Clean Versus Conventional Makeup: An examination of Microbial growth

Hannah Salamie and Alicia Cecil

ABSTRACT

The use of so-called “clean” or “organic” makeup products is growing in popularity, rivaling the use of conventional cosmetic products. These “organic” products contain alternative preservatives that are considered less toxic, but still need to limit microbial growth to be used safely. It is unknown whether these preservatives are as effective at controlling contamination of the cosmetics as the traditional preservatives. A two-part analysis utilizing a variety of used makeup, clean makeup, and conventional makeup was performed. We compared a line of “clean” products to a line of “conventional” products to evaluate both the numbers and types of microorganisms that grew in them. Makeup samples were evaluated for microbial growth after being left out without user interference, and after manipulating the products in a way that mimicked normal use**.** To enumerate the bacteria in the products we used both pour plate methods and a modified letheen agar and enrichment technique as outlined in the Bacterial Analytical Manual from the Food and Drug Administration. Following enrichment, colonies were counted and traditional biochemical techniques were used to identify isolates from the plates. We found that there was no difference between clean and conventional makeup products and their ability to prevent bacterial growth. Both types of products had minimal contamination, and organisms that were isolated were identified as normal environmental bacteria and skin flora, suggesting both are safe for consumer use and pose little risk for introducing infection in those with healthy immune systems.

INTRODUCTION

Clean cosmetics are in demand among consumers and are considered to be healthier than conventional or “nonorganic” cosmetics (Raphael). Clean cosmetics contain more natural ingredients, thereby preventing the consumers from exposing themselves to the chemicals that often are found in traditional cosmetics. Although clean cosmetics are considered healthier, it is necessary to determine the ability of these ingredients to prevent microbial contamination as compared to their conventional counterparts. The drives the hypothesis: makeup products classified as organic will exhibit greater growth of microorganisms because they lack the traditional chemicals and preservatives that prevent their growth.

Examining the microbial growth on cosmetic products is significant because cosmetic use is extremely common in our current culture. It is common for many makeup users to ignore the expiration dates on products and use unsanitary practices when applying these products to their faces (Higgs 2017). This type of behavior may promote the growth of microbes. Additionally, microbes may be pathogenic and could induce harm to the user. However, if the microbes that grow in these products are not pathogenic, then there is less concern about microbial growth for healthy immunocompetent individuals. The makeup industry is booming right now, with more and more individuals becoming consumers in the entire market (Biron 2019). Thus, these new and old makeup users need to know how to stay healthy, while enjoying the expression of makeup.

MATERIALS AND METHODS

Clean Versus Conventional – Attraction of microbes

- Clean and conventional set of makeup left out for 7 days
- Products swabbed onto nutrient agar/pour plates
- Incubated and colonies were counted
- Identification: Gram stain, catalase, coagulase, glucose, and starch hydrolysis assays

Clean Versus Conventional – After Use

- Clean and conventional makeup sets were handled for 6 weeks
- Products were swabbed onto nutrient agar/pour plates
- No growth was observed after incubation

- Clean and conventional makeup sets were handled for one month
- Products were combined with tween 80 and Modified letheen broth (MLB)
- Mixture was spread onto Modified letheen agar (MLA)
- Incubated and colonies were counted
- Identification: Gram stain, catalase, glucose, and starch hydrolysis assays

RESULTS

Clean Versus Conventional – Attraction of microbes

- Microorganisms found included *Corynebacterium, Micrococcus luteus, Staphylococcus epidermidis*, and *Staphylococcus saprophyticus*.
- Colony counts for all products were below the 30 colony minimum for contamination.
- All products except liquid foundations presented microbial growth.

Clean Versus Conventional – After use

- Microorganisms found included *Corynebacterium, Micrococcus luteus*, and *Staphylococcus epidermidis.*
- Colony counts for all products were below the 30 colony contamination threshold.
- All products displayed microbial growth and showed increased growth after enrichment with MLB.

Table 1. Summary of colony counts for each makeup type and plate type after one week of being left out.

Type of Makeup Product	Conventional Eyeshadow	Clean Eyeshadow	Conventional Facial Powder	Clean Facial Powder
Colony Count on agar plates	12	4	3	2
Colony Count on pour plates	12	10	1	8

Table 2. Summary of colony counts for each makeup type by condition after one month.

Type of Makeup product	Conventional Eyeshadow Applicator	Conventional Eyeshadow Touch	Clean Eyeshadow Applicator	Clean Eyeshadow Touch	Conventional Lipstick	Clean lipstick
Colony Count Set 1	3	0	7	1	13	~493
Colony Count Set 2	0	0	7	0	1	1
Colony Count Set 3	0	0	1	0	1	3
Average Colony Count	1	0	5	1	5	165.67

