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HC 209: Intro to Mammalian Microbiomes
Fall Term 2018

Should I Swap my Facial Cleanser Out for Yogurt?
The Skin Microbiome, Facial Cleansers, and Probiotics

A microbiome is all the genetic material in a microbial community and environment, with microbes being microscopic organisms. In humans, the skin microbiome is unique and varies based on location, with four distinct environments (moist, sebaceous (oily), dry and other) that each foster their own microenvironment. The face is mostly made up of oily, sebaceous regions, like the forehead and the crease on the side of the nostrils. Sebaceous sites have higher density of lipophilic species, or species that like being around lipids, like propionibacteria and corynebacteria, which have adapted to the lipid rich environment that lacks oxygen (Dréno et al. "Microbiome in Healthy Skin" 2016).

Facial cleansers are used to reduce sebum, or oil, on the face. The surfactants in cleansers make hydrophobic materials better able to dissolve in water and help them get removed from the skin's surface. Surfactants have an amphiphilic structure, with both a hydrophilic polar head group (likes to be around water) and nonpolar lipophilic tail (likes to be around lipids/fats) that drives surfactants to areas where water and oil meet to help the cleansing process (Walters et al. 2012). The purpose of cleansing the face is to get rid of excess sebum to control acne. Excessive sebum production (hyperseborrhea) alters the surface layer of skin by forming blackheads or whiteheads (comedones) on the pilosebaceous follicle, made up of a hair follicle and sebaceous gland. The inflammation of the follicle is a form of dysbiosis, or microbial imbalance. However, an overly aggressive skin care regimen may also be causing acne rather than combating it (Dréno et al. "The Influence of Exposome" 2018). Cleansers can modify the skin barrier and the skin microbiota balance, triggering an immune response that results in inflammation. Additionally, washing away lipids, enzymes and natural moisturizing factors weakens the skin barrier functionality of the skin microbiome. Surfactants can also remain after the skin is washed and can continue to degrade the skin barrier and disrupt its lipid structural order, resulting in redness, dryness, and irritation (Walters et al. 2012).

Skincare has been developing to become gentler and less destructive to the skin microbiome, and one way is through hydrophobically modified polymers (HMP). HMP's large polymer/surfactant complexes make cleanser less aggressive and minimizes the damaging effects of cleansers on skin. This happens because the surfactant will self-assemble to the hydrophobic parts of the polymer, and since they are all clustered to the parts that do not like water, they cleanser works slower. This makes the cleanser gentler and helps maintain the skin barrier and the native lipids that are part of the facial skin composition (Walters et al. 2012).

Probiotics are another method that could potentially benefit the skin without the harmful effects of cleansers. Probiotics are live microorganisms that benefit the host's health in some way (Maguire 2017). The notion of the gut-brain-skin axis poses an interesting potential benefit of oral probiotics for the skin. The gut-brain-skin axis reflects an association between acne and mental health, and mental health and GI problems, so oral probiotics could potentially benefit the skin based on this link. Oral probiotics have also shown potential benefit in treating acne, as one study found that application of a probiotic containing Lactobacillus rhamnosus improved clinical outcome, though more research is needed (Dréno et al."The Influence of Exposome" 2018). Topical probiotics have also shown promising benefits to the facial skin. New emollients and

moisturizers with lysates of bacteria like vitreoscilla filiformis or lactobacillus have been designed to help restore the skin barrier and skin microbiome (Dréno et al. “Microbiome in Healthy Skin” 2016). Supplementation of the probiotic L. paracasei improves skin barrier function, and lactobacillus bacteria and ammonia-oxidizing and nitrifying bacteria in general help to reestablish a healthy skin microbiome. Lactobacillus has an anti-inflammatory effect and stimulates the growth of S. Epidermidis, which can ferment glycerol and repel an overgrown colony of P. acnes, which is the primary acne associated bacterium. Sucrose is a prebiotic (food) to S. Epidermidis but not P. Acnes, so topical application of sucrose has been shown to increase levels of S. Epidermidis and lower P. Acnes levels. Finally, probiotic metabolism forms acidic molecules that lower the pH of other molecules around them, so they may help restore aging skin that often has a higher pH (Maguire 2017).

Personally, I was interested in the potential benefits of topical probiotics for the skin, so I conducted a brief experiment where I put yogurt on my face every day for seven days. I used Chobani non-fat plain Greek yogurt, which had five live and active cultures advertised on the container: S. Thermophilus, L. Bulgaricus, L. Acidophilus, Bifidus, and L. Caesi, with the L. indicating Lactobacillus. I applied a coat of this over my entire face and let it sit for 20 minutes before washing it off (Fig. 1). It hardened and dried like a face mask, creating a similar tightening sensation (Fig. 2). Before and after photos can be seen in Figures 3 and 4. Overall, I did not observe a lot of change after the week, if anything possibly a more even skin tone and less redness, but I certainly had no negative effects. I might have observed changes if I continued the experiment for a longer duration or conducted it on someone with a different skin type than me, as I have dry skin that is not very acne prone. I certainly agree that there is potential in probiotic skin treatments and that more research needs to be done.

Figures:

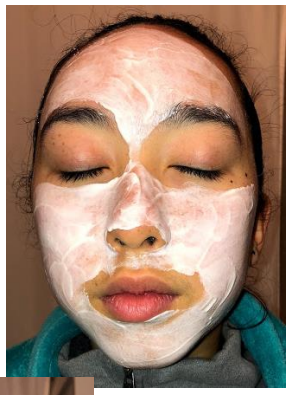

Figure 1: Application of Yogurt

Figure 2: After 20 min.

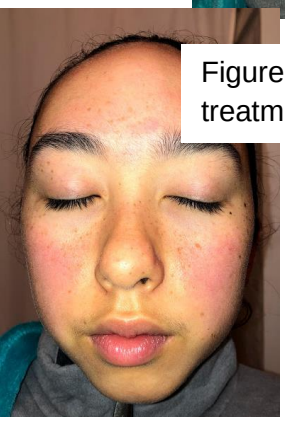

Figure 3: Pre seven day treatment

Figure 4: Post seven day treatment

Works Cited

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Maguire, Mia, and Greg Maguire. "The role of microbiota, and probiotics and prebiotics in skin health." *Archives of Dermatological Research*, vol. 309 (2017): 411-421.

Walters, Russel M et al. “Cleansing formulations that respect skin barrier integrity” *Dermatology research and practice* vol. 2012 (2012): 495917.