Disinfectant Efficiency

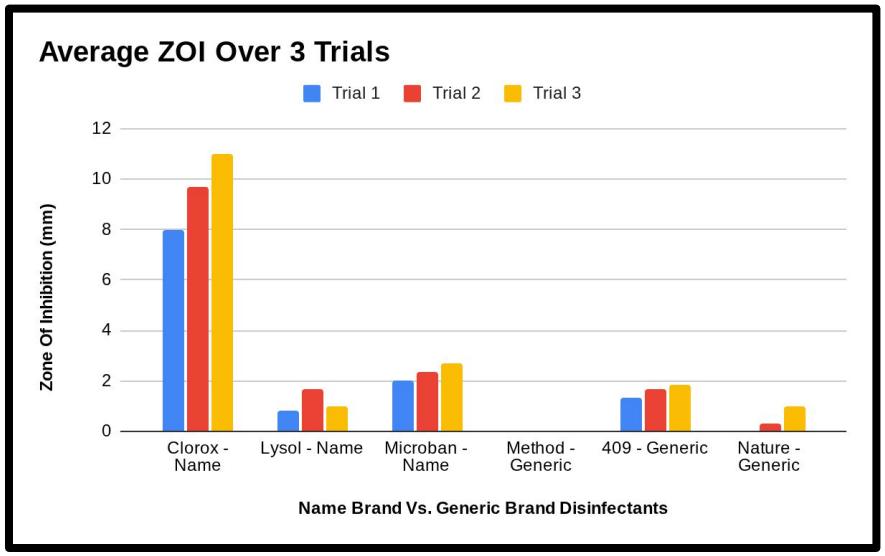
Research Question

How effective are name-brand Vs. Generic brand disinfectants?

Project Design

- Label LB agar plate and inoculated with *E. coli* to create a bacterial lawn.
- Divide plate into sections for disinfectants and a sterile water control.
- Place soaked paper disks on labeled areas using sterilized tweezers.
- Incubate plate upside down at 37°C for 24 hours.
- Measure zones of inhibition and determine susceptibility (susceptible, intermediate, or resistant).

Data Analysis & Results



Conclusions

Proper disinfection is essential to eliminate harmful bacteria. Using the disk diffusion method, studies show that generic disinfectants can be as effective as or more effective than name brands. This project tests different disinfectants on *E. coli*, examining how formulation and contact time affect effectiveness.

Introduction

Cleaning is regularly necessary in households, but situations involving illness or contaminated food require disinfection to eliminate harmful bacteria from surfaces and inanimate objects. A study evaluated the effectiveness of various disinfectants against common foodborne bacteria, including *Bacillus cereus*, *E.coli, Listeria monocytogenes*, *Salmonella*, and *Staph.* A concept called “Disk Diffusion” was used, where zones of bacterial growth inhibition on agar determined efficacy. Contrary to common belief, the results demonstrated that store-brand, or generic, disinfectants were consistently more effective in eliminating the bacteria. These findings can benefit everyday consumers, challenging the notion that commercial, or name-brand, disinfectants are always superior in quality. This experiment shows the importance of regular testing to maintain standards of hygiene and prevent foodborne illnesses. The study cited is similar to the project being conducted because it’s testing various disinfectants, name-brand and generic, against various bacteria; however, this project is limited to only *E.coli* due to it being easy to collect. Disinfectants may differ in effectiveness for many different reasons, including chemical formulations, which means the concentration or pH levels. Application factors include the contact time, the type of surface, and the structure of biofilms present.

Question

How effective are Name-brand Vs. Generic brand disinfectants?

If I use Name-brand disinfectants, then the Zone of Inhibition (ZOI) will be bigger, as measured in millimeters. A concept called “Disk Diffusion” will be used, where zones of bacterial growth inhibition on agar determine efficacy. After completing the measurements, I predict that the Name-brand disinfectants will be more effective at killing *E. coli*, due to the fact they have the same active ingredients as Generic-brand disinfectants and often in higher qualities.

