The Effect of Eyeliner on Skin Protection from Ultraviolet Light

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Introduction

Skin cancer cases have risen dramatically since 2009. In 2009, cases of melanoma skin cancer was around 40,000 cases (American Cancer Society, [n.d.]). In 2018, there are approximately 55,000 cases of melanoma skin cancer (American Cancer Society, [n.d.]). A majority of these cases are caused from overexposure to ultraviolet light, also known as UV light. This type of light damages the deoxyribonucleic acid (DNA) cells because it can penetrate the skin and disrupt the chemical bonds (Barnard, I. R. M, 2018). Continual damage to skin cells by UV exposure can prevent the chemical bonds from repairing, thus causing a mutation in copies of the DNA (Barnard, I. R. M., et al, 2018). The mutated sequences of DNA are what start forming skin cancer. A study done by Isla Barnard and 7 other researchers did an experiment to test skin damage using a tanning bed that emitted UV protons (2018). The researchers found that 12 minutes in a tanning bed damages DNA just as much as 30 minutes outside in the sun. (Barnard, I. R. M., et al, 2018). DNA damage from UV light can drastically affect how the DNA is copied, thus causing potential cancer cells to grow.

The purpose of these experiments was to test if different skin care products would protect yeast cells against harmful UV rays. Yeast cells were used as a model organism in replacement of human skin. It is important to test different UV light defense products in order to know what will protect your skin the most. The research question was if Maybelline black eyeliner was able to protect skin from UV light better than a lotion SPF. It was important to test this question because Egyptians used to put black kohl around their eyes as a protectant from the sun. Kohl was used as a protective substance because it produces nitric oxide (Wexler, 2014). The nitric oxide would promote the immune system to fight against an infection like a sunburn (Wexler,

2014). This experiment demonstrated whether using kohl was a better UV protectant than a lotion SPF. Our prediction was that black eyeliner would have just as much UV light protection as sunscreen. To test our prediction, three plates were tested under UV light. The yeast growth and death were measured on each plate after being exposed to UV light. Our hypothesis stated that black eyeliner can preserve as many yeast cells under UV light protection as a sunscreen.

Method

The lids to the agar plates were removed and kept on a clean zone area on the table. Using a sterile swab, yeast was gathered and spread on each of the three plates in three different directions. With the agar side of the plate facing up, the three plates were smoothly and tightly wrapped with plastic wrap. On plate one no treatment was applied on top of the plastic wrap. On plate two Neutrogena Pure & Free baby sunscreen with a broad spectrum SPF 50 treatment was applied covering the entire surface of the plastic wrap. On plate three the black Maybelline cream eyeliner treatment was applied covering the entire surface of the plastic wrap. The foil side of each of the three plates was then wrapped with aluminum foil to minimize contact on that side of the plate from the UV rays. The three plates were then placed into a UV treatment for three seconds. After the three plates were taken out of the UV treatment the foil and plastic wrap was removed and discarded. Then each lid was placed back on each of the plates and then were stored for two days at room temperature with minimum light exposure. The plates were then removed and both the foil and no foil sides were measured for yeast growth.

Results and Discussion

The experiment tested the hypothesis that black eyeliner could protect and grow as many yeast cells as a sunscreen would under UV light. As shown in Figure 1, The control plate had

100% growth on the foil side on the plate, and 0% growth on the no foil side. The no foil side of the control plate did not have treatment to protect the yeast from the ultraviolet light. Without protection on the no foil side, the ultraviolet light caused a 100% death rate. The foil side protected the yeast cells because of the barrier of the aluminum foil and allowed for the yeast to grow. Figure 2 depicts the line where the yeast was protected and was able to grow.

The graph shows that the plate with sunscreen treatment had a 100% growth rate on the foil and no foil side of the plate. The SPF formed a barrier between the ultraviolet light and the yeast cells. The SPF protection allowed the yeast cells to be able to grow. This plate shows that the yeast cells cover the entire plate and are evenly spread on both sides of the plate, as seen in Figure 3.

The graph shows that plate treated with black eyeliner had 100% yeast growth on the foil side and 75% growth on the no foil side of the plate. The black eyeliner did not protect as many yeast cells from the ultraviolet light on the foil side of the plate. The no foil side had a larger growth of yeast cells when in direct contact with the ultraviolet light. Figure 4 shows that the yeast cells were still able to grow under ultraviolet light when protected by black eyeliner.

