"Natural" Sunscreens Although More Expensive are Not More Effective at Preventing UV Exposure

Tara Lunsford[1], Alanna Lecher[1], and Cassandra Korte[1]

[1]Lynn University

November 22, 2022

Abstract

Skin cancer, the most common type of cancer within humans, has approximately 3.5 million cases each year. The evidence supports that the use of sunscreen can help to prevent different forms of skin cancers. There are a multitude of brands that make sunscreen, each claiming to be better than the next. The two main types of sunscreen are physical and chemical. Physical sunscreens deflect the ultraviolet (UV) rays of the sun and are normally made of zinc oxide or titanium dioxide, whereas chemical sunscreen absorb the suns UV rays and can be composed of many different ingredients. It was hypothesized that the physical sunscreens would do a better job at protecting against the sun's rays than the chemical sunscreen brands. In this experiment E. coli growth was tested under UV light exposure with an application of five different brands of sunscreen. The control was exposed to UV with no sunscreen protection. After exposure to the UV light, the bacteria were set aside to grow and colonies were counted for survival. A statistical ANOVA was used to look at the significance between each brand of sunscreen, physical and chemical. Through the statistical analysis it was found that there was no significant difference between each brand of sunscreen. However, there was a significant difference in E. coli counts between each sunscreen application and the control. There was no statistical difference in E. coli counts between sunscreen types, indicating both types of sunscreen provide the same amount of protection from UV radiation.

"Natural" Sunscreens Although More Expensive are Not More Effective at Preventing UV Exposure.

Tara Lunsford, Alanna Lecher, Cassandra Korte

Background

- Every year, 3.5 million Americans will be diagnosed with skin cancer (Zhou, 2015).
- Ultraviolet (UV) radiation from the sun is one of the biggest contributors to skin cancer prevalence the 21st century (Armstrong and Kricker, 2001).

- There are two different types of sunscreen available:
  - Physical sunscreen works to protect the skin by deflecting or blocking the sun's rays.
    - Physical sunscreens are made from either titanium dioxide or zinc oxide and are typically more expensive than its chemical rival (Skinacea, 2012).
  - Chemical sunscreen absorbs the sun's rays to help to protect the skin (Skinacea, 2012).
    - Chemical sunscreen may be comprised of various ingredients, making them less expensive than physical sunscreens (Skinacea, 2012).

- Consumers tend to view physical sunscreens as more natural, and as a result, may view them as a more efficient product.
- Green or organic personal care products have become increasingly popular in recent years
  - Second largest seller for organic product sales in the US organic industry (Kim, 2011).

- There are three main consumer values: health consciousness, environmental consciousness and appearance consciousness (Kim, 2011).

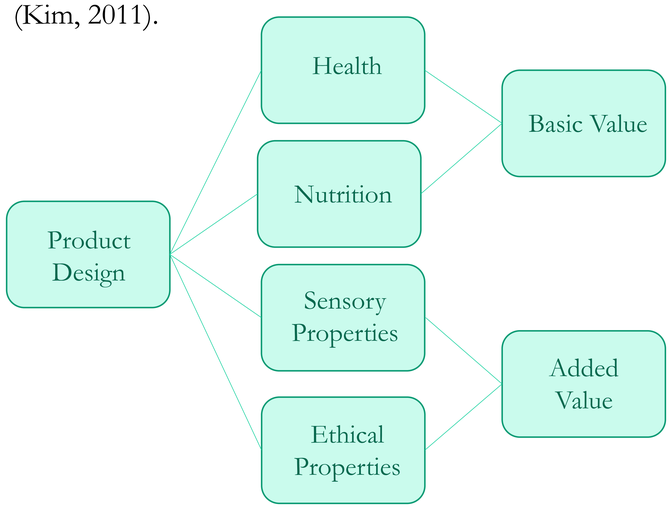


Figure 1. Properties that go into the creation of products (Schleenbecker, 2013)

- The purpose of the current study was to determine the efficiency of physical sunscreen compared to chemical sunscreen using a novel model organism for this type of study, *Escherichia coli (E. coli)*.

Contact Tara Lunsford: tara.lunsfo@gmail.com

Materials and Methods

Chemical | Physical | Chemical | Chemical | Physical

Figure 2. Different brands of sunscreen used categorized as physical or chemical and their prices per ounce (Torres, 2018).

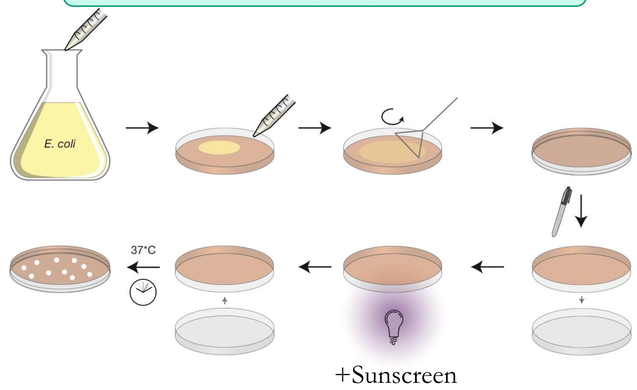


Figure 3. Illustration of the experimental procedure used (Torres, 2018).

Figure 4A. UV lamp off with sunscreen.