Methods

Procedures - Disinfectant Testing Lab SOP

1. Get 1 LB agar plate. Label on the **bottom** of the plate: Class Period, Group Number, date & “Disinfectant Testing”
2. Get 1 sterile swab. Use the swab to get bacteria from the E. coli stock plate. (Only go to the stock plate **once)**
3. Open the agar plate. Use the swab with *E.coli* on it to inoculate the agar plate with bacteria by swabbing back and forth across **the whole plate** to create a bacterial lawn. Turn the plate and continue swabbing across the entire plate in the opposite direction until every part is covered with bacteria.
4. Throw the used swab into the biohazard waste.
5. Use a Sharpie to divide **the bottom of the plate** into 4 quadrants. Use a Sharpie to put a dot in the center of each quadrant, with a tiny letter labeling which disinfectant dish will be used in each quadrant. Put on a dot right in the middle of the plate, label it **“W”** for the sterile water control.
6. Sterilize tweezers with alcohol and flame. Let cool 30 seconds before using.
7. Use sterilized tweezers to dip 1 sterile paper disk into the sterile water. Make sure it is not dripping any liquid, and carefully place the disk on the dot labeled W in the center of the plate.
8. Re-sterilize tweezers before each use, and repeat with each of the disinfectants until all 5 disks are on the plate.
9. Close the LB agar plate & do not bump it. **Leave plate right side up for at least 5 minutes to dry.**
10. In a notebook, set up a large drawing of the plate with the appropriate labels as viewed from the bottom.
11. Secure plate with two small pieces of tape & incubate **upside down** for 24 hours at 37 degrees Celsius.
12. Use a ruler to measure all zones of inhibition present using mm (millimeters). Label measurements on the drawing.
13. Make a data table and determine if *E.coli* is susceptible, resistant, or intermediate to each of the disinfectants.

Methods

Materials

- Clorox
- Lysol
- Method Apc Disinfectant
- Microban
- 409 Disinfectant
- Nature Disinfectant

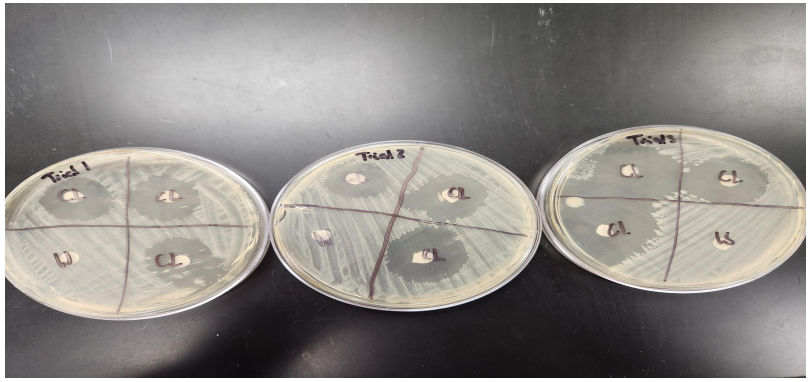
Materials

- Sterile Paper Discs
- Agar Plates
- *E.coli* Stock Plates
- Sterile Swabs
- Water

Control & Variables

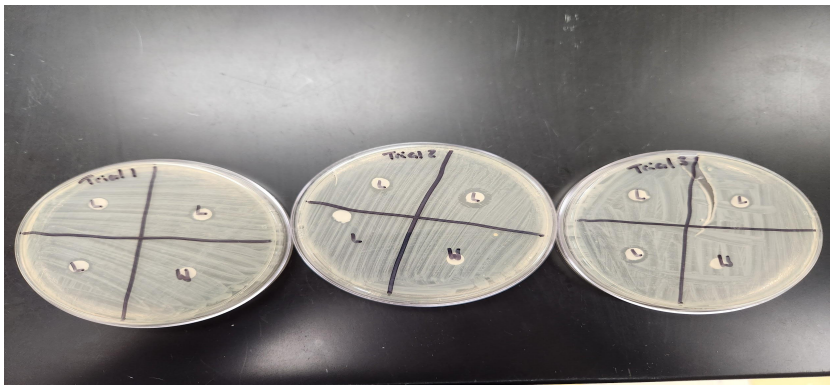
Independent Variables	Clorox, Lysol, Method, 409, Microban, Nature
Dependent Variable	Zone Of Inhibition
Controlled Variables	Water, *E.coli*, Type of Agar, # of Tests, SOP's, Disk Size, measuring ZOI in millimeters

