

Preserving Scalp Microbiome: Clinical Evaluation of a Microbiome-Friendly Anti-Dandruff Shampoo Using In Vivo qPCR Profiling

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INTRODUCTION & OBJECTIVES

The scalp microbiome plays a crucial role in maintaining skin barrier function, modulating inflammation, and preventing disorders such as dandruff and seborrheic dermatitis. Conventional anti-dandruff treatments often disrupt this delicate microbial balance, potentially compromising long-term scalp health. This study aimed to assess the impact of an anti-dandruff shampoo on the scalp's microbial ecosystem and overall dermatological condition. The formulation includes Salicylic Acid and Propanediol Caprylate, a naturally derived ester-like compound selectively activated by *Malassezia* enzymes, targeting the microorganism responsible for dandruff.

MATERIALS & METHODS

A 4-week, single-arm, in vivo clinical study was conducted with 60 participants presenting with Seborrheic Dermatitis-prone scalp at varying intensities (mild, moderate, and severe). Microbial samples were collected at baseline, week 2, and week 4. Quantitative polymerase chain reaction (qPCR) analysis was performed using the SMART Probe Scalp Panel, a multiplex assay designed to quantify 20 key bacterial and fungal markers associated with scalp health. The method is based on hydrolysis probe detection with optimized primer-probe sets, ensuring sensitivity and specificity. Dermatological assessments, high-resolution imaging, and patient-reported outcomes (PROs) were also recorded.

RESULTS

The shampoo preserved both bacterial and fungal alpha and beta diversity throughout the study, highlighting its ability to maintain a stable and balanced scalp microbiome. This ecological stability is clinically relevant, since loss of diversity is often linked to scalp disorders. Beneficial commensals such as *Cutibacterium acnes* significantly increased, while potentially pathogenic species including *Staphylococcus aureus* and *Malassezia restricta* remained stable overall. In participants with moderate-to-severe flaking (n=19), *Malassezia* spp. levels decreased by Day 14 and remained stable through Day 28, (p< 0.001 from baseline) consistent with the mechanism of action of key ingredients and highlighting the product's microbiome-rebalancing effect.

Clinical assessments showed a clear reduction in scalp flaking, irritation, and erythema. Patient self-assessments reported significant improvements in scalp hydration, comfort, and hair quality.

These results are consistent with the activity of the ingredients included in the formula: Propanediol Caprylate, a plant-based ingredient that down-regulates dandruff-causing fungi while supporting the scalp microbiome, and salicylic acid, a keratolytic agent that helps reduce scales and promotes scalp renewal.

