# Breast Cancer in Adolescent and Young Women: Investigating Breast Microbiota, Estrogen, and Bacteria Impact on Biomarker Discovery

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# Introduction

## Motive

Breast cancer incidence among adolescent and young adult (AYA) women in the United States has notably increased over the past decades and remains one of the leading causes of cancer-related deaths in AYA women.

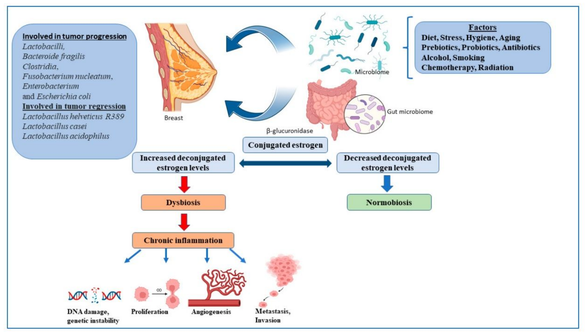
Between 2010 and 2019, diagnosis of breast cancer among individuals aged 30 to 39 surged by 19.4 percent. In the age group of 20 to 29, there was a 5.3 percent increase.

## Question

With the rising incidence of adolescent and young adult women breast cancer, are there any other ways to rapidly and efficiently diagnose?

## Background

The surge in breast cancer cases cannot be solely attributed to genetic changes in this demographic. Breast cancer is linked to estrogen and changes in the breast microbiome are confirmed in breast cancer patients. Microorganisms(such as bacteria) inhabit the breast microbiome. Estrogen receptors can be found in the breast tissue, and may interact with the breast microbiome.




## Goal

The goal is to understand the roles of the breast microbiome and estrogen in breast cancer with the goal of a biomarker discovery with aspirations for rapid diagnosis.

## Procedure

**Effect of Estrogen on Bacteria**

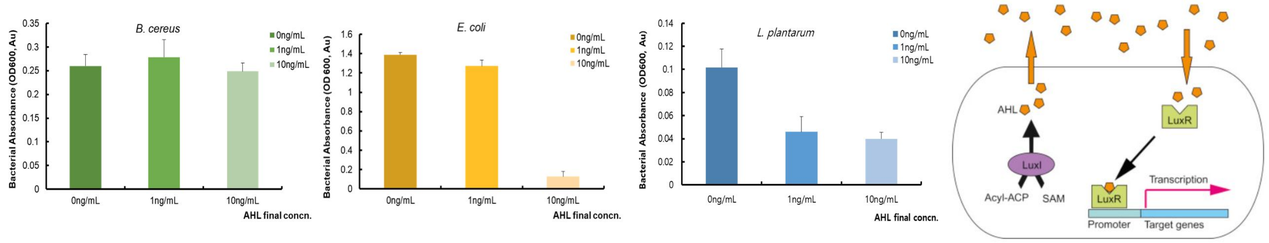
*-E.coli*
*-B. cereus*
*-L.plantarum*

**L. plantarum Product on Bacteria**

- Product exposed to estradiol condition (Concentrations and exposure time)
- Product decreased other bacteria growth

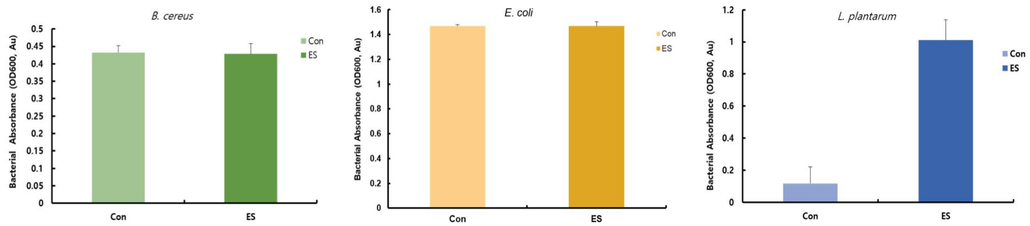
# Result

### Bacterial Growth by AHL



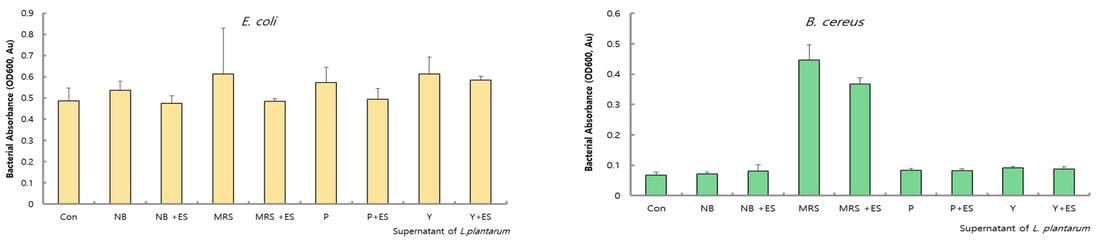

AHL, a type I autoinducer, facilitates bacteria-to-bacteria communication. *E. coli* growth sharply decreases with increasing AHL concentration. *L. plantarum* growth is also restrained by AHL, with less restraint at higher concentrations. *B. cereus* grows at low AHL concentrations but decreases as AHL concentration increases.