Results



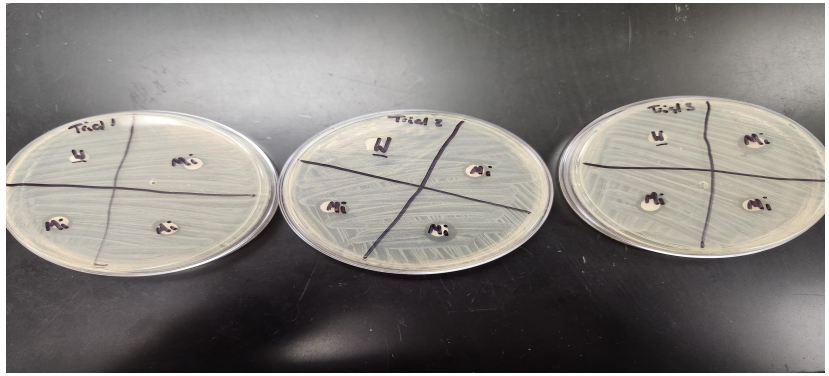
Clorox - Bleach

- Large ZOI's
- Effectively killed E.coli



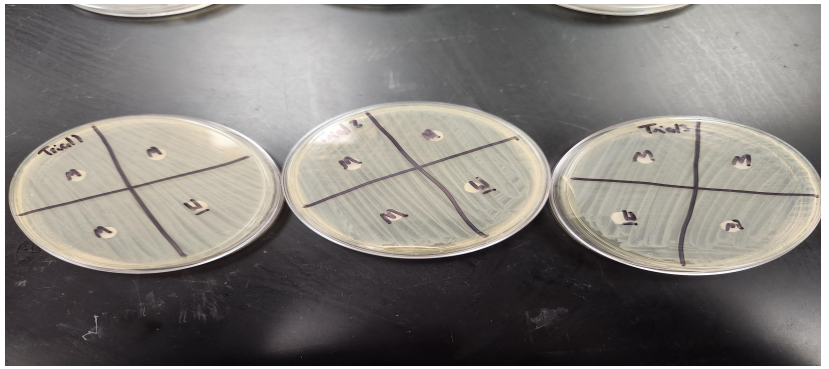
Lysol - Disinfectant Spray

- Small ZOI's
- Ineffective against E.coli



Microban - Disinfectant Spray

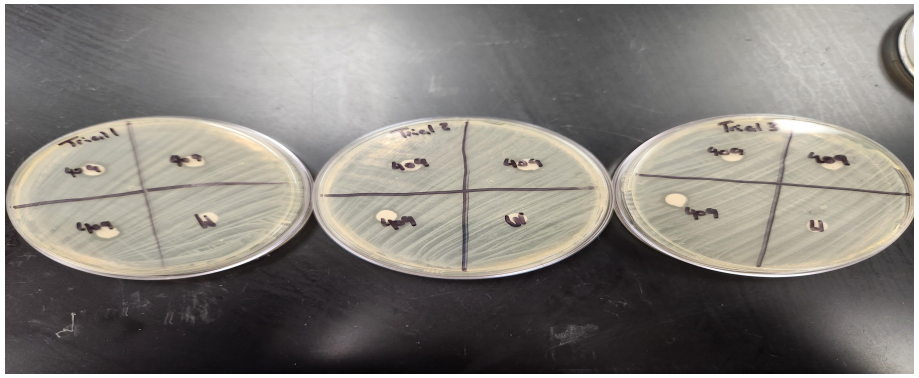
- Small ZOI's
- Ineffective against E.coli



