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The Effect of Disinfectants and Antibiotics on Microbial Growth of Escherichia coli

**Abstract**

The purpose of this laboratory experiment is to note the effects of disinfectants and antibiotics on microbial growth in a petri (agar) dish. Of which, both of the antibiotics, were tested at a normal and diluted concentration. We hypothesized that there would be a statistical significance found in our data that proved either the disinfectant or antibiotic is more effective. The importance of this experiment lies in gaining a better understanding of microbial growth and the many factors that go into it as well as what may guard against it. Effectiveness of both the disinfectant and antibiotic was determined by measuring the zone of inhibition of bacteria growth on the petri dish around the antibiotic disks and disinfectant, which were compared to the control disk. We compared the effects of two antibiotics (penicillin and gentamicin) and one disinfectant (bleach) on the bacterial growth of Escherichia coli (E-coli). This was done by micro pipetting 100 μL of our bacteria onto the dish, placing the various antibiotic disks around it, and then allowing it to incubate. Our results proved our hypothesis and disproved the null hypothesis, which stated there would not be a statistical significance found. These findings are supported by the length of the zone of inhibition measured for each type of antibiotic and disinfectant as well as the different concentrations. It was 0 mm for both the diluted and undiluted penicillin, ranging from 2.2-3.7 mm for undiluted gentamicin, ranging from 3-3.8 mm for the diluted gentamicin, and ranging from 3.1-10.8 mm for the bleach. These results are statistically significant as they have a p-value of less than 0.05, according to the One-way ANOVA test.

**Methods**

The materials used for this experiment were a 20-100 μL micropipette, 4 agar petri dishes, 2 penicillin antibiotic disks (one having been diluted in water for five minutes), 2 gentamicin antibiotic disks (one having been diluted in water for five minutes), 100 μL of the E-coli bacteria, 100 μL of the bleach. First, the bacteria were spread around the petri dish using 4-5 sterile beads and allowed to sit in the petri dish for 5 minutes. Then, a control disk was placed in the middle of the dish, and the 4 antibiotic disks were placed in different sections. 100 μL of the bleach was used instead of the control disks for 2 of the petri dishes out of 4. After a one-week incubation period, the zone of inhibitions was measured in mm, from the edge of the disk to the edge of the zone of inhibition. After organizing all the collected data into one table, a One-Way ANOVA test was performed in order to determine the statistical significance of the results and to extract a p-value.

**Results**

Following the measurement of all the zone of inhibitions found in each of the 4 petri dishes, we determined there was enough data to support our hypothesis as the statistical test used gave a value of significance. The statistical analysis used was a One-Way ANOVA test, which presented a p-value >0.05, meaning the results of the experiment are statistically significant. As shown in Table 1, the zone of inhibition for the gentamicin disks were all greater than 0 mm, and clearly displayed greater effectiveness against microbial growth than the penicillin disks or the bleach. For the penicillin disks, there seemed to be no zone of inhibition. The effects of the bleach seemed to produce less precise results, as the zones of inhibitions did not have a spherical or circular shape.

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| --- | --- | --- | --- | --- | --- | --- |
| Zone of Inhibition (mm) | Undiluted penicillin disk | Diluted penicillin disk | Undiluted gentamicin disk | Diluted gentamicin disk | Bleach | Control |
| Plate 1 | 0 mm | 0 mm | 2.2 mm | 3 mm | N/A | 0 mm |
| Plate 2 | 0 mm | 0 mm | 3.7 mm | 3.7 mm | N/A | 0 mm |
| Plate 3 | 0 mm | 0 mm | 3.7 mm | 3.7 mm | 10.8 mm | N/A |
| Plate 4 | 0 mm | 0 mm | 3.4 mm | 3.8 mm | 3.1 mm | N/A |

***Table 1: Zone of Inhibition in the 4 Petri Dishes***

**Discussion**

In regard to our hypothesis, it was effectively proven by the data measured following the weeklong incubation of the petri dishes. There was no zone of inhibition for any of the penicillin disks, both diluted and undiluted. There is clearly a greater effectiveness against E-Coli growth using gentamicin than penicillin or bleach. Although plate 3 had a 10.8 mm zone of inhibition for the bleach, that is most likely due to human error and contamination. This may be that our micro pipetting of either the bacteria or disinfectant was not precise, or the bacteria was not spread across the petri dish with the beads well enough. It is likely the petri dish was kept open too often as everything was being added to it. Although the experiment was done individually with each group member getting their own petri dish, the data acquired from each petri dish were used all together as we saw consistent results in each petri dish. This allowed us to perform the ANOVA test, which concluded that there was in fact statistical significance in our data.

The final results that were acquired, and the conclusions they have allowed us to draw, lines up with the general biology behind our bacteria of choice, E-coli, and the most effective disinfectant, gentamicin. The bacteria E-Coli is a gram-negative strain of bacteria and gentamicin is an antibiotic that can be used against a range of gram-negative bacteria. This general information helps explain why we got the results we did. Experiments like these allows us, as students, to better understand and actually gain experience with the knowledge we are learning.

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