Figure 1. Study Design Timeline with Assessments

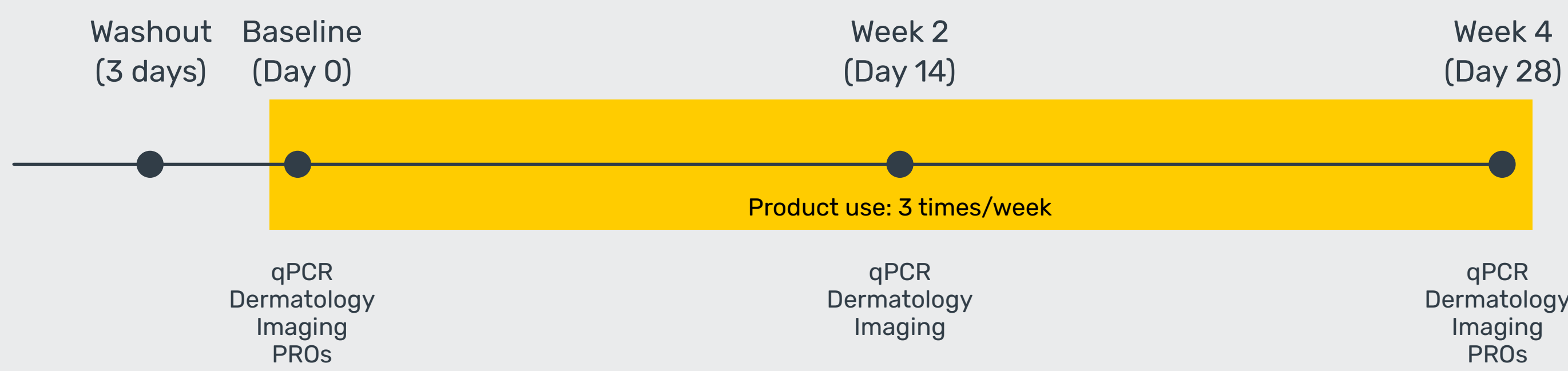