Method - Disinfectant Spray

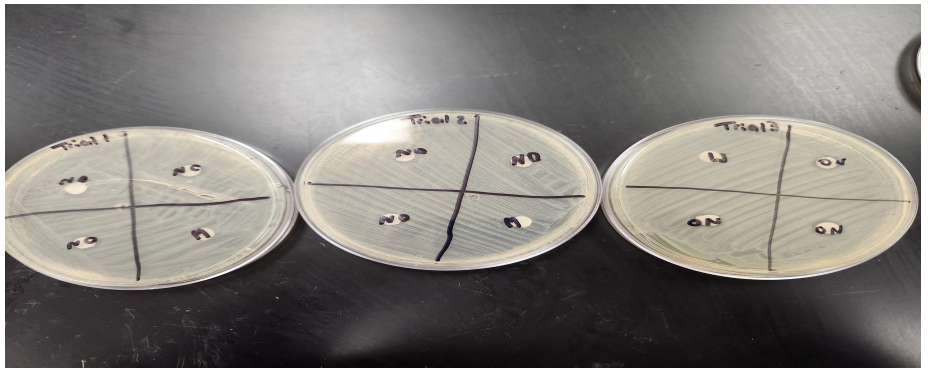
- No ZOI's present
- No E.coli killed

Results



Open Nature - Disinfectant Spray

- Small ZOI's
- Ineffective against E.coli

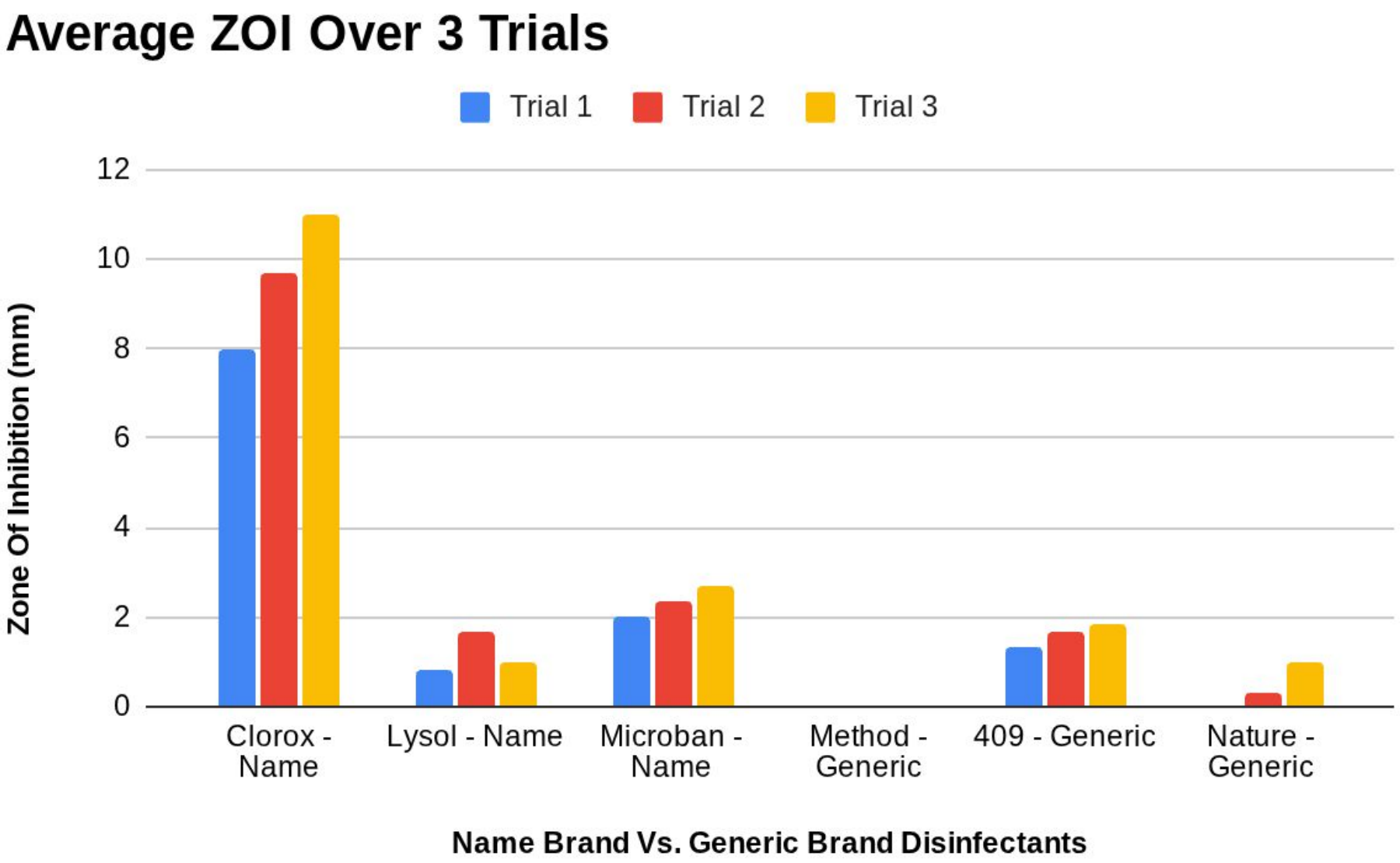


409 - Disinfectant Spray

- Small ZOI's
- Ineffective against E.coli

Trial 1				**Trial 2**			**Trial 3**		
Clorox	8mm	7mm	9mm	11mm	9mm	9mm	10mm	10mm	13mm
Lysol	1mm	0.5mm	1mm	3mm	1mm	1mm	1mm	1mm	1mm
Microban	2mm	2mm	2mm	3mm	2mm	2mm	3mm	2mm	3mm
Method	0mm	0mm	0mm	0mm	0mm	0mm	0mm	0mm	0mm
409	1mm	2mm	1mm	1mm	2mm	2mm	1.5mm	2mm	2mm
Nature	0mm	0mm	0mm	1mm	0mm	0mm	1mm	1mm	1mm

Results - Graph



Discussion

My original research question was, “How effective is Name-Brand Vs. Generic Brand Disinfectants?” This question is important for consumers as well as industries. Everyday consumers tour stores in search of the best disinfectant, the most effective; meanwhile, industries seek out a disinfectant to properly disinfect their equipment without the possibility of contamination. This is an interesting question because of how many disinfectants there are and how we can only try to trust the claims they make about killing “99.9%” of bacteria. During this experiment, the results were as expected; the Name-Brand disinfectants were more consistent, killing a greater amount of E.coli. Clorox, known as bleach, unsurprisingly killed the most E.coli out of any of the other disinfectants tested. For the Generic brand disinfectants, they were weak, ineffective against E.coli. Method, a brand that can be found at Safeway, didn’t kill any E.coli after the bottle itself claimed to kill E.coli, Salmonella, as well as other common bacteria. An unexpected finding was that Lysol and Microban, both Name-Brands, were underwhelming; they killed E.coli but failed to do so as effectively as Clorox, which had Zones as big as 13mm, 11mm. The original prediction was Name-Brand Disinfectants will kill more E.coli than Generic-Brand disinfectants as measured by their ZOI (Zone of Inhibition). If