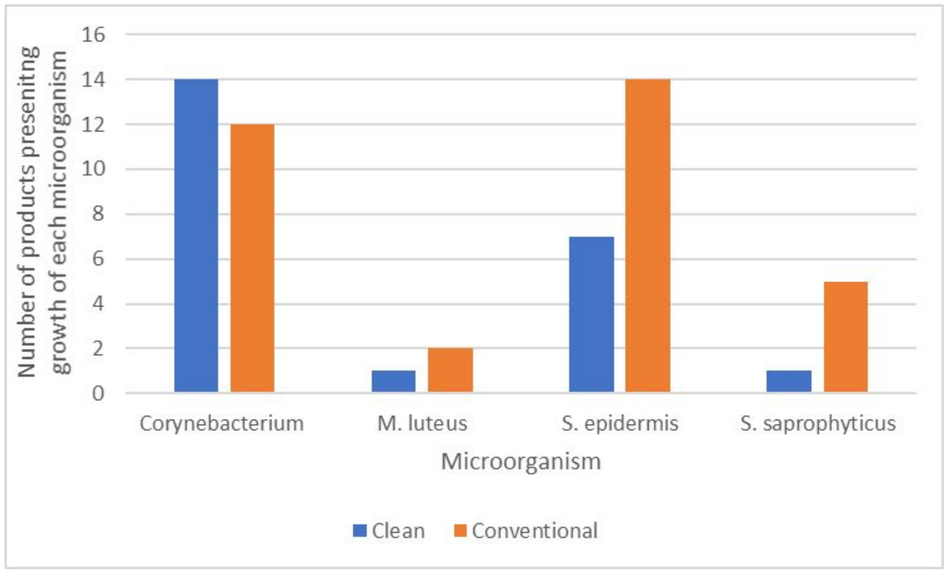

Figure 1. Number of clean and conventional products exhibiting growth of each microorganism identified after examination in all portions of the study

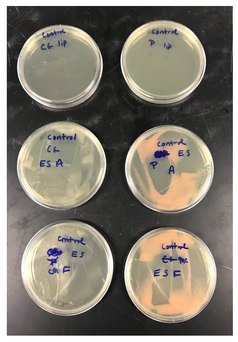

Figure 2. Control plates prior to enrichment with MLB.

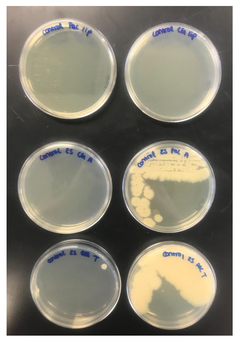

Figure 3. Control plates after enrichment with MLB.

CONCLUSION & DISCUSSION

All products examined displayed colony counts below 30, which is considered the threshold for microbial contamination in cosmetics (FDA, Periz et al. 2014). Due to this no statistical analysis could be performed. Qualitatively, no distinct pattern between clean and conventional products were observed. Both clean and conventional products appear to limited microbial growth in their products to the same effect. All microbes identified from these products were common to the normal flora of humans and are nonpathogenic.

This indicates that even though bacterial growth was present in both makeup types, it is not likely to cause illness or infection in the average user. These bacterial species were likely introduced into the makeup products through contact with a users’ skin or the air in the case of part II.

The conclusions made have both positive and negative implications for makeup users in the real world. Focusing on the positive, the colony counts being below the threshold for contamination provides that users can trust preservatives while their products are in frequent usage. Preservatives like parabens in conventional products or phenoxyethanol in clean products will slow or prevent microbial growth. Additionally, the bacteria species found are a part of the normal human flora, which can provide ease of mind that any bacteria introduced to their products are not pathogenic. Negative implications are directed towards makeup users with compromised immune systems. In the immunocompromised individual, bacteria of the normal flora can be potentially pathogenic (Davis 1996). These individuals will have to take greater steps to ensure the cleanliness of their products and environments when using makeup products of either category as they pose the same risk. Despite this, makeup lovers can remove concerns about microbial growth when choosing between clean and conventional products.

REFERENCES

Biron B. Business Insider: Beauty has blown up to be a $532 billion industry — and analysts say that these 4 trends will make it even bigger [Internet]. Business Insider: c2019 [cited 2020 Mar 21]. Available from: https://www.businessinsider.com/beauty-multibillion-industry-trends-future-2019-7.

Davis CP. Normal Flora. In: Baron S, editor. Medical Microbiology. 4th edition. Galveston (TX): University of Texas Medical Branch at Galveston; 1996. Chapter 6. Available from: https://www.ncbi.nlm.nih.gov/books/NBK7617/.

Higgs MM. Literally Nobody Throws Out Their Makeup When They Should. Racked . 2017 Mar 22 [accessed 2021 Apr 4]. https://www.racked.com/2017/3/22/14861372/throw-out-makeup-cosmetics-old.

Huang J, Hitchins AD, Tran TT, McCarron JE. BAM Chapter 23: Methods for Cosmetics. U.S. Food and Drug Administration . 2017 Oct 31 [accessed 2021 Apr 4]. https://www.fda.gov/food/laboratory-methods-food/bam-chapter-23-methods cosmetics.

Periz G, Misock J, Huang MJ, Dewan K, Sadrieh N. FDA 2014 survey of eye area cosmetics for microbiological safety. Lett Appl Microbiol. 2018 Jul;67(1):32-38. doi: 10.1111/lam.12995. Epub 2018 May 7. PMID: 29665083.

Raphael R. Fast Company: What’s driving the billion-dollar natural beauty movement? [Internet]. Mansueto Ventures: c2017 [cited 2020 May 3]. Available from: https://www.fastcompany.com/3068710/whats-driving-the-billion-dollar-natural-beauty-movement.

ACKNOWLEDGEMENT

We would like to thank the University of Indianapolis Ron and Laura Strain Honors College and the Department of Biology.