

The Effect of Oxygen Level and Propionate Concentration on Antibiotic Efficacy in *Listeria monocytogenes*

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Background

- Ampicillin inhibits cell wall synthesis. Gentamicin inhibits protein synthesis at the ribosome.
- Propionate is a common short chain fatty acid produced by the microbes in human intestines. It is produced in high concentrations when digesting fibrous foods.
- Listeria monocytogenes* is a foodborne pathogen. It is an intracellular pathogen.
- Listeria* is a facultative anaerobe.

Main Research Questions

- How do different propionate concentrations affect the growth of *Listeria monocytogenes*?
- How do different propionate concentrations interact with antibiotics to impact growth of *Listeria monocytogenes*?

Research Methods

- Listeria monocytogenes* were treated with varying propionate concentrations of 0mM, 1mM, 5mM, 15mM and 25mM as well as either 10 ug/mL ampicillin, 10ug/mL gentamicin or no antibiotics.
- The treatments were left to grow for 18-20 hours at 36°C in an aerobic chamber.
- The optical density of each treatment was taken and converted into an optical density percent change value as compared to the no treatment condition. A higher OD (% No Propionate) means enhanced cell growth.

Results

Does propionate concentration affect *Listeria monocytogenes* growth in ampicillin, gentamicin and no antibiotics?

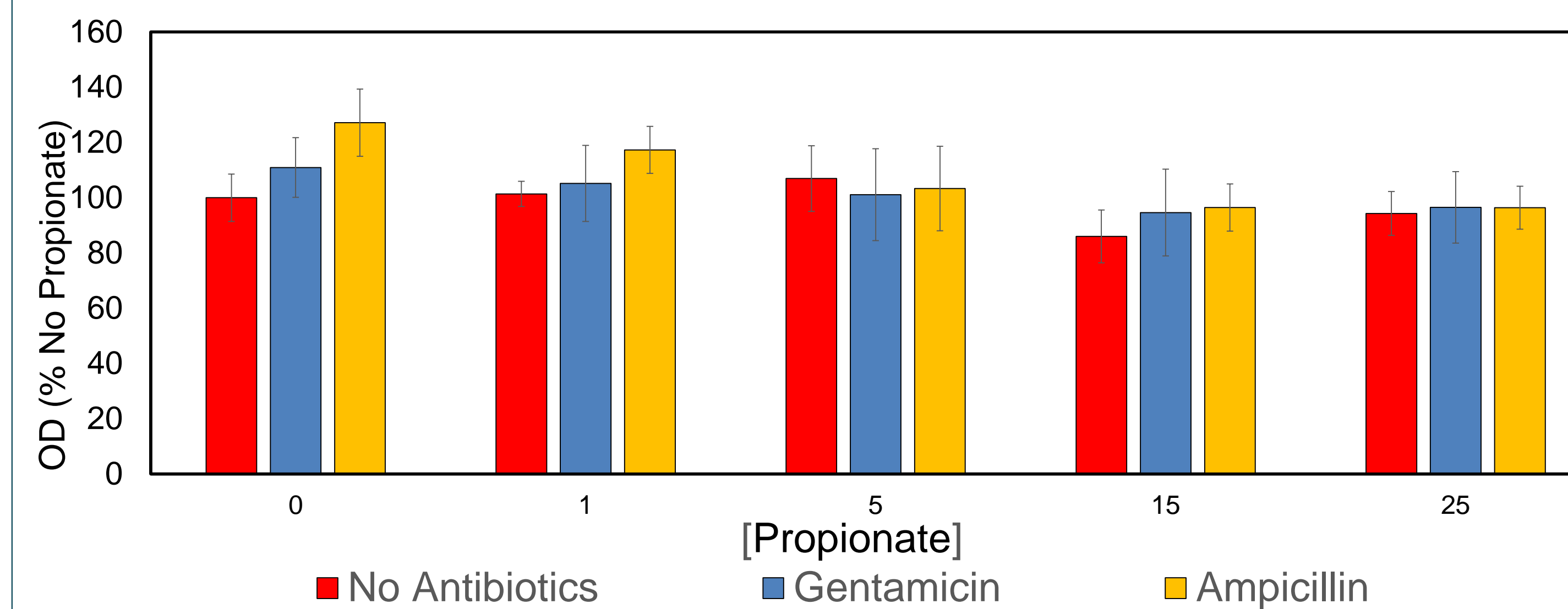


Figure 1. 10ug/mL gentamicin and 10ug/mL ampicillin were compared at propionate concentrations of 0mM, 1mM, 5mM, 15mM, and 25mM to determine percent change and compare *Listeria monocytogenes* growth.

