CASE STUDY

Acne revisited: microbiome control



Summary

Skincare ingredient: CutiBiome CLR™

Application: Care for skin which is oily and acne-prone

Key benefits: Scientifically and perceivably improves skin with state-of-the-art microbiome-approach

The Challenge

Cosmetic products can have significant positive effect on acne-prone skin. Cleansing, skin conditioning, the use of keratolytics, reducing sebum production and killing the bacteria which were always known to cause acne have been the paradigm for decades now. The treatment of acneic skin is going through a revolution at the moment, however. We know so much more about the pathophysiology of acne than we did 10 years ago.

What was always known to be the acne-causing bacterium, *Cutibacterium acnes*, is now recognized to be not bad at all. Although, strictly speaking, it would not be correct to talk about 'good' versus 'bad' bacteria, if there are 'good' bacteria on and in our skin, *Cutibacterium acnes* can definitely be considered to be one of them. Killing *C. acnes* should not be the aim anymore.

C. acnes is a single species, but within this species, there exist different genetic variants, strains. This is where it gets complicated and challenging for the cosmetic scientist as most strains of *C. acnes* are harmless and even beneficial, but there are strains of *C. acnes* which play a central role in causing acne. Killing *C. acnes*, as a species is not the answer and might even be detrimental. Focusing on these so-called virulent and acne-causing strains is the way forward.

It must be said that the pathophysiology of acne encompasses other important mechanisms, such as hormone-induced sebum production (promoting the growth of the virulent strains of *C. acnes*) and inflammation (directly and indirectly caused by *C. acnes*). 'There are more roads leading to Rome' and it is important to travel all roads to get to optimum results and synergies. CLR's product which is presented here, CutiBiome CLR™, travels all these roads. For this article, however, we focus on how it takes on the challenge of the virulent strains of *Cutibacterium acnes*. CutiBiome CLR™ doesn't kill bacteria, it regulates the skin microbiome and its behavior.

Understanding *C. acnes*, how skin interacts with *C. acnes* and *C. acnes* interacts with skin is key. Neutral and beneficial strains of *C. acnes* normally dominate the hair follicles, whereas the virulent strains only dominate the hair follicle in acne lesions. The reason for this lies in the increase in sebum production. This is beneficial for the virulent strains of *C. acnes* as these have a genetic advantage, i.e., a higher triglyceride lipase activity and can digest sebum much more effectively. This is only where the problem starts, though.

The problem evolves when the virulent strains start to build biofilm. A biofilm is an organized conglomerate of bacterial cells attached to a surface and embedded into a self-produced matrix composed of polysaccharides. This protective shell forms a barrier allowing virulent *C. acnes* to survive in harsh environments and multiply. After the virulent strains of *C. acnes* have started to build a biofilm, the situation develops from bad to worse, acne is practically unavoidable.

The microbial component of acne includes 3 challenges:

Challenge 1: to keep virulent strains from *C. acnes* from multiplying without killing neutral and beneficial strains

Challenge 2: to keep virulent strains from *C. acnes* from producing biofilm

Challenge 3: to have a positive impact on acneic skin

The Solution

CutiBiome CLR™ is a synergistic combination of manuka, magnolia and black pepper (INCI: Octyldodecanol, Leptospermum Scoparium Branch/Leaf Oil, Piper Nigrum Seed Extract, Magnolia Officinalis Bark Extract).

Challenges 1 and 2

In order to assess the activity of CutiBiome CLR™ on the growth and biofilm forming activity of *C. acnes*, three virulent strains (HM-552 (HL110PA1), HM-492 (HL005PA1), HM-523 (HL053PA2)) and one "neutral" strain (ATCC 6919™) were analyzed. Studies were performed as follows.

Growth:

Tubes with test agent were inoculated with bacterial suspensions at a final concentration of 1000 CFU/ml and incubated at 37°C under anaerobic conditions. Samples were taken at t = 0 and t = 24 h, processed and plated to obtain total viable counts. A carrier control included bacterial suspensions with 3% Tween 80 (used in other tubes to solubilize CutiBiome CLR™).