### Bacterial Growth by Estradiol




Estrogen was treated and bacterial growth was confirmed. In the case of *B. cereus* and *E. coli*, bacterial growth was not affected by ES, whereas *L. plantarum* showed growth more than 5 times due to ES, showing that it was affected by ES.

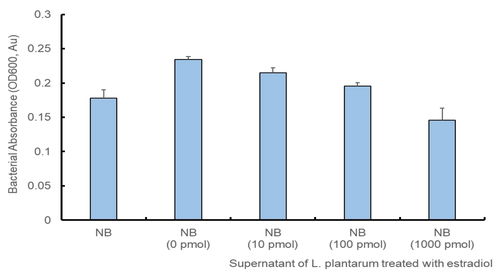
### *L. plantarum* Product in Various Mediums Influenced by Estradiol




*L. plantarum* cultured with estradiol showed growth similar to the control without the product. The production of growth-promoting substances in *L. plantarum* products seems to have been suppressed.

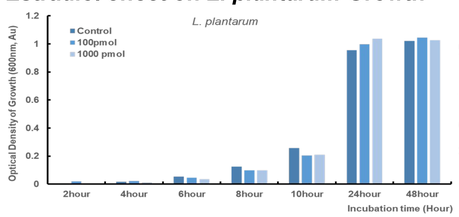
When treated, *B. cereus* growth varied: low with Control/*L. plantarum*, high with MRS. MRS+estradiol decreased growth compared to MRS, implying estradiol inhibits growth-promoting substances.

### *B. cereus* Growth with *L. plantarum* Product



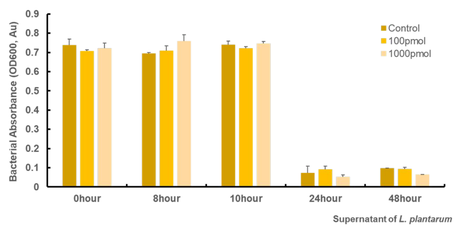

As the concentration of estradiol was gradually increased, bacteria began to decrease. Only the product with 100 pmol Estradiol showed reduced bacterial growth compared to the no treatment control.

### Estradiol effect on *L. plantarum* Growth



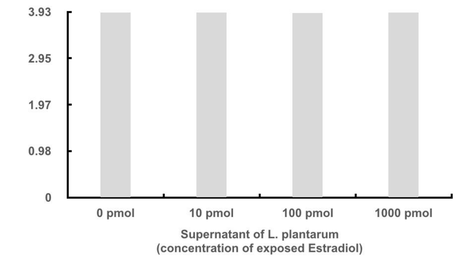

Estradiol generally inhibited growth for up to 10 hours. However, after 48 hours, the presence or absence of control or Estradiol did not significantly affect growth.

### *L. plantarum* product on Growth of *B. cereus*

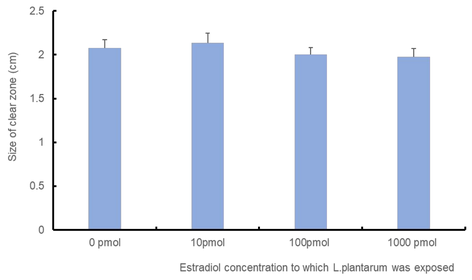



After 8 hours, *B. cereus* growth increases because of *L. plantarum* product as it was made in high estradiol conditions. After 24 hours, *B. cereus* growth decreases.

### Exposure of *L. plantarum* to Estradiol and Property of the Product



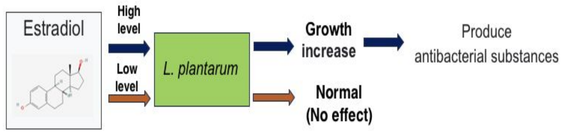

Decrease in protein degradation which affects the metabolism




At 10 pmol, clear zone enlarged, indicating active digestion. Higher estradiol reduced zone size, suggesting decreased digestion.

# Conclusion and Discussion

- Estradiol increases the growth of *L. plantarum*.
- Protein degradation in L. *plantarum* exposed to estradiol is reduced.
- *L. plantarum* antibiotic material is produced when the amount of bacteria is large.
- *L. plantarum* can be used as a biomarker for breast cancer.




# Further Research

How *L. plantarum* can be used as a biomarker?

Depending on the estradiol condition, the function of *L. plantarum* changes.

*L. plantarum* has the controlling effect of growth on other bacteria.