Hand washing and bacteria report sample

Literature, Russian Literature

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Soap manufacturers develop various products that include conventional soaps and antibacterial soaps to address today's microbial threats. Antibacterial soaps are developed based on conventional ones with antibacterial agents added to the product. These antibacterial agents must have the ability to kill germs, but should not give adverse effects to human's skin and general physiology. Scientific approach to investigate the effectiveness of antibacterial soaps begins with the hypothesis that antibacterial soap reduces more bacterial contamination compared to the conventional (non-antibacterial) soap. The two hypotheses are:

- There will be decrease in bacterial growth variables (types, numbers of colonies, and average colony size) in non-washed and washed contaminations.
- There will be differences in the decrease of bacterial growth variables (types, numbers of colonies, and colony size) from the use of antibacterial and non-antibacterial soaps.

Materials and Methods

Materials used in this experiment consisted of: sterile (uncontaminated) water, a general purpose agar plate (petri dish and agar), four cotton swabs,

antibacterial soap, non-antibacterial soap, and a permanent marker. The procedures were conducted by four students with the following assignments: Student 1 (contamination) was tasked with hands contamination; Student 2 (hand washer) was tasked with cleaning student 1's contaminated hands; Student 3 (handlebar) was tasked with preparing agar plate and inoculation of bacterial culture; and Student 4 (writer) was tasked with recording the process and the results.

Contamination was done by contacts of Student 1's hands with various objects such as door handles, phones, clock, and board erasers. Contamination was done further by contacts with objects in the restroom such as: water taps, toilets, toilet paper, and toilet sinks. In the meantime, a general purpose agar plate was prepared, divided into four quadrants, and was marked using a permanent marker. Two upper quadrants on the left and right were marked as LC (Left Control) and RC (Right Control) respectively, as shown in Figure 1.

Figure 1. Agar plate with four quadrants that show left and right control in the upper quadrants. Both quadrants show swab streaks for bacterial inoculation.

After control sample collection, both hands of Student 1 were cleaned separately. Cleaning of both hands of Student 1 was done by Student 2 (the hand washer) in two separate sinks. The left hand of Student 1 was cleaned using sterile water and antibacterial soap in one sink. The right hand of Student 1 was cleaned using sterile water and non-antibacterial soap in another sink. Drying was done by shaking each hand in the air and avoiding contacts with any objects. Washing procedure by the hand washer, the use

of different sinks, and air drying were done to ensure that there was no cross contamination between the left and the right hands. Student 1 was ready for experimental sample collection.

After cleaning and drying of both hands, Student 1 and 3 prepared for experimental sample collection. Experimental sample collection was done using a fresh cotton swab on the palm of the left hand and the swab was streaked on to a lower left quadrant of the plate marked as LE (Left Experimental). Sample collection was also done using another fresh cotton swab on the palm of the right hen and the swab was subsequently streaked on to the lower right quadrant of the plate marked as RE (Right Experimental). Experimental quadrants LE and RE are used to represent result from antibacterial and non-antibacterial soaps respectively. Experimental quadrants and swab streaks of the agar plate was shown in Figure 2. The entire process of contamination, sampling, and inoculation was recorded, and the agar plate was incubated for one week.

Figure 2. Experimental quadrants LE and RE of the agar plate used to represent antibacterial and non-antibacterial soaps respectively.

Results

After one week of inoculation, the culture on agar plate showed some microbial growth indicated by bacterial colonies, and no fungal colony observed. The bacterial colonies and their respective sizes in diameters found on agar plate were shown in Figure 3.

Figure 3. Bacterial growth observed on agar plate after one week of incubation.

Bacterial growth in control quadrants (left and right hands) indicated

diversity in size colors and size. There were yellow and red bacteria colonies observed with diameter size ranging from 1. 5 mm, 5 mm to 8 mm in the LC quadrant. There was only one yellow bacteria colony with a diameter of 12 mm in the RC quadrant. Bacteria colonies on LC and RC quadrants were shown in Figure 4. Bacteria growth in experimental quadrants showed red and yellow colonies in the left and right quadrants respectively. Bacteria growth in these experimental quadrants LE and RE showed diameters of 2 mm and a diameter larger than 2 mm (extension from RC quadrant) respectively, as shown in Figure 5.

Figure 4. Bacteria colonies observed in control quadrants LC (A) and RC (B) with various colors and sizes.

AB

Figure 5. Bacteria colonies observed in experimental quadrants RE (A) and LE (B) with various colors and sizes.

AB

There were differences in colony diameters and sizes between control and experimental results observed on the agar plate. These results also showed that there were also differences in bacteria colony colors and sizes between left and right hand in both control and experimental quadrants where left hand result showed a tendency of more variation in colony colors and diameters compared to the right hand. Types and average diameters of the bacteria colonies were summarized in Table 1.

Comparisons of all variables in non-washed contaminations and washed contaminations in control and experimental respectively were presented in Figure 6, while comparisons of all variables from the use of antibacterial and

non-antibacterial soaps were shown in Figure 7.

Figure 6. Variables from non-washed (control) and washed (experimental) contaminations.

Figure 7. Variables from treatments with antibacterial and non-antibacterial soaps

Discussions

This bacterial dominance may also support the indication that contamination intensity by the right hand is lower than that of the right hand. Colony types and numbers of colony from left and right hands in experimental quadrants show relatively similar values. These similar values may suggest the bacterial growth that can be achieved after washing.

Comparison of all variables (colony types, numbers of colonies, and colony size) between non-treated (control) and treated (experimental) contaminations in Figure 6 shows a tendency of decreasing variables. This indicates that the bacterial growth is suppressed by washing. Similarly, Figure 7 shows that all variables show a sharper trend of decrease with the use of antibacterial soap than those with the use of non-antibacterial soap. This indicates that antibacterial soap prevent the growth of bacteria more efficiently than the non-antibacterial soap.

In addition to possible unequal contamination of left and right hands, colony diameter in RC grows large and crosses the RC quadrant to the RE quadrant. This is possibly due to the non-proportional swab of sample in RC quadrant that allows bacteria to grow to RE quadrant; thus contaminating the culture in RE quadrant. These two factors may be the experimental errors occurring in this exercise.

The above results support the hypotheses stating that washing suppresses bacterial growth; and the use of antibacterial soap is more effective in suppressing bacterial growth compared with non-antimicrobial soap. Furthermore, this exercise shows that science is the greatest thing, as it provides tools for investigating effectiveness of controlling bacterial growth.