Biofilm formation:

Bacterial inocula were prepared to a cell density of 1x108 CFU/ml. A 96-well plate was prepared with individual wells containing 100 µl of test compound and carrier control. A total of 100 µl of bacterial inocula was added to each test well. The well plates were then incubated at 37°C for 24 h. Subsequently, wells were processed to remove any non-adherent bacteria (bacteria in biofilm adhere). Finally, 2% crystal violet (CV) dye solution was added and wells were rinsed and dried to remove unbound dye. Bound dye was solubilized and biofilm biomass was quantified with a microplate reader at an optical density of 595 nm (OD595). Background interference was negated by subtracting CV-stained blank wells from test absorbance values.

Results:

Figure 1 shows that CutiBiome CLR™ was able to halt the growth of 2 out of 3 virulent strains, without killing the neutral strain. Only the growth of HM-552 strain appeared to be more difficult to reduce. However, in the same figure it is shown how CutiBiome CLR™ influences the biofilm-forming activity of the 4 different strains. Where the growth of HM-552 was relatively hard to stop, its biofilm-forming activity was fully abolished with CutiBiome CLR™. This leads to interesting conclusions. Where growth of the strain cannot be fully controlled, with CutiBiome CLR™, its biofilm forming capacity can. Vica versa, when, with CutiBiome CLR™, growth can be fully controlled, its biofilm forming capacity cannot fully.

Concluding from these experiments, where CutiBiome CLR™'s activity was tested on multiple strains of *C. acnes*, it was shown to effectively keep the virulent strains' growth and biofilm forming behavior under control without killing bacteria, potentially leading to a disbalance in the hair follicle's microbiome.

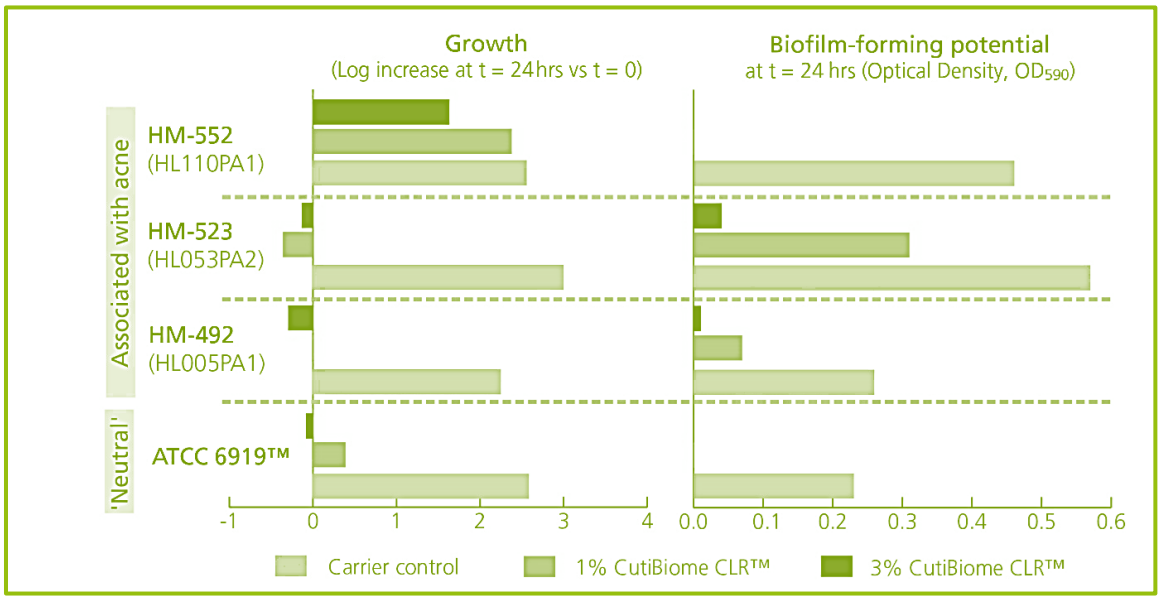

Figure 1: *Reduction of growth and biofilm-forming ability of C. acnes phylotypes by CutiBiome CLR™*

Challenge 3

The activity of CutiBiome CLR™ (3%) on acne was assessed in an 8-week application study on 20 volunteers with mild to moderate acne.

