Impact of Sex Hormones on the Growth of Bacteria Associated with Eczema

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INTRODUCTION

Eczema, an autoimmune disease that causes red, scaly skin, is one of the most prevalent skin diseases in the United States. Although the exact cause of eczema is unknown, researchers believe that skin barrier defects and environmental triggers are factors (Brown & Reynolds, 2006). Skin barrier defects, lack of lipids, and pH change can also cause bacteria colonization on skin that is prone to eczema (Nowicka & Grywalska, 2018). Most patients use topical corticosteroids to treat their eczema, but they have common side effects such as skin atrophy and corticosteroid addiction.

Although much research has been done on the causes of eczema, little has been done to examine gender bias. Females are more prone to eczema than males (National Eczema Association, 2018). In this study, the gender bias of eczema was examined by looking at the effects of sex hormones on skin microorganisms. I hypothesized that eczema is associated with the growth of bacteria in eczema-affected skin; estrogen might directly affect the growth of these pathogenic bacteria.

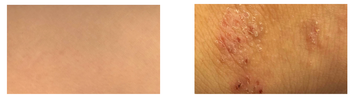
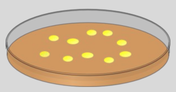


Figure 1. This image compares normal skin with skin that is affected by eczema

AIMS

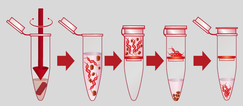
- To compare bacterial growth from eczema-affected and unaffected skin
- To identify bacteria types found on eczema-affected skin through 16s rRNA PCR sequencing
- To examine effects of estrogen on the growth of bacteria isolated from eczema-affected skin
- To initiate an alternative approach in non-steroid treatments

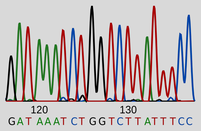
RESEARCH METHODOLOGIES



1. Sample Collection
- Skin swabs were taken from unaffected and affected skin areas of 5 female subjects
- Bacteria was grown on Tryptic Soy Agar with and without estrogen

2. DNA Purification
- Specific bacteria colonies selected
- DNA was purified with the DNeasy Blood & Tissue Kit





3. PCR and Sequencing
- Used primers DG74 and RW01 to amplify the 16s rDNA region
- Sent out for sequencing

3. Database Search
- Used NCBI Blast to find bacteria types with 16s rDNA sequence

DATA AND FINDINGS

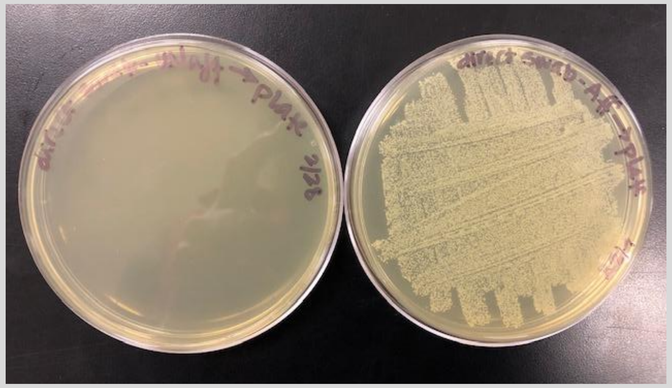


Figure 2. A lawn grew from the sample taken from affected skin (right); no bacteria grew from the sample taken from unaffected skin (left).

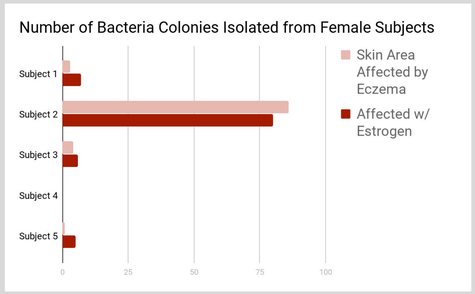
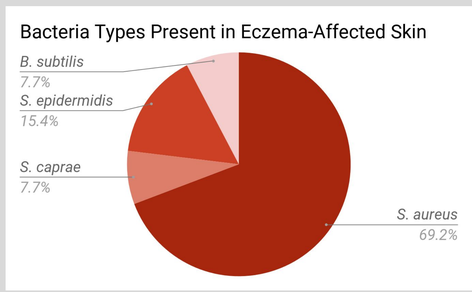


Figure 3. For subjects 1, 3, and 5, more bacteria colonies grew when estrogen was present. Subject 5, the negative control, had no eczema.

Figure 4. 16s rRNA PCR product from individual colonies selected from subject 1 (1-3), subject 2 (4-7), subject 3 (8-11), subject 5 (12-13). They all have the same fragment sizes of 370 bp as the positive control (14). Lane 15 is the negative control.

Figure 5. Bacteria types present in eczema-affected skin found through 16s rRNA PCR sequencing and blast search



CONCLUSIONS AND ANALYSIS

Bacteria isolated from eczema-affected skin formed a lawn whereas bacteria isolated from unaffected skin had no growth at all (figure 2). The drastic difference between the two plates confirms that eczema is related to bacteria growth on the skin. To determine whether bacteria growth is a cause or effect of eczema flares, more research will need to be done.

For 3 out of the 5 samples taken from areas of skin affected by eczema, bacteria colony number had a slight increase when estrogen was present (figure 3). In samples from subject 1, there were 4 more bacteria colonies on the plate with estrogen. Subject 5 was the negative control and has no eczema; their samples still displayed similar results. This suggested that estrogen might have a direct effect on the growth of bacteria, but it is unclear whether estrogen affects pathogenic bacteria more than nonpathogenic bacteria. The opposite occurred for subject 2: 80 colonies grew from subject 2's sample taken from affected area with estrogen, and 86 colonies grew without estrogen. For both conditions, significantly more colonies grew overall despite having the same dilution as other subjects. In order to make a solid conclusion, more trials with more test subjects will need to be done. Since the colony numbers were so small, a difference in colony numbers between the two conditions (with and without estrogen) might be overrepresented.

Blast results showed that 12 out of the 13 bacteria samples collected were from the *Staphylococcus* genus (figure 5). Among the 12, *S. aureus* is dominant. The sample that identified as *B. subtilis* was taken from subject 5, the negative control. *B. subtilis* is known to inhibit the effects of eczema (Özdemir and Erol, 2013). The relationship between *B. subtilis* and eczema will need to be further examined.

IMPLICATIONS AND NEXT STEPS

Consistent with eczema being more prevalent in females, my study reflected this gender bias; finding female subjects was significantly easier. I easily found female subjects from asking around but only found one male subject who was not affected in the moment, resulting in a lack of male subjects for my experiment.

This research is valuable because estrogen was directly tested on bacteria taken from people's eczema-prone skin. The understanding of the gender bias can lead to future developments of non-steroid treatments.

Further research in this area includes comparing the effects of both male and female hormones (testosterone and estrogen) and investigating the bacteria population found in a single sample.

ACKNOWLEDGEMENTS AND REFERENCES

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