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Introduction

- Most strains of *E. coli* are harmless but the some strains are pathogenic and can often cause diarrhea and illness in its host (CDC, 2015).
- *E. coli* O157:H7 is a harmful toxin producing strain and is known to live in the intestines of healthy cattle, and can potentially infect meat products during processing (CDC, 2015).
- *E. coli* is responsible for over 100,000 illnesses, almost 5,000 hospitalizations, and 100+ deaths annually. This costs America around \$540 a year including medical care, premature deaths, and lost productivity.(Food Poison Journal, 2015)
- The most common food source for *E. coli* turns out to be beef, which has been implicated in 55 percent of *E. coli* outbreaks. (Food Safety News, 2014)
- Organic acids are generally recognized as safe (GRAS) antimicrobial agents. (Journal of Food Science Technology, 2016)
- Garlic has been used in all parts of the world not only as a spice or a food but also as an antimicrobial. (Journal of Applied Microbiology,1998)

Objectives

1. To observe the effects of 1:100 ratio of garlic powder to raw ground beef on the growth of *E. coli* K-12 in ground beef.
2. To observe the effects of 0.01% formic acid on the growth of *E. coli* K-12 in ground beef.

Materials and Methods

•A 325 gram sample of raw ground beef was used over a course of 10 days and used to create a negative control, a positive control, a treatment of 1:100 garlic powder to raw ground beef and a treatment of 0.01% formic acid.

•Positive Control: Half of the initial ground beef sample was inoculated by putting the ground beef in a stomacher bag with 1 mL of *E. coli* K-12 inoculate. The bag was left to sit for 10 minutes.

•Negative Control: The other half of the initial ground beef sample was left uninoculated, and stomached with 90 mL of peptone water.

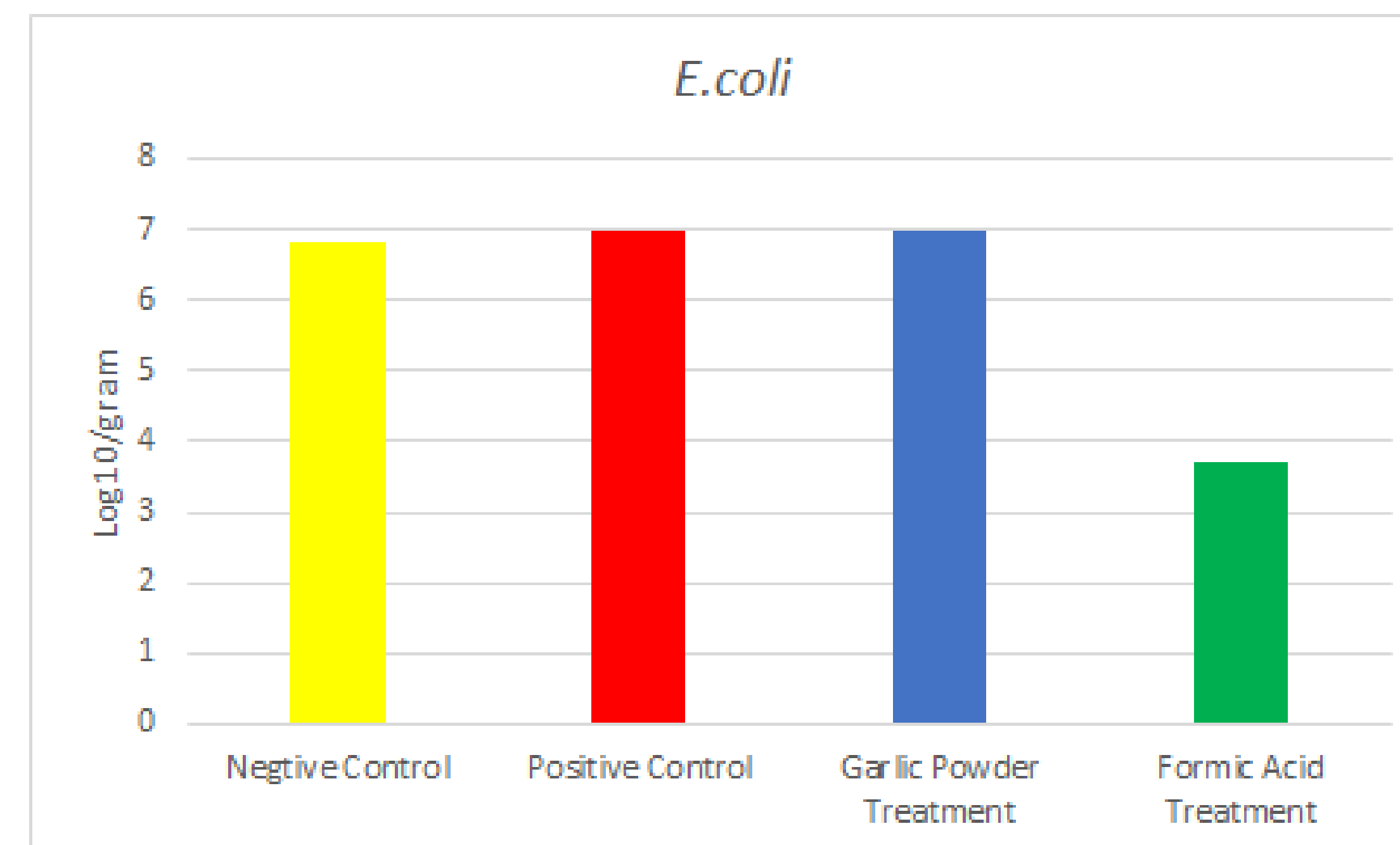
•Garlic powder treatment: 0.01 gram of garlic powder was put in a stomacher bag with 10 grams of inoculated raw ground beef and 90 mL of peptone water. The bag was stomached for 1 minute and left to sit for 10 minutes.