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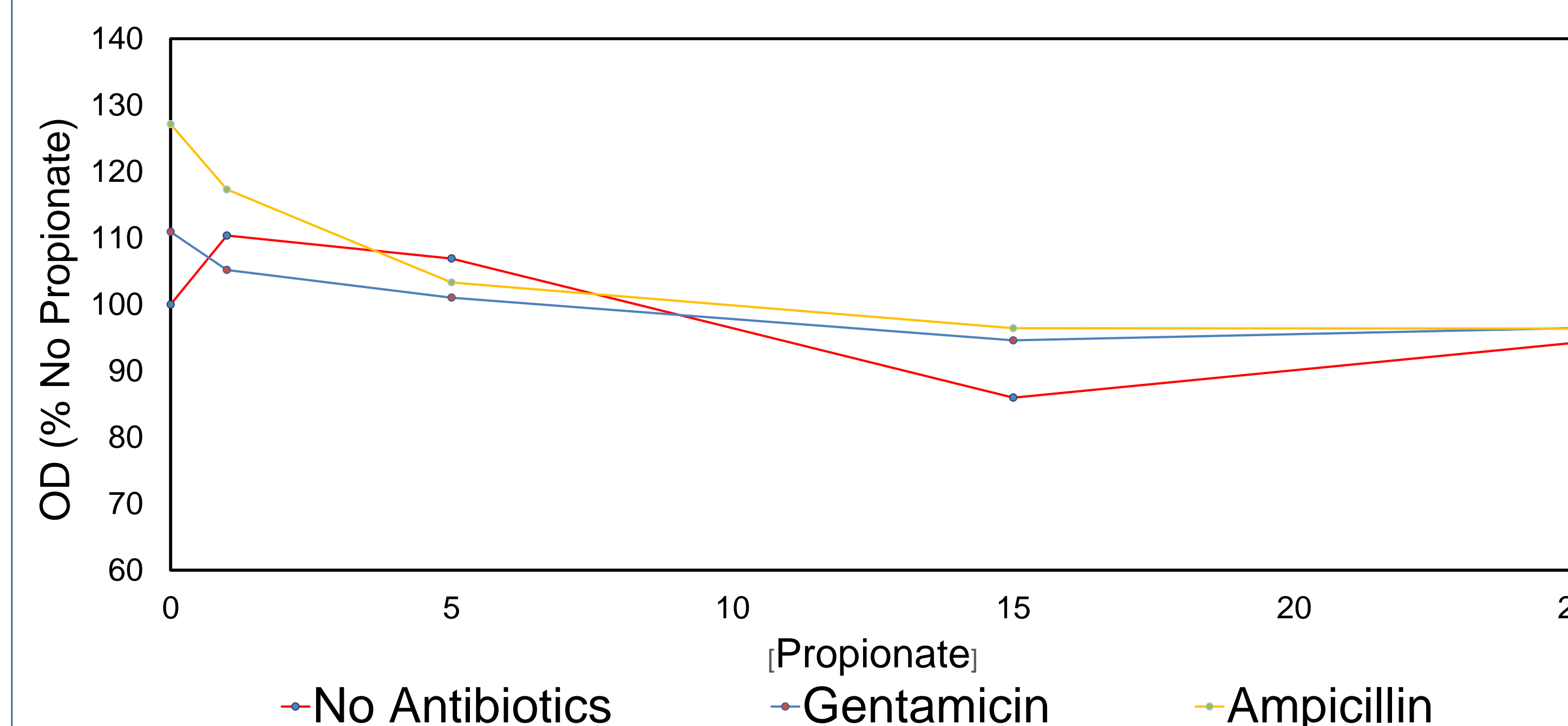


Figure 2. 10ug/mL gentamicin and 10ug/mL ampicillin were compared at propionate concentrations of 0mM, 1mM, 5mM, 15mM, and 25mM to determine percent change and compare *Listeria monocytogenes* growth.

Does propionate affect *Listeria monocytogenes* growth without antibiotics?

