Introduction

- Food and waterborne illness (food poisoning) occurs by ingesting food or beverages contaminated with bacteria. The onset of symptoms may occur within minutes to weeks and often presents itself as flu-like: nausea, vomiting, diarrhea, and/or fever.

- *Salmonella enterica* var. *typhimurium* is one of the most common causes of food poisoning in the United States. Common sources include: eggs, raw poultry & meat, unpasteurized milk or juice, cheese, and nuts (U.S. Department of Health & Human Services, 2014).

- *Staphylococcus aureus* is present in up to 25% of healthy people. It commonly resides on the skin and in nasal passages. Foods prepared or come in contact with carriers that require no additional cooking are at risk. (E.g., Salads, sandwiches, beverages, etc.) (U.S. Department of Health & Human Services, 2014). Once contaminated, the toxin produced by *Staphylococcus* responsible for food poisoning is able to remain active after food has been reheated.

- Beverages obtained from soda fountain machines have been found to contain pathogenic bacteria. Currently there is one known outbreak of food poisoning linked to soda fountain machines (Godard et. al., 2013 and White et. al., 2010).

- The viability of most bacteria is inhibited by extreme conditions such as low pH or high sugar concentrations; soda products tend to have a very low pH and high sugar content (Todar, 2004 and Chirile et. al., 1983). In diluted soda the inhibitory effects may not be as significant, thus leading to a potential reservoir of infection.

Methods

10 mL diluted SodaStream Cola (n=10) 10 mL Sterile Water (n=10)

- Add 1 mL of *Staphylococcus* or *Salmonella*
- Removed 1 mL samples
- Live/dead fluorescent stain
- Measured fluorescences
- Calculated % viability

Results: Live/dead Stain

- 0 min
- 24 hrs

Results: Staphylococcus

- % viability (log10)
- Time (hr)
- Soda
- Water

Figure 1. Live/dead fluorescent staining of *Staphylococcus* in water at t = 0 min and *Salmonella* in soda at t = 24 hrs. Green fluorescent stain (A,C) represents all cells, and the red fluorescent stain (B,D) represents only dead cells.

Results: Staphylococcus

- % viability (log10)
- Time (hr)
- Soda
- Water

Figure 2. Mean log10 percent viability (with SEM) of *Staphylococcus* in soda (n=7) and water (n=7) during a 24 hr time course. Initially, there was a significant decrease in the viability of *Staphylococcus* in soda when compared to water, which was determined by a two-way ANOVA [F(1,6) = 188.2, p<0.0001]. The viability of both groups did not decrease significantly throughout the 24 hr time course [F(4,24) = 2.245, p=0.0941].

Results: Salmonella

- % viability (log10)
- Time (hr)
- Soda
- Water

Figure 3. Mean log10 percent viability (with SEM) of *Salmonella* in soda (n=7) and water (n=7) during a 24 hr time course. Initially, there was a significant decrease in the viability of *Salmonella* in soda when compared to water, which was determined by a two-way ANOVA [F(1,4) = 18.17, p<0.0053]. There was also a significant decrease in the viability of *Salmonella* in soda throughout the 24 hr time course when compared to water [F(4,24) = 58.97, p<0.0001]. Overall, the viability of *Salmonella* was initially the same for both groups but over time it significantly decreased in soda compared to water [F(4,24) = 23.35, p<0.0001].

Conclusions

- The viability of *Staphylococcus* immediately decreased in soda.
- The viability of *Salmonella* gradually decreased in soda within 3 hrs.
- *Salmonella* showed more resistance in soda than *Staphylococcus* during the first 3 hrs.
- Portions of the populations for each species remained after 24 hrs. Most people will consume their beverage within this time frame.

Future Studies

1. Observe the viability of other common food/water pathogens in soda.
2. Observe the differences in regular sodas versus diet sodas.
3. Observe if the initial amount of bacterial contamination affects viability.

Cited


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