•Formic acid treatment: 1 mL of formic acid was put into a stomacher bag with 90 mL of peptone water and 10 grams of inoculated raw ground beef. The bag was stomached and left to sit for 10 minutes.

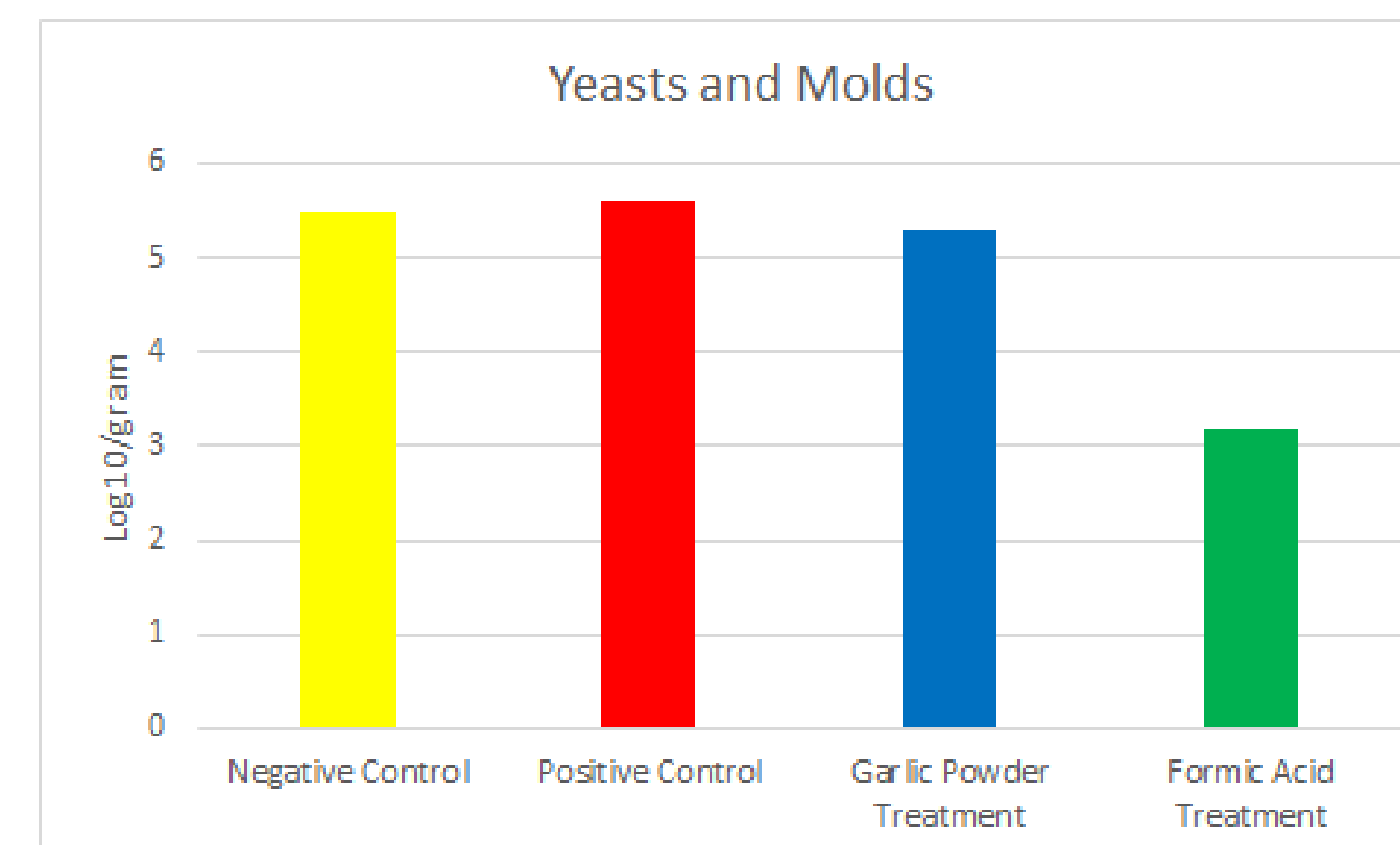
•Three serial dilutions were chosen for each type of media that allowed for optimum results. The controls were plated on days 0, 2, and 7. The garlic powder treatment and the formic acid treatment were plated on days 2 and 7.