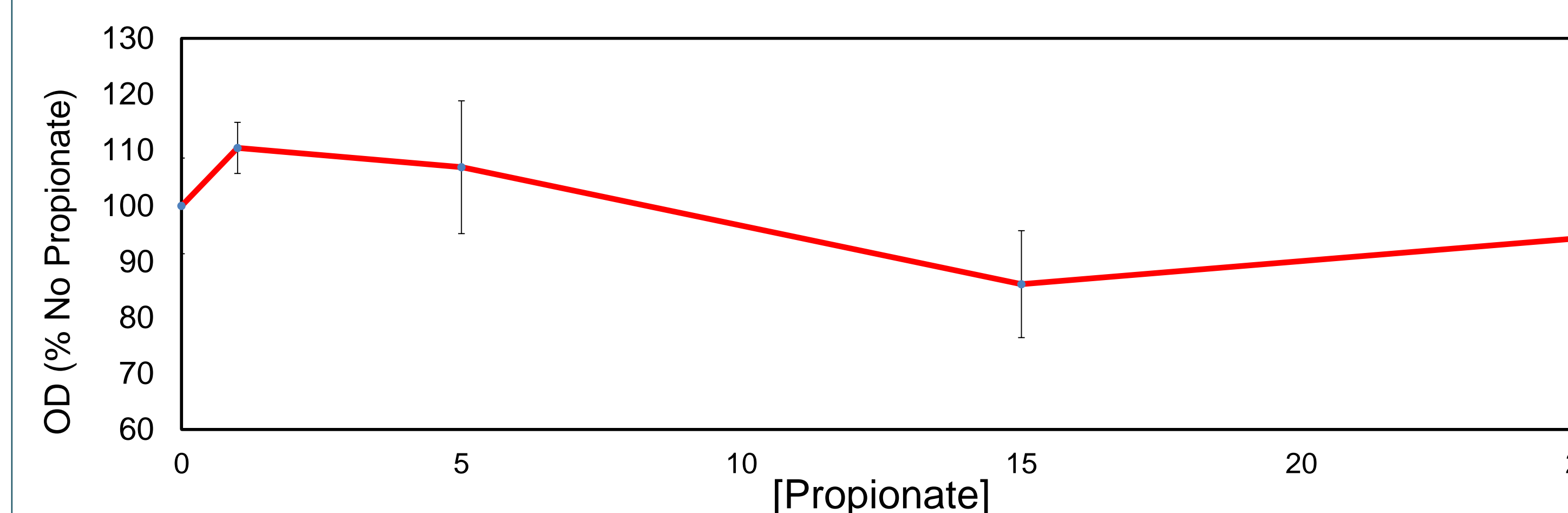


Figure 3. Propionate concentrations of 0mM, 1mM, 5mM, 15mM, and 25mM were compared without the presence of antibiotics. This figure represents higher cell growth inhibition at higher propionate concentrations, starting at 1mM.

Does gentamicin affect *Listeria monocytogenes* growth?