Results:

Over the period of 8 weeks, sebum production was reduced by almost 41% (see figure 2). Thirteen out of 20 volunteers already showed reduction of sebum after 1 week into the study. An interesting correlation could be found between the measured reduction of sebum and the perceived reduction of sebum. Sixty-five percent of the volunteers reported that they felt their skin was less oily after 1 week of use of the formulation with CutiBiome CLR™. After 8 weeks, this number had increased to 80% (see figure 3).

The number of papules, comedones and pustules also clearly decreased over the 8 weeks of using the formulation with CutiBiome CLR™ (see figure 4). Here, too, the volunteers reported that their skin, but also their quality of life, had improved. Their skin felt more comfortable and less unpleasant (see figure 5).

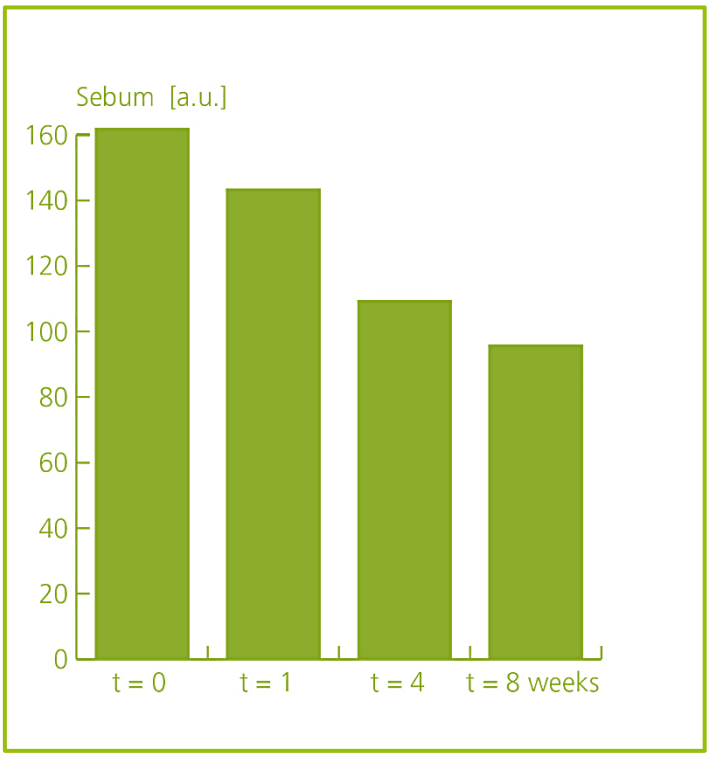

Figure 2: *Effect on sebum production as determined with Sebumeter*

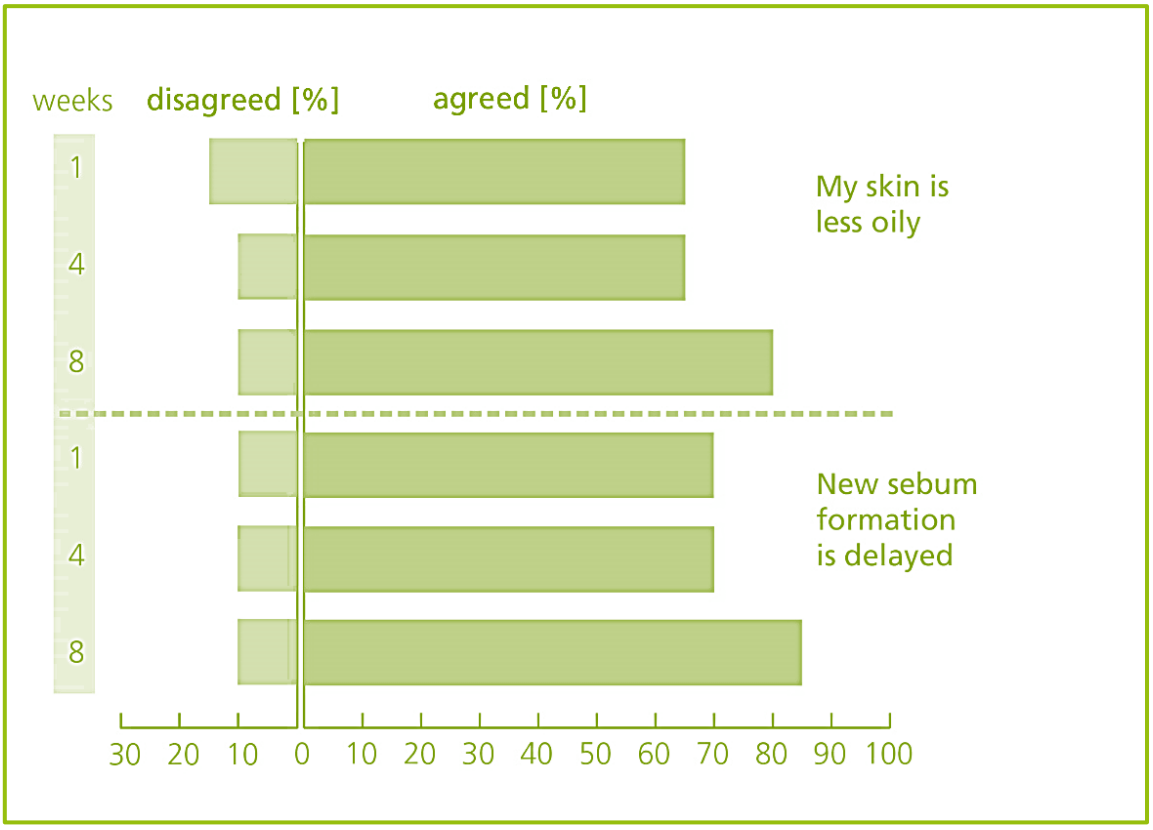

Figure 3: *Effect on skin oiliness in the perception of the volunteers*

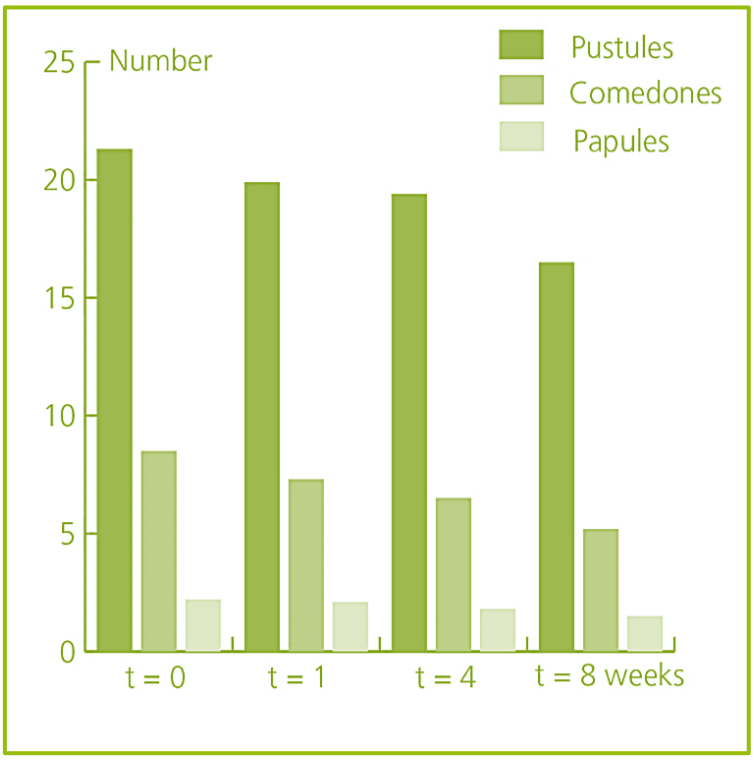

Figure 4: *Effect on number of papules, comedones and pustules*

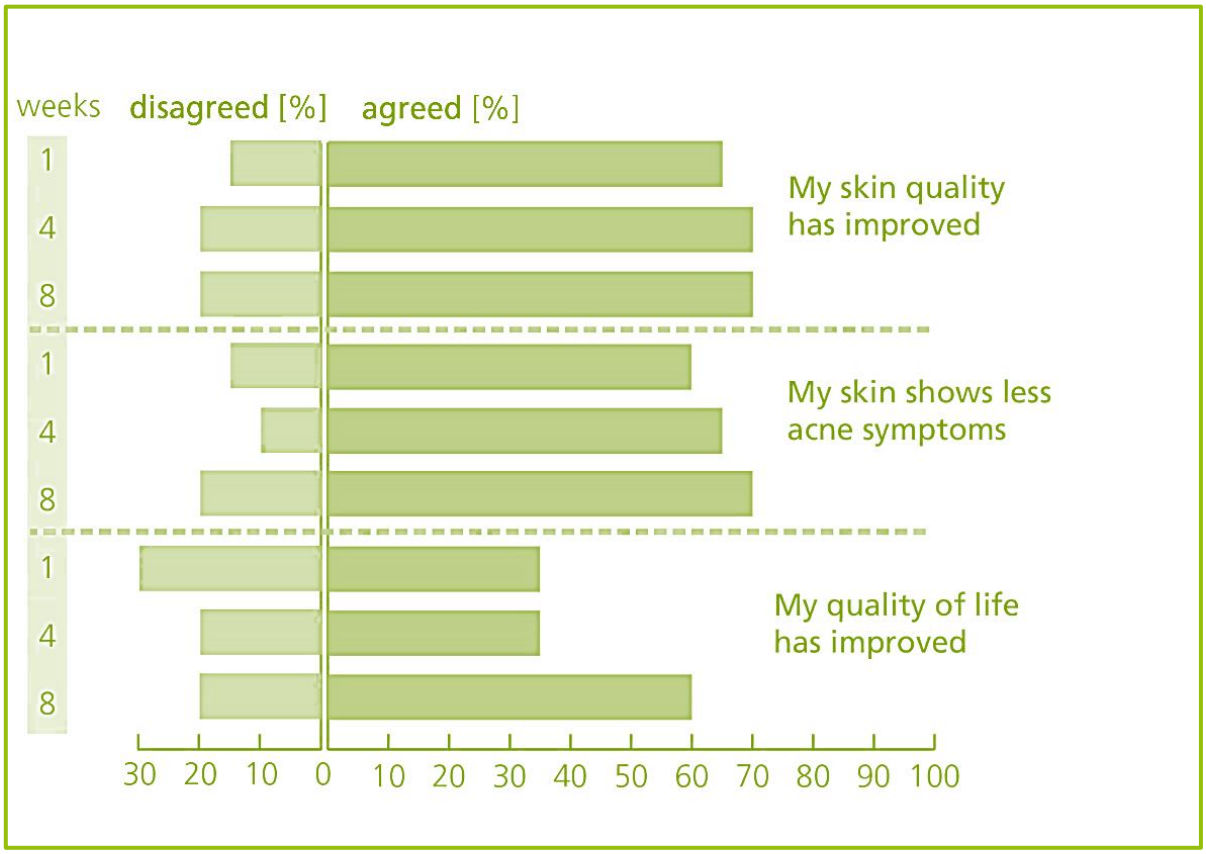

Figure 5: *Effect on typical features associated with acne in the volunteers' perception*

Key Takeaways

With consumer focusing on acne-free skin, CutiBiome CLR™ could be a pivotal ingredient in skin- and hair care formulations. It is a synergistic complex of lipophilic extracts from Manuka, Magnolia and Black Pepper. Major benefits include:

- CutiBiome CLR™ doesn't kill bacteria, it regulates the skin microbiome and its behavior
- CutiBiome CLR™ also decrease the number of papules, comedones and pustules
- CutiBiome CLR™ reduces the film forming activity and inflammation involved in acne and dandruff
- CutiBiome CLR™ supports the scalp microbiota

For more information, please visit:

CutiBiome CLR™