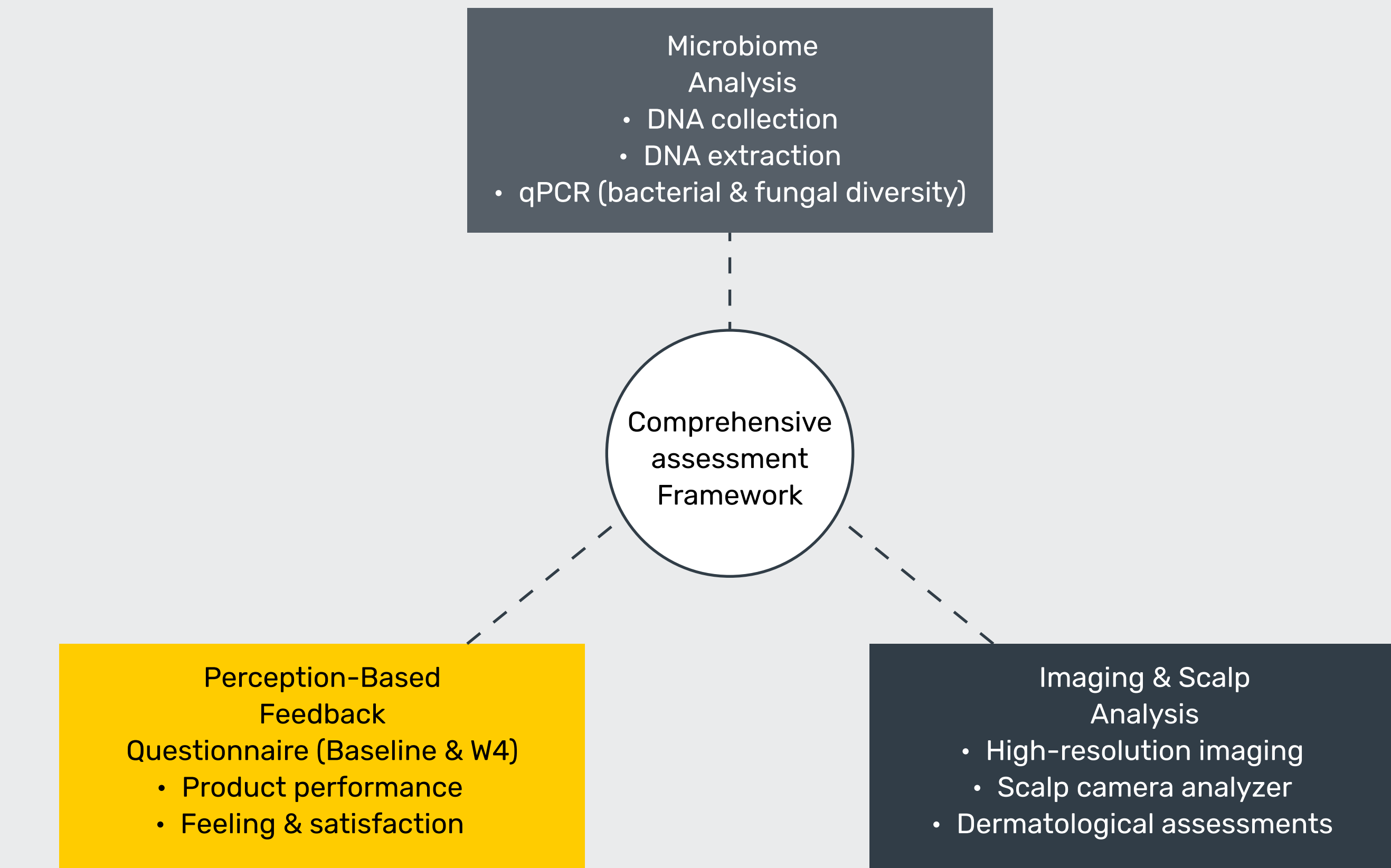
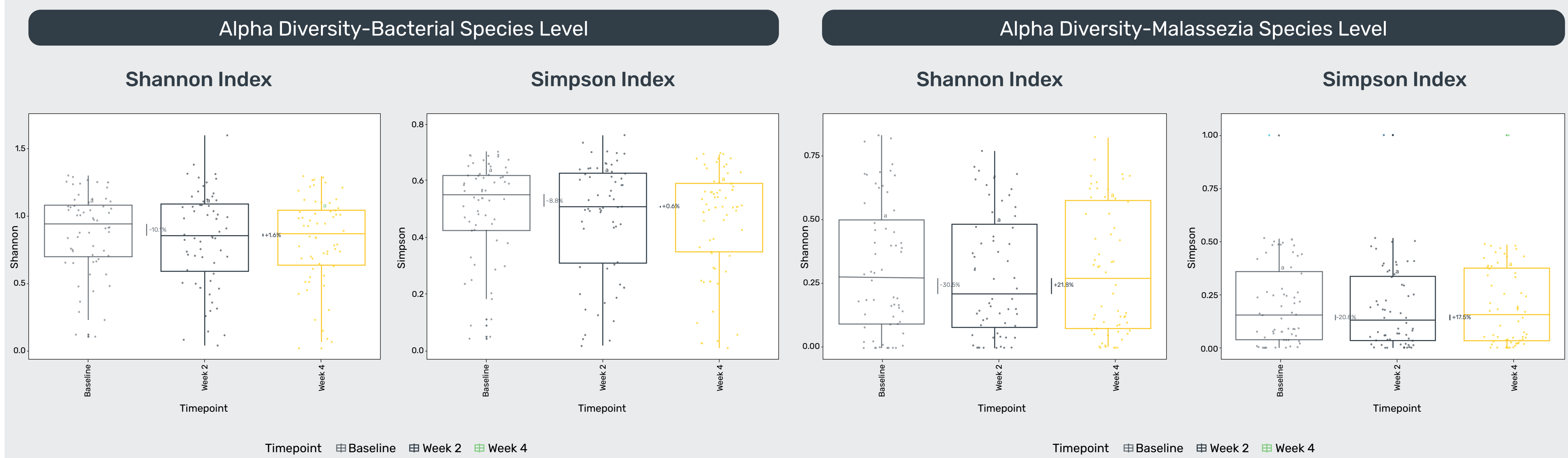