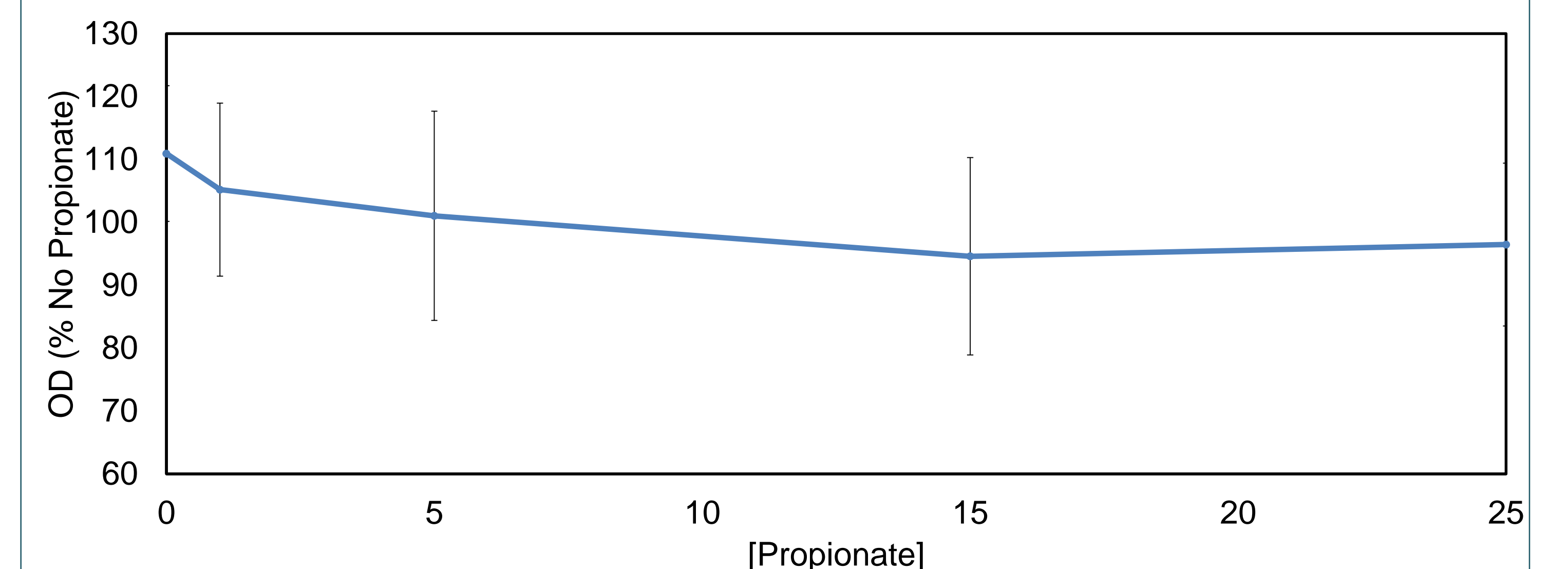


Figure 4. Propionate concentrations of 0mM, 1mM, 5mM, 15mM, and 25mM were compared in the presence of 10 ug/mL gentamicin. This figure represents higher cell growth inhibition at higher propionate concentrations.

Does ampicillin affect *Listeria monocytogenes* growth?

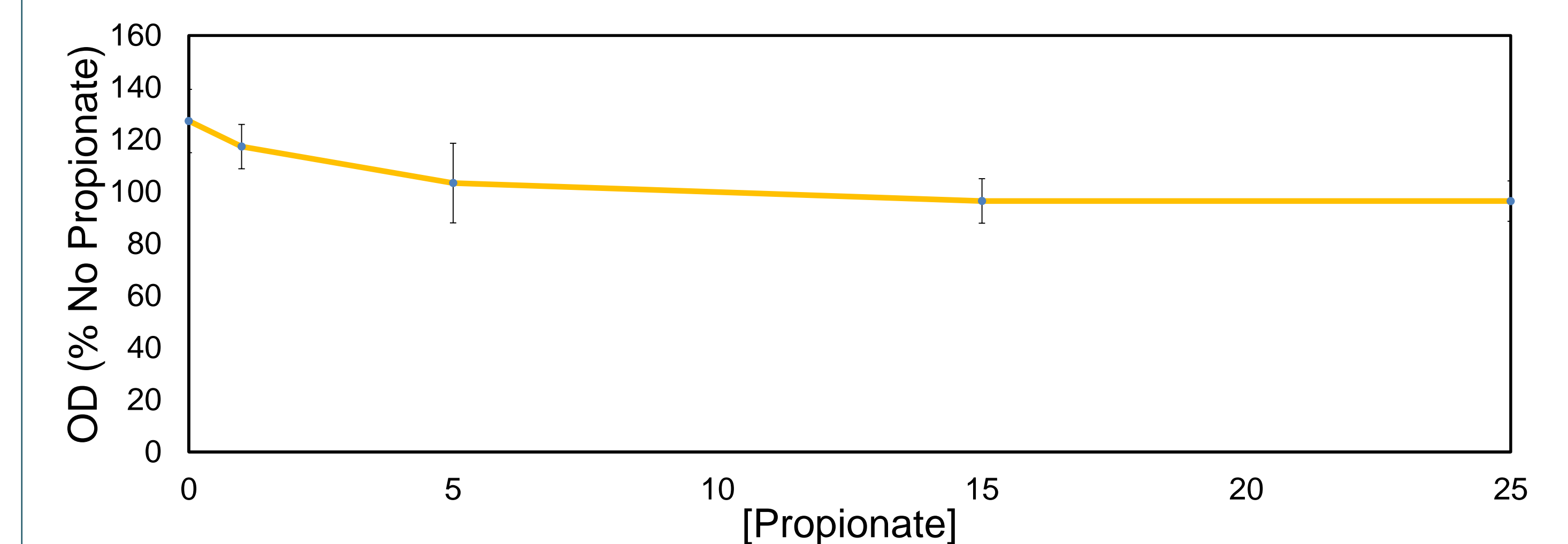


Figure 5. Propionate concentrations of 0mM, 1mM, 5mM, 15mM, and 25mM were compared in the presence of 10 ug/mL ampicillin. This figure represents higher cell growth inhibition at higher propionate concentrations.

Conclusions

- The most evident trend was decreased cell growth at high propionate concentrations of 5mM, 15mM and 25mM.
- Propionate treatments with no antibiotics, 10 ug/mL ampicillin and 10 ug/mL gentamicin do not vary *L. monocytogenes* growth significantly, but all treatments do generally show less cell death at 0mM propionate, which suggests that high levels of propionate hinder *L. monocytogenes* growth.
- Propionate may be useful in clinical settings as a dietary supplement or used in conjunction with certain antibiotics to increase efficacy and enhance cell death.
- Due to the Covid-19 campus closure, anaerobic conditions are not included in this project.**

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