•Three replicates were performed for each treatment for a total of 270 plates: 90 PCA plates, 90 McConkey agar plates, and 90 PDA plates. All plates were incubated at 37 degrees Celsius, except for the PDA plates which were incubated at 30 degrees Celsius. The raw ground beef was stored at 4 degrees Celsius.

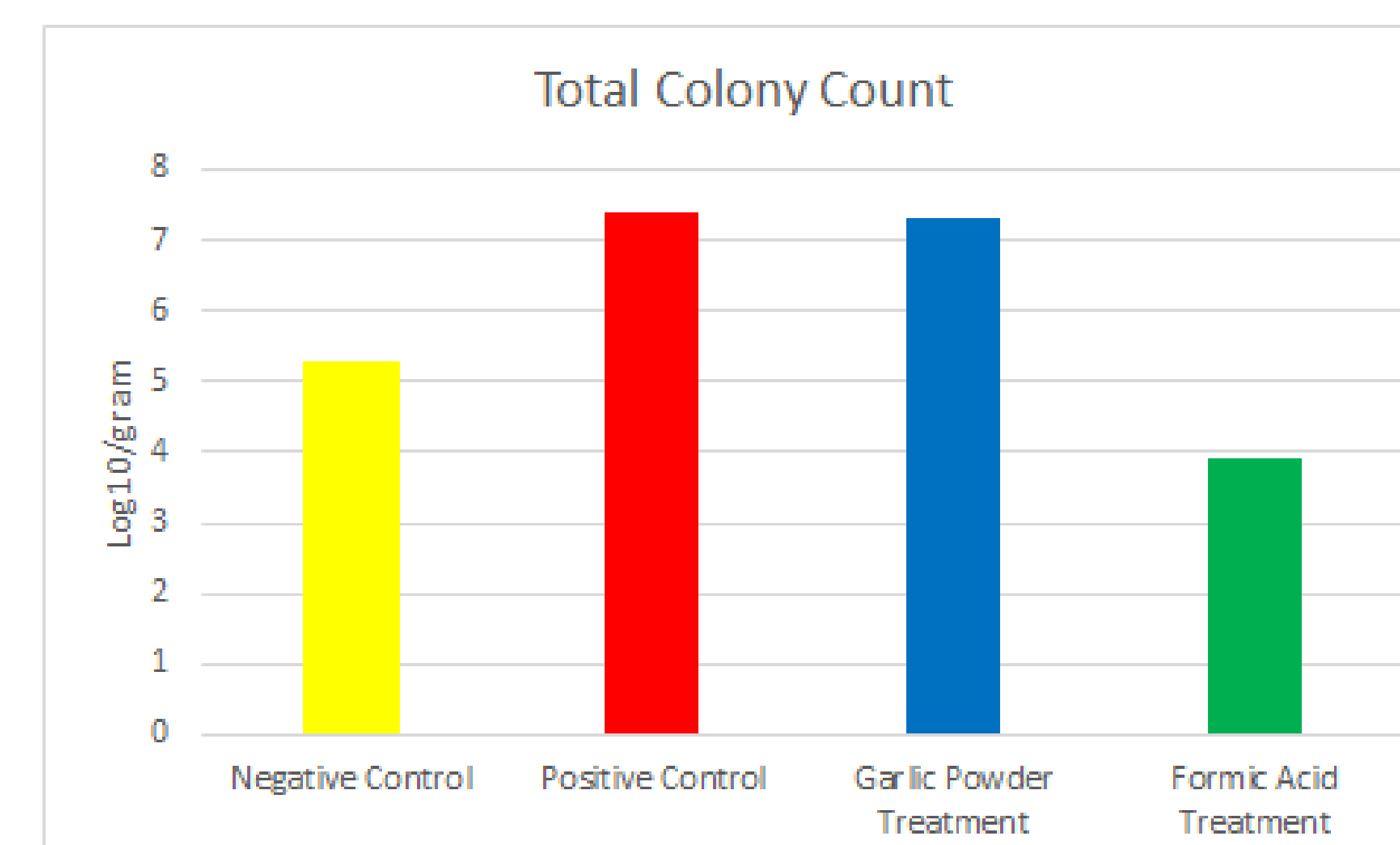
Results



Graph 1. Impact of garlic powder or formic acid on *E.coli*



Graph 2. Impact of garlic powder or formic acid on yeast and mold



Graph 3. Impact of garlic powder or formic acid on total colony count

- The use of 0.01 grams of garlic powder for 10 grams of ground beef showed no statistically significant log reduction on *E.coli* K-12 (P value > 0.05). (graph 1)
- The use of 0.01 ml of formic acid for 10 grams of ground beef showed a significant log reduction of 3.3 Log/g on *E.coli* K-12 (P value < 0.05). (graph 1)

- The data showed 0.01 grams of garlic powder had no significant log reduction on yeast and mold (P value > 0.05). (graph 2)
- The analysis of data showed 0.01% formic acid had a significant log reduction of 2.4 Log/g on yeast and mold (P value < 0.05). (graph 2)

- Total colony showed no significant log reduction with the 0.01 grams of garlic powder treatment (P value > 0.05). (graph 3)
- Total colony showed a significant log reduction with the 0.01% formic acid treatment (P value < 0.05). (graph 3)

Table 1. Impact of garlic powder or formic acid on *E.coli* K-12 in ground beef, reported in log₁₀/g.

Item	Negative control	Positive control	Garlic Powder	Formic Acid
E.coli	6.8	7.0	7.0	3.7
Yeast and Mold	5.5	5.6	5.3	3.2
Total Colony Day 2	5.3	5.4	5.3	4.4
	7.2	7.4	7.3	3.9

Conclusions

- The result of this study showed that even in small proportions formic acid had significant effects on *E.coli* K-12 in ground beef indicating the potential use as antimicrobial agent in the beef industry. In addition, it showed that garlic had no significant effect on *E.coli* K-12, further studies would be required to determine if different proportions of garlic powder would have significant effects.
- The negative control must have been contaminated at an early stage in the experiment. It was expected that the negative control would show little to no growth of *E. coli* K-12, however the negative control showed almost as much growth as the positive control. This error could be due to the air conditioning system circulating the *E. coli* K-12 in the air and consequently in the negative control sample and/or not using proper aseptic technique.

References

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