allowed, I would’ve tested different bacterias other than E.coli and done 4 trials instead of 3. Sterilization and alterations to the plates may have also affected my results; when placing the paper disks, they might have been too hot, or I waited too long collecting outside bacteria. Also, there could have possibly been other factors at play; like while making the bacterial lawn, I could’ve laid down a thicker layer.

Implications for Future Research

This research is important for consumers as well as industries. Everyday consumers tour stores in search of the best disinfectant, the most effective; meanwhile, industries seek out a disinfectant to properly disinfect their equipment without the possibility of contamination. These findings could potentially be useful for medical settings and the general public. Everyone worries they're at risk for illness; the evidence I've collected can give them insight into effective brands. In terms of hospitals or other medical settings, they need a strong, effective disinfectant to help keep equipment clean and properly sterilized. The general public wants an effective disinfectant to help clean their surfaces and keep the risk of illness in their homes down. New questions that arose during my research were: Why did Bleach kill the most? And: What's inside each disinfectant? I assumed Clorox would be the strongest, but why? What's the chemical makeup that makes it potent? For the other disinfectants, especially Method, what's inside that reduced its efficiency? To follow up this original study, I'd test a wider variety of disinfectants and do deeper research on the makeup of each; also, I'd test them against different bacteria.

References

Nhabe, Tshegofatso, Evaluating the Effectiveness of Various Store-Brand Disinfectants and One Commercial Kitchen Disinfectant in Eliminating Bacterial Contamination on Kitchen Surfaces (July 22, 2024). OIDA International Journal of Sustainable Development, 17 (12), 25-34, 2024. Available at SSRN: https://ssrn.com/abstract=4995306