Nov 24, 2024

Consider about topics:

* ~~Sugar and plant growth – sugar affect roots~~
* Bacteria & hand
* Hand spread bacteria

Discussed with family – in pandemic, hand hygiene has been reinforcing almost every to prevent covid-19 spread. Decide to study Bactria and infection spread. Bacteria culture is easy to perform at home.

* infection disease
* Hand hygiene and infection
* How bacteria spread?
* Hand to food, how much bacteria we eating from hand spread?

Nov 27, 2024

Draft a timeline

* Dec 1-15: background research, question, hypothesis, and experiment design, order Agar kit from amazon
* Dec 15-25: perform first experiments and reflection, any revision
* Dec 27,2024 – Jan 25, 2025: repeat 2nd and 3rd experiments
* Jan 26: analyze experiment and data
* Feb: start paper, PowerPoint
* Mar: prepare trifolder display board

Nov 30, 2024

**Background Research**

“Global mortality associated with 33 bacteria pathogens in 2019: a systematic analysis for the global burden of disease study 2019”

* 343 million individual records from 204 countries and territories
* 33 bacteria across 11 major infection syndromes
* 13.7 million infection – death
* Infection – 2nd leading cause of death

Dec 1, 2024

**Background Research**

How infection occurs

Chains of infection:

* How germs around: mode of transmission
* Contact – hand

A diagram of a chain of infection

Description automatically generated

Dec 6, 2024

**Background Research**

Holemes, in 1855, a book “Puerperal Fever private pestilence”

* A women dies form puerperal fever after one week of post mortem exam
* Physician’s unwashed hand infection Fever. Death

For the first time – hand spread bacteria

Dec 7, 2024

**Background Research**

Several studies: Printed literature

Hand wash – prevent infection

Dec 8, 2024

**Background Research**

CDC: at least 20s hand wash

Research: quick wash is more common (5s)

Dec 12, 2024

**Experiment idea**

1.~~Different hand wash time and bacteria on hand~~

2. Hand-to-food model, hand spread bacteria to food (dirty hand, washed hand)

3. wash time: 20s (recommended minimal time), 5s (commonly observed)

4. Food – apple,

5. hand-apple contact time: 5s, (5s rule)

6. How to culture bacteria at home? watch video, asked mom.

**Questions:** hand will spread bacteria to ready-to-eat food. Different hand wash – bacteria on apple

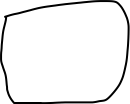
**Hypothesis:** Only 20s can reduce bacteria spread by hand significantly.

**Experiment variables**

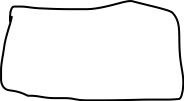
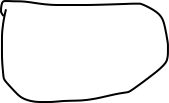
* Manipulated: hand wash time - 0s (dirty hand), 20s hand wash, 5s hand wash
* Dependent: the number of bacteria colonies
* Controlled: same liquid soap, same water, contact time hand-apple, Swab time on apple, same amount soap for washing, bacteria growth environment

**Experiment design**

Dirty hand touch apple. Wash 5s – apple wash another 15s – apple



Swab the apple swab apple swab apple



Streakthe agar plate with swabagar plate agar plate

**“ dirty group” 5s-hand wash 20s hand wash**



Incubate and observe every day, ? days, observe to see

Dec 13, 2024

Mom ordered Nutrient agar kit from amazon

Dec 21, 2024

Prepare agar plates according to instructions with mom. Keep agar plate in fridge.

Dec 22, 2024

**Experiment 1**

1. I shopped around 4 hours totally in Costco and Superstore.
2. Mom helped to clean apple skin with both water and alcohol swab, and clean knife with alcohol swab, (alcohol clean is to prevent contamination from slicing)
3. I touch apple slice for 5s (mom do timing)
4. Use sterile cotton swab to swab my apple, then transfer bacteria to agar plate by streaking plate
5. Wash hand with lquid soap for 5s, touch apple 5s, swab apple, streak agar plate
6. Wash hand for another 15s (total 20s), touch apple, swab, agar plate
7. A untreated plate as control to rule out I did make contamination
8. Incubate with electric blanket.

Dec 23, 2024

**Observe**

Day 1: all plates has water droplets, each plate had little yellowish colonies.

(looks wired) Continue culture

Dec 24, 2024

**Observe**

Day 2: all plates have several big patches of yellowish bacteria. Result wrong, should be single colony

Reason: contamination. ? water droplet, discuss with mom, read, \* I forgot to place the plate up-side down. Experiment 1 failed

Dec 29, 2024

**Re-do experiment** as Dec 22. !!! place plates upside down (experiment 2)

Dec 30, 2024

**Observe**

Day 1: nothing growth

Dec 31, 2024

**Observe**

Day 2: Dirty hand plate has many tiny dots. 5s also has dots. 1 dot in 20s. nothing on control plates

Continue culture

Jan 1, 2025

**Observe**

Day 3: colonies growth bigger, most are single colony. Dirty hand plate has most colonies, then 5s, 20s only few. Which is consistent with my hypothesis.

* Counted each plate: Dirty hand 518, 5s: 217. 20s: 24. (count 3 times for each plates, then average) (mom reminded the colonies might grow together especially in dirty hand plates as too many colonies)

Continue to culture, to see whether colonies is better than today’s.

Jan 2, 2025

**Observe**

Day 4: yes, some colonies together, bad. “culture for 3 days for rest experiments)

Jan 11, 2025

**Experiment 3**

Jan 12, 2025

Day 1: good

Jan 13, 2025

Day 2: starting grow

Jan 14, 2025

Day 3: count: dirty hand – 561, 5s-hand wash- 287, 20s-45

Jan 19, 2025

Experiment 4:

Jan 20, 2025

Day 1: nothing

Jan 21, 2025

Day 2: all plates, including control plate has bacteria. Fail.

Order more Agar kit

Jan 8, 2025

Experiment 5

Jan 9, 2025

Day 1: OK

Jan 10, 2025

Day 2: OK

Jan 11, 2025

Day 3: Dirty-466, 5s-339, 20s-55.

Jan 12, 2025

**Statics study:** excel to calculate Mean, SD.

Dirty hand 5s 20s

Experiment 1 518. 217. 24

Experiment 2 561. 287. 45

Experiment 3. 466. 339. 55

Mean. 515 281. 41

SD 47.571 61.22 15.82

Jan 13, 2025

P-value: <0.05 (helped by mom)

T-test: Excel: Dirty vs 5s: P<0.05

Dirty Vs 20s: P <0.05

5s vs 20s: P<0.05

Jan 14, 2025

Think results:

20s most significant – consistent with hypothesis

? 5s also significant – more bigger discrepancies between experiments, 5s is very short while washing, some places on hand was washed, some was not, result pretty random, unstable. ? whether leftover bacteria enough to cause sickness.

Conclusion: if not wash hand, and eat food, sick from bacteria.

Application: wash hand reduces bacteria spread

Feb 1-Feb 28, 2025

Writing paper