INTRODUCTION

In the gut, *C. albicans* is mostly in its yeast form (see figure 2) and is harmless. On the other hand, when exposed in vitro to environmental factors such as increase in temperature or oxidative stress it can shift its morphology from yeast to filamentous (see figure 2). In its filamentous form, *C. albicans* can invade the host by breaking though the epithelial cells. The filament attaches to cell and can start perforating the epithelial layer causing extensive tissue damage [1]. To date, the gut environmental cues inducing change in morphology are not well characterized. The hormone estrogen (E2) has been shown to influence *C. albicans* morphology [2] but at concentration above pathological range. High level or estrogen is reported during severe sepsis, a condition known to be associated with candidiasis [3]. Microgravity has been reported to increase gene virulence in *C. albicans* [4], and to lower the immune system. In this study, we asked whether E2 at concentration found during sepsis alter *C. albicans* morphology and whether there is an interaction between estrogen and microgravity on *C. albicans* morphology.

MATERIALS AND METHODS

- For these experiments *C. albicans* was grown in minimum liquid media (MM) in a shaking incubator at 30°C overnight and we used 2 and 4 million *C. albicans* for our experiments.
- In our experiments, we used 0.1 nM estrogen to mimic the systemic level of E2 observed in patients with sepsis [3].
- For microgravity experiments, a clinostat (see figure 1 below) was used to simulate microgravity. Microgravity subjected tubes and controls tubes were placed within an incubator at 30°C.
- Brightfield microscopy was utilized to observe *C. albicans* morphology. Images were captured using a DM4-B Leica microscope equipped with MC170 HD camera.
- Five random pictures for each condition were taken and scored 1 when filament was present and zero with no filaments.

Figure 1: Tubes containing *Candida albicans* placed on a clinostat to generate microgravity

RESULTS

![Candida albicans morphology](image)

**Figure 2:** *Candida albicans* morphology. In the picture, the three most common morphologies of *C. albicans* are represented: Yeast cell, the budding yeast (AKA pseudohyphae) and filamentous or hyphae.

![Interaction between microgravity and estrogen](image)

**Figure 4:** Two way ANOVA analysis: The figure shows that microgravity significantly increase the number of filament, \( P < 0.001 \), whereas E2 has no effect on the number of filament \( P = 0.08 \). A two way ANOVA analysis revealed that E2 significantly reduces the number of filament in *C. albicans* subjected to microgravity \( P = 0.006 \).

CONCLUSIONS

**C. albicans and Microgravity**
- *C. albicans* exhibited an induced filamentation effect over the course of three days within minimal media when exposed to microgravity compared to control.
- *C. albicans* and Estrogen
  - E2 itself had no effect on filamentation
  - *C. albicans* and Combination of Microgravity + E2
    - In presence of E2, microgravity produced significantly less filaments
Future Direction:
- Investigate the cellular mechanism of filamentation during microgravity and the signaling pathway of E2

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