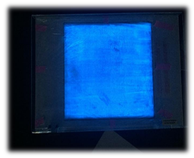


Figure 4B. UV lamp on with sunscreen.

Experimental Methods: Pipetted the E.coli that onto a plate that contains nutrient agar. E.coli was spread using aseptic technique.

Next, saran wrap was taped onto the UV lamp in order to spread the SPF 30 sunscreen. Then the top of the plate was removed, and it was placed face down on the UV lamp.

The UV lamp was closed and turned on for 2 seconds. The petri dish top was put back on and this process was done for all the sunscreens.

The plates were left in the incubator overnight at 37*C, and the next day colonies were counted on each plate to see the survival rate.

Statistical Methods: All trials were combined to run the statistical analysis. Using R, an ANOVA, Tukey Kramer Test and descriptive statistic analysis was performed.

References

Califf, R. M., & Ostroff, S. (2015). Sunscreen and the FDA. *The New England Journal of Medicine, 373*(2), 197. doi:http://dx.doi.org/10.1056/NEJMc1507737

Physical vs. Chemical Sunscreen. (2012, September 11). *Skinacea.* Retrieved from http://www.skinacea.com/sunscreen/physical-vs-chemical-sunscreen.html#.XA65pmyouUk

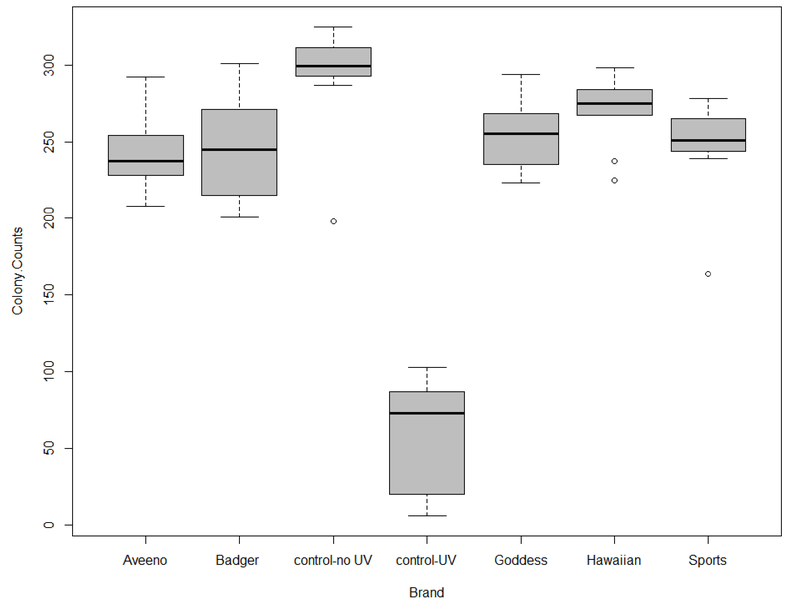
Rivers, J. K. (1996). Melanoma. *The Lancet, 347*(9004), 803-6. doi:http://dx.doi.org/10.1016/S0140-6736(96)90873-9

Schleenbecker, R., & Hamm, U. (2013). Consumers' perception of organic product characteristics. A review. *Appetite, 71*, 420–429. https://doi-org.ezproxy.fiu.edu/10.1016/j.appet.2013.08.020

Torres, A., Martin, L., Korte C. (2018, April). *The Effectiveness of Different Types of Sunscreen against UV Light on Escherichia Coli.* College of Arts and Sciences Student Symposium, Boca Raton, FL.

Zhou, C., Ma, T., Zhou, D., Shen, T., & Zhu, Q. (2015). Association of glutathione S-transferase pi (GSTP1) Ile105Val polymorphism with the risk of skin cancer: A meta-analysis. *Archives of Dermatological Research, 307*(6), 505-513. doi:http://dx.doi.org/10.1007/s00403-015-1576-9

Results



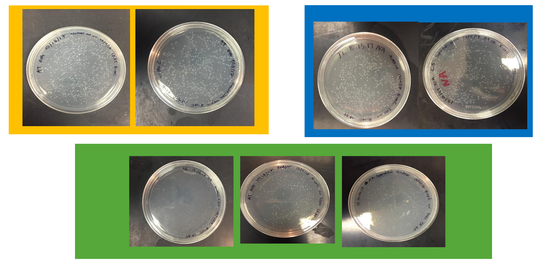


Figure 5. Pictures of experimental results

Sunscreen Brands	Cost of Sunscreen per oz	Hazard Risk Factor
Badger	$15.99 per 2.9 oz	1
Goddess Garden	$19.99 per 6 oz	1
Aveeno	$9.49 3 oz	5
Hawaiian Tropics	$7.99 6 oz	5
Up and Up Sports	$6.59 10.4 oz	4

Figure 6. Cost and hazard risk factor of each sunscreen (ewg.org/skindeep)

Discussion

- The results of this experiment did not support our hypothesis. There appeared to be no statistical difference concerning the effectiveness of physical sunscreens over chemical sunscreens.

- Because there was no statistical difference in the effectiveness of the different types of sunscreens, perception that they are better is not accurate in terms of protecting against UV exposure.

- A possible reason behind the higher pricing of physical sunscreens could be due to other elements such as hazard risk factor or reef safety properties.