0.05$). It also helps to rebalance scalp pH, increasing it by 0.45 units vs. D0 ($p < 0.05$), reflecting a better general state of the scalp barrier. As consequence of improved scalp condition, a decrease of sebum production (-17%, $p < 0.05$) was observed as well as in dandruff presence (-28%, $p < 0.001$) to lead to brighter (+25%, $p < 0.001$) and healthy hair as measured with the Glossymeter.



Conclusion

The present study supports the notion that acting on the scalp condition, and more specifically on inflammation processes, represents a valuable approach to restore the scalp barrier and improve the dandruff condition. The *Anetholea anisita* extract showed its capacity to improve the scalp barrier condition through anti-inflammatory and pro-resolving mechanisms. The latter, especially the lipoxin and resolvin D families, represent new markers to tend to a healthy scalp. To conclude, the *Anetholea anisita* extract is a valuable natural ingredient for cosmetic applications to improve hair condition.

References

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About the speaker



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After my master's degree in Neurosciences and my PhD in Biomolecules & therapeutic pharmacology, I spent 9 years in the development of medical devices suitable for skin repair before to join LMC's R&D as a Project Manager in 2014. For 6 years, I led the development of the biological screening platform and the development of cosmetic ingredients. For 3 years, I am in charge of the global research and development for the company. With my team, we are developing innovative ingredients (active and functional and delivery systems) for the cosmetic market.