The no foil plates allowed direct ultraviolet to kill the yeast in the control plate and the plate treated with black eyeliner. When the plates were wrapped in foil it protected the ultraviolet light, and the yeast grew in all treatments. The use of SPF allowed to yeast to grow under all conditions. Therefore there is a direct relationship between the use of SPF and yeast growth. The use of eyeliner as a ultraviolet light protectant also yielded an increase in yeast growth. The data gathered allowed a direct correlation to be made, when yeast is protected from ultraviolet light the growth will increase.

The hypothesis predicted that black eyeliner protects skin from ultraviolet rays. The hypothesis is partially supported because it protected 60% of the yeast cells, but it was not a replacement for SPF. It was expected that the black eyeliner would provide some protection from ultraviolet rays; however, it was unknown how much protection it would have. The growth was unexpected because eyeliner is not a commonly used UV light protectant. It was also unexpected, because it was unknown if eyeliner today still contained the ingredients that Egyptians used. This result could have happened because the black eyeliner could have an ingredient used in UV light protectants. Also, this result could have happened because the UV light had a hard time penetrating through the wax or the color black.

The experiment could have some potential biases. The eyeliner could potentially be made of a majority of wax, thus preventing an even spread over the plastic wrap. Also, there could be experimenter bias because the amount of yeast grown in each plate was estimated, not individually counted. One limitation to this experiment was using yeast as an alternative for human skin. Using yeast cells instead of human skin can cause a different result because skin has a different chemical makeup. Some other questions raised could be if other makeup products like black eyeshadow or black lipstick could provide protection from ultraviolet light. Some future experiments could be performed, such as, testing yeast growth or have participants use a swatch of each product on their arm when they are in direct sunlight.

References

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Barnard, I. R. M., Tierney, P., Campbell, C. L., McMillan, L., Moseley, H., Eadie, E., Brown, C. T. A., & Wood, K. (2018). Quantifying Direct DNA Damage in the Basal Layer of Skin Exposed to UV Radiation from Sunbeds. *Photochemistry and Photobiology, 94*, 1017-1025. http://dx.doi.org/10.1111/php.12935

Wexler, P. (2014). History of Toxicology and Environmental Health: Toxicology and Antiquity II. American Press.

Figures and Graph

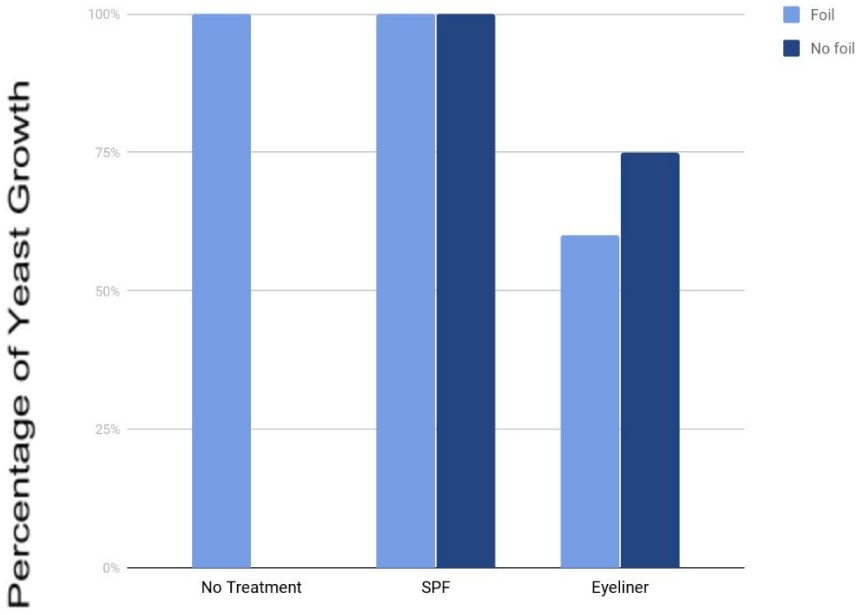

Figure 1: Graph of the percentage of yeast growth on the foil and non foil sides of each plate.

