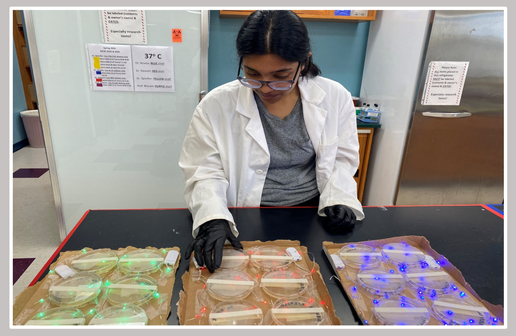

Seeing the Light:
Effect of Light Color on Bacterial Growth

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Introduction

Bacterial contamination remains a major challenge in healthcare, laboratories, and natural environments, creating a need for inexpensive, non-toxic methods to control bacterial growth (Hamblin et al. 2005, Maclean et al. 2009). Previous studies reported that exposure to specific wavelengths of visible light, particularly blue light, reduced bacterial survival and colony formation in multiple bacterial species (Ashkenazi et al. 2003, Maclean et al. 2009). The hypothesis of this study is blue light significantly decreases the growth of *Bacillus subtilis* and *Escherichia coli* compared to growth in red, green, full-spectrum, and no light.

Figure 1. Petri dishes with nutrient agar inoculated with *Bacillus subtilis* and *Escherichia coli* exposed to different light.

Materials & Methods

- *Bacillus subtilis* and *Escherichia coli*
- 36 Petri dishes with nutrient agar
- LED lights (red, green, blue, and full spectrum)

Nutrient agar was prepared, sterilized, and poured into Petri dishes. Bacterial cultures were diluted with distilled water (1:100) and spread onto the dishes using sterile technique. Three replicates per bacterial species were exposed to red, green, blue, full spectrum, and no light by placing the Petri dishes in sealed envelopes. Th bacteria were incubated at 37 °C and observed at 24, 48, and 72 hours after inoculation. Growth was estimated as percent surface coverage.

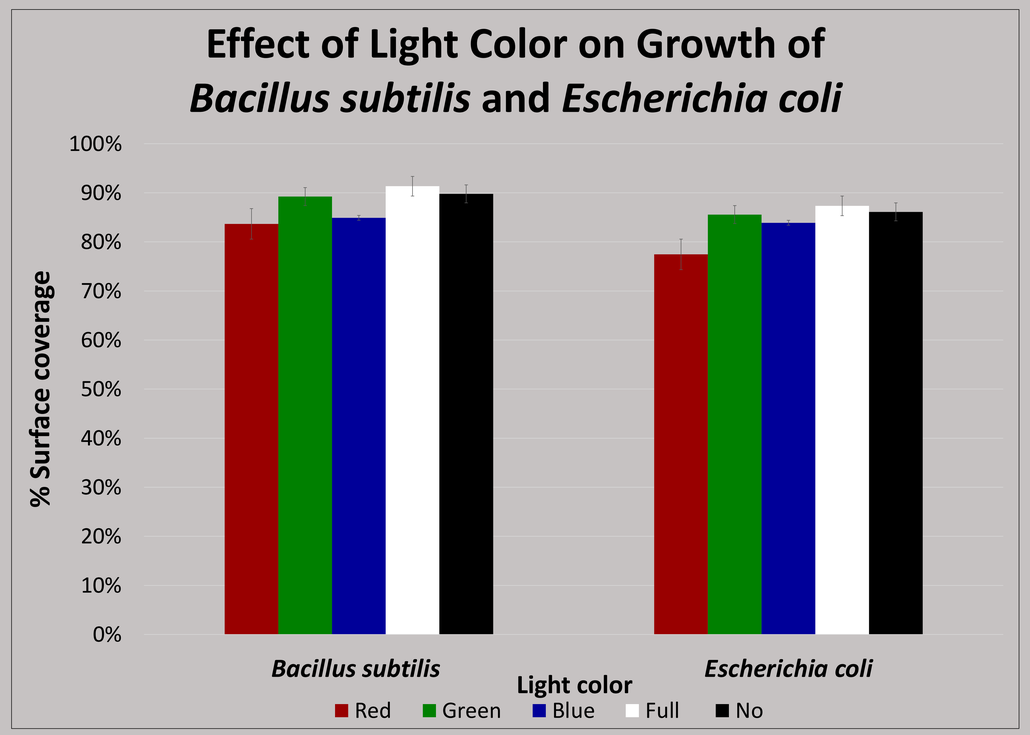

Figure 2. Bacterial growth (% surface coverage) of *Bacillus subtilis* and *Escherichia coli* after 72 hours under red, green, blue, full-spectrum (positive control), and no light (negative control) (n=3, $\bar{x} \pm$ SD).

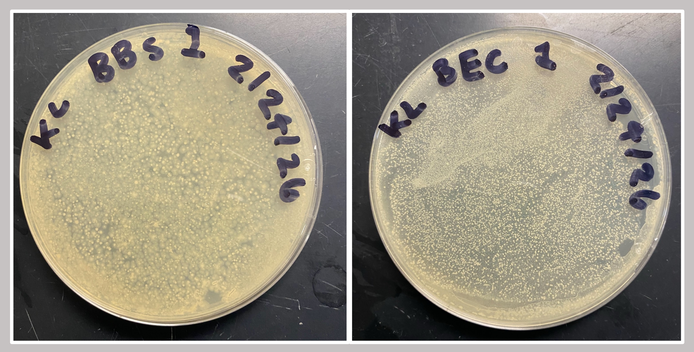

Figure 3. *Bacillus subtilis* and *Escherichia coli* exposed to blue light om nutrient agar for 72 hours.

Results

Red light significantly decreased bacterial growth compared to green, blue, full spectrum, and no light (Figure 1, one-way ANOVA, $F_{2,6}$=5.4, $p<0.05$).

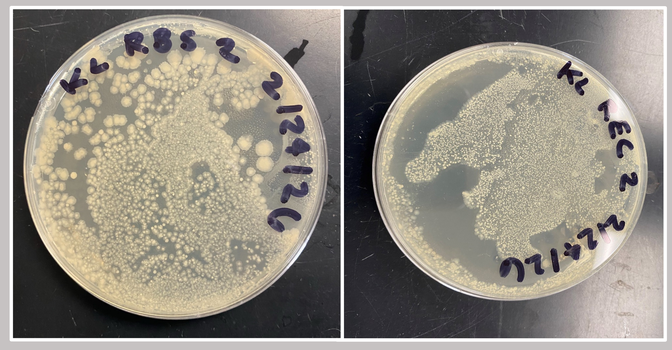

Figure 4. *Bacillus subtilis* and *Escherichia coli* exposed to red light om nutrient agar for 72 hours.

Discussion

The results did not support the hypothesis, because red light rather than blue light produced the greatest reduction in bacterial growth. This finding contrasts with previous studies that reported blue light has strong antimicrobial effects against a variety of bacterial species (Ashkenazi et al. 2003, Maclean et al. 2009). Differences in experimental conditions, such as light intensity and exposure duration, may account for differences in bacterial inhibition. These findings suggest that light color influences bacterial growth and may have applications in environmentally friendly methods for controlling microbial populations in healthcare, the food industry, manufacturing, and environmental systems.

Literature Cited

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