Figure 2. Comprehensive assessment Framework (360°)



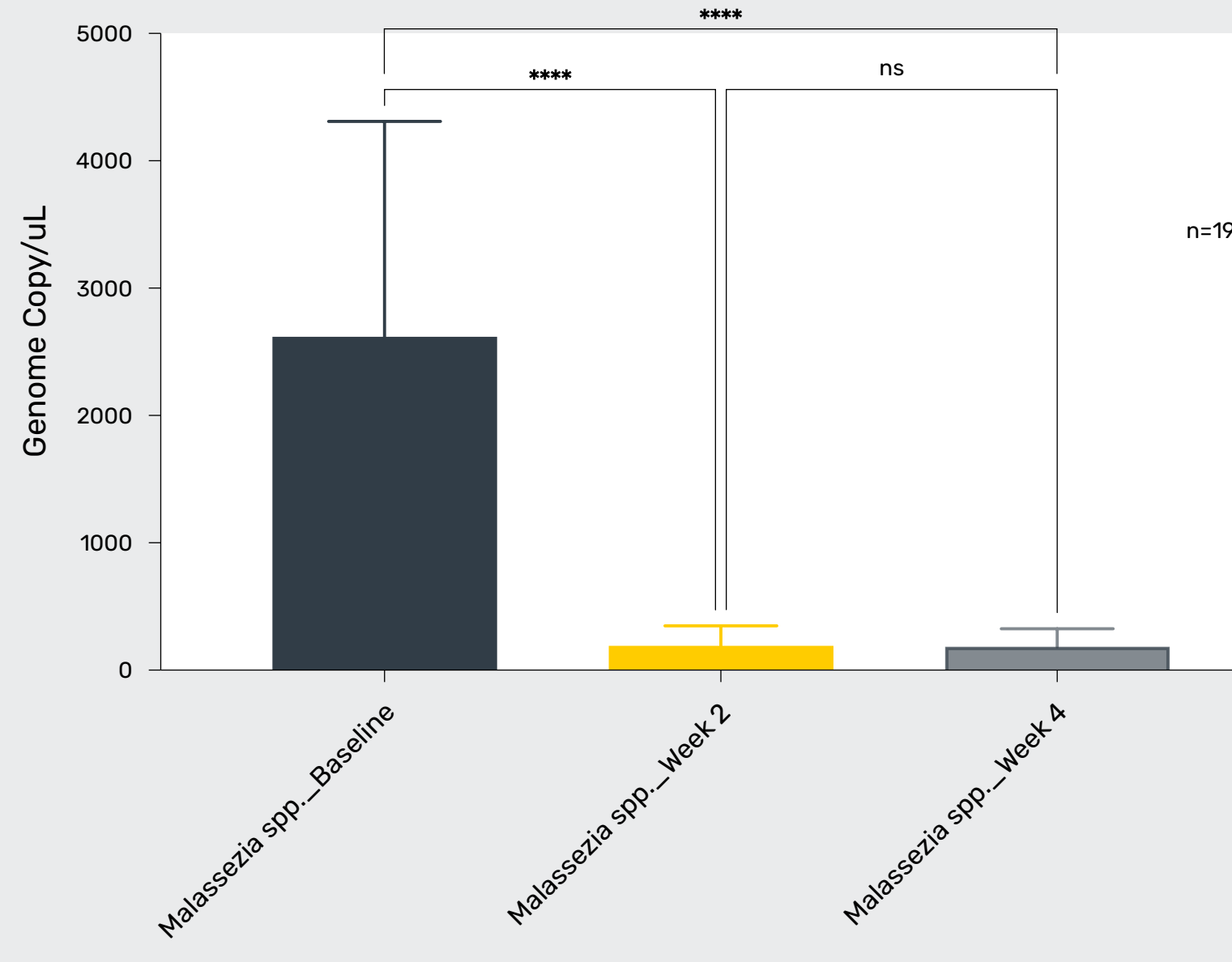
Figures 3 and 4. Shannon & Simpson Index show no significant changes across 4 weeks. Indicates stable fungal ~ bacterial richness and evenness during product use. Confirms no disruption of scalp microbiome diversity.



Bacterial diversity remained stable throughout the study, with no significant changes in richness, evenness (Shannon Index), or dominance of specific species (Simpson Index).

Fungal diversity remained stable throughout the study, with no significant changes in richness, evenness (Shannon Index), or species dominance (Simpson Index).

Figure 5. *Malassezia* spp abundance over time on participants with moderate/severe flakiness at Baseline.



Levels of *Malassezia* spp decreased in subjects with moderate-to-severe flaking (n=19) at Day 14 and remained stable through Day 28 (p<0.001).

CONCLUSIONS

This study demonstrates that the formulation provides effective cosmetic anti-dandruff management while preserving microbiome integrity. The observed microbiome-rebalancing effect, particularly in participants with moderate-to-severe flaking, supports beneficial microbes while selectively reducing potentially pathogenic species. These findings highlight the importance of microbiome-preserving strategies in dermatology and lay the groundwork for a more detailed microbiome-clinical correlation analysis.

References:

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