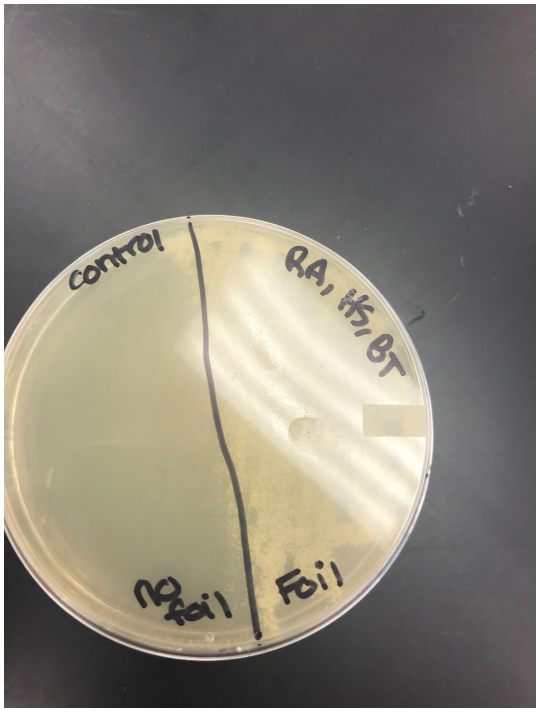

Figure 2. Yeast growth on the control plate.

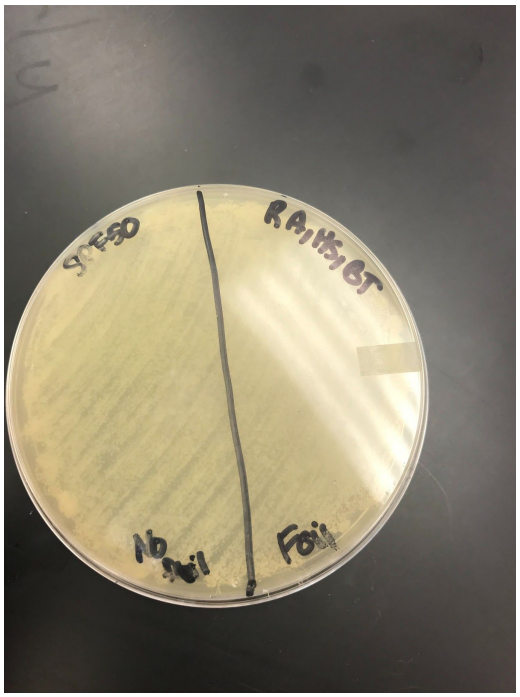

Figure 3. Yeast growth on the SPF treatment plate.

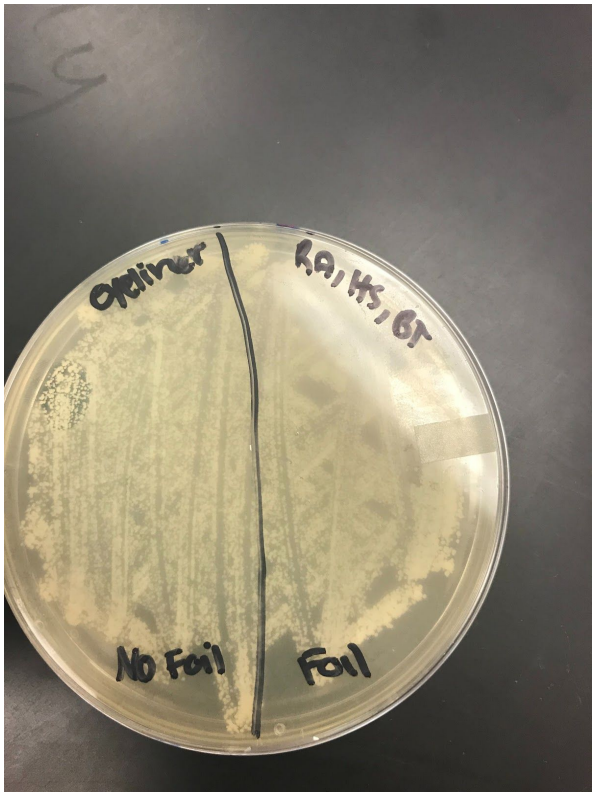

Figure 4. Yeast growth on the black eyeliner treatment plate.