IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 9 Ser. 3 (September. 2024), PP 39-42
www.iosrjournals.org

Title

Theertha Hariharan Arulmozhi,
10th Grade Student At University High School, Irvine, Ca.

Karthikeyan Sivashanmugam,
Vellore Institute Of Technology, Vellore

Date of Submission: 01-09-2024 Date of Acceptance: 09-09-2024

I. Background

There is an apprehension that there may be another pandemic which is lurking and may invade us at any time.

During the COVID-19 pandemic, Mucormycosis, also known as the black fungus infection, which is an opportunistic infection became common throughout India in COVID survivors. Decreased counts of commensal bacteria on human hands caused by increased usage of hand sanitizer due to the pandemic may be the cause of this black fungus plague. To conduct this experiment, 5 volunteers had their palms swabbed three different times. The first swab was for the control batch, with nothing applied. The second swab was taken after herbal hand sanitizer was used by the volunteers, and the third was taken after alcohol hand sanitizer was used. These 15 samples were streaked onto petri dishes prepared with Luria Bertani Agar, and left to grow at 37 degrees celsius for 48 hours. The results of the experiment showed that using hand sanitizer removes 50-95% of the bacteria on your hands. While all my control groups had 10-40 colonies (each dot on the petri dish was a separate colony/type of bacteria) on them, the groups that used hand sanitizer only had 1-10 colonies on them, and show that the bacteria hand sanitizers kill could be good or bad; sanitizer doesn't differentiate. This means that the original hypothesis was correct. Since hand sanitizer, as said before, doesn't differentiate good and bad bacteria, it kills just as many commensals as it does harmful bacteria, making way for opportunistic bacteria and viruses, such as COVID-19, to latch on.

II. Introduction

Hand sanitizer is widely used as a quick and effective way to reduce the number of germs on hands in any situation. Sanitizer is made of roughly 60 percent alcohol and 40 percent water, with added fragrances and colors. Most sanitizers are branded to say that they "kill 99.9% of germs," and though these hand sanitizers do kill a large amount of bacteria, both good and bad, they cannot kill all bacteria. An example of a virus that cannot be killed by hand sanitizer is the NoroVirus, which is famous for causing food borne illnesses. NoroVirus has a coating that is not dissolvable by hand sanitizer, and therefore hand sanitizer is powerless against this virus [5].

Hand Sanitizer is also very effective at killing SARS-CoV-2, better known as the Coronavirus. The Coronavirus is an enveloped virus, meaning it is protected by a cage of their own proteins as well as some of the cells' lipid based walls. The lipid bilayers that surround viruses like the Coronavirus are held together by a combination of hydrogen bonds and hydrophobic interactions. Just like the lipids surrounding the virus, alcohol also has a polar and nonpolar region, allowing the alcohol in hand sanitizers to essentially dissolve the lipid membrane around the virus [4].

Knowing this, it is easy to understand why the regular use of hand sanitizer was encouraged by health organizations during the COVID-19 pandemic. However, hand sanitizers not only kill the COVID virus, but also kill the commensal bacteria that live on our skin.

Commensal bacteria are microbes, mainly bacteria, that reside on the surface of the body and the mucosa, which is the soft tissue that lines the body's canals and organs [8]. These commensals do not harm human health, but rather live in harmony with the human. There are ten times more commensal bacteria than the cells present in the human body [10].

Commensals share a symbiotic relationship with their human hosts. Commensal bacteria play many roles to help the body. Commensals are involved in the development of the intestinal architecture and immunomodulatory processes. They also supply the host with essential nutrients and defend the host against opportunistic pathogens such as Mucormycosis. They also help inhibit the growth of respiratory pathogens by producing antimicrobial products or signals as well as competing for nutrition and space with the pathogens. Commensals essentially protect the human body by taking up all the space on the palms of the hands and the

lining of organs, leaving no space for pathogens to latch on and grow. In return, the host provides the bacteria with nutrients and a stable environment [6].

As stated, effectiveness of hand sanitizer against the Coronavirus made sanitizer a highly used substance during the pandemic. Since the amount of Mucormycosis infections increased as the pandemic went on, it can be reasonably hypothesized that increased hand sanitizer usage killed not only pathogens on human hands but also the commensal bacteria, leaving space for pathogens that spread diseases like Mucormycosis to latch onto humans and grow.

III. Aim Of Study

The aim of this study is to find out if the indiscriminate and regular use of hand sanitizer contributes to an increase in pathogenic bacteria on the surface of the hand, and how the bacterial makeup of the surface of the hand changes with this use of sanitizer.

IV. Methodologies

The first step in studying this concept was to find volunteers. I found 5 volunteers who conveniently went to the college I was conducting the experiment at, and they participated in the experiment after voluntary permission. I took a swab of each volunteer's hand (without hand sanitizer). This would be my control batch. I streaked the swabs onto separate petri dishes already prepared with Luria Bertani Agar at a temperature of 37 degrees Celsius. I asked each volunteer to use herbal hand sanitizer and wait for an hour, during which their hands were dried with the help of a fan to circulate air. After an hour, I took a swab of each volunteer's hand and streaked the swabs onto separate petri dishes already prepared with Luria Bertani Agar at a temperature of 37 degrees Celsius

For the second part of my experiment, I asked my volunteers (an hour after the previous swab) to use a normal chemical hand sanitizer and wait for an hour, during which time their hands were dried with the help of a fan to circulate air. After an hour, I took a swab of each volunteer's hand and streaked the swabs onto separate petri dishes already prepared with Luria Bertani Agar at a temperature of 37 degrees Celsius. Thankfully, all of my swabs caught on and grew the first time I streaked the petri dishes, so I didn't have to redo any of my swabs. After this, I waited 48 hours to see the results of my experiments.

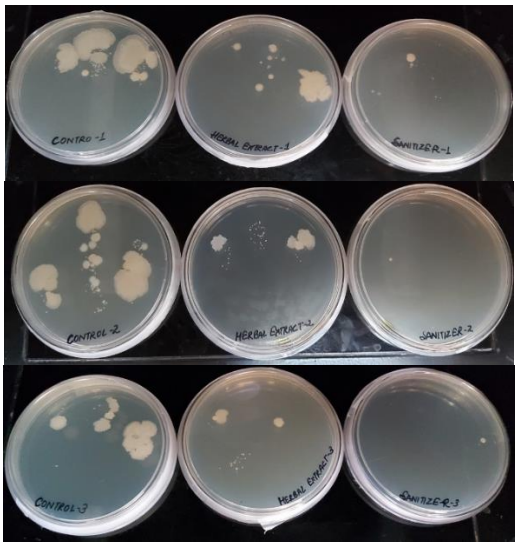
Inclusion Criteria

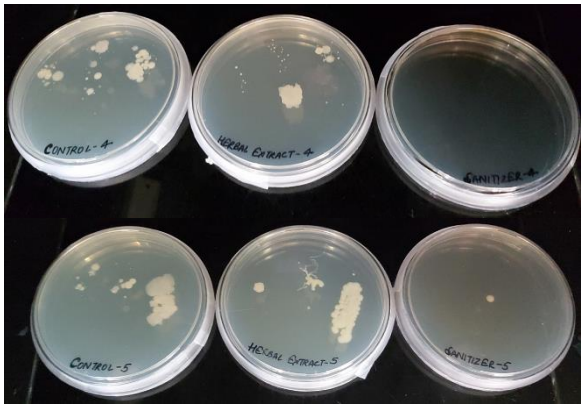
1. Volunteers who are healthy physically and have no major prior illnesses or underlying conditions
2. Volunteers who are not involved in regular manual labor that requires the use of their hands in their job
3. Volunteers who do not have skin conditions such as psoriasis, eczema, and dry, itchy or scaly skin

Exclusion Criteria

1. Volunteers who are already susceptible to illness due to prior illness, underlying conditions, or age
2. Volunteers who are regularly involved in manual labor that requires the use of their hands
3. Volunteers who have skin conditions such as psoriasis, eczema, and dry, itchy or scaly skin
4. No systemic illness like diabetes mellitus which may predispose them to all the pathogens.

V. Results





Sample	Plain Hand Swabs	Herbal Hand Sanitizers	Chemical Sanitizers
Sample 1	Amount of colonies were around 15-30	50% less colonies than with no hand sanitizer	95% reduction from control group
Sample 2	Amount of colonies were about 25-35	80% less colonies than with no hand sanitizer	95% reduction from control group
Sample 3	Amount of colonies were about 10-20 (middle was made up of multiple colonies)	80% less colonies than with no hand sanitizer	95% reduction from control group
Sample 4	Had around 15-20 colonies	60% less colonies than with no hand sanitizer	95% reduction from control group
Sample 5	Had 10-25 colonies	50% less colonies than with no hand sanitizer	95% reduction from control group

The results of the experiment showed that alcohol hand sanitizer was more effective than herbal hand sanitizer, and way more effective than using nothing, as expected.

When the control groups were left to grow, they grew extremely fast and extremely big. At the end, they took up about a quarter to half of the petri dishes. There were more than 15 distinct colonies in each control dish. These colonies are not all pathogenic, and most of them may be colonies of commensals.

Meanwhile, the herbal sanitizer group's bacteria growth was remarkably smaller than the control groups, with approximately 50-80 percent less bacteria growth than the control group at the end. These samples didn't grow very fast like the control samples, but they also didn't grow extremely slowly, like the alcohol hand sanitizer samples. Instead, the bacteria grew a little slower than the control samples, and in the end had a much smaller amount than the control group. This hand sanitizer killed a lot of bacteria and viruses, which consists of both commensals and bad bacteria.

The alcohol sanitizer bacteria samples, as stated before, grew the least out of all of the samples, with 20-45 percent less growth than the herbal hand sanitizer group, and 95 percent less growth than the control group. The alcohol sanitizer samples barely grew at all. There were rarely more than two distinct colonies in each alcohol hand sanitizer dish. Pretty much all the bacteria on the hand, even the good commensal bacteria, were wiped out.

This data does support my hypothesis because it goes along with my idea that since hand sanitizers kill both good and bad bacteria, they leave space for opportunistic pathogens to infect our bodies. These opportunistic bacteria are the reason I think that hand sanitizers will lead humankind into another pandemic in the near future.

VI. Discussion

There were a few noticeable trends in my research. Usage of chemical hand sanitizers reduced bacterial growth by about 95 percent in all cases, and Usage of herbal hand sanitizers reduced bacterial growth by about 50-80 percent

Though commensals do grow back quickly after they are wiped out when hand sanitizer is used, the small window of time that the commensals aren't on the palm of the hand could lead to many opportunistic bacteria colonies. This will lead to some diseases becoming more common and may eventually lead to a pandemic. This is why my research and results agree with my hypothesis.

Variables that could have influenced the results include unintentional small fluctuations in temperature, as this experiment was conducted in a lab used by an entire college. Additionally, the individual volunteers using different amounts of hand sanitizer could have affected the results in a small way, as not everyone uses the same amount of hand sanitizer

There aren't any published studies at the moment that are directly related to my experiment. However, there have been many studies published since the beginning of the pandemic on the danger of using too much hand sanitizer and the effectiveness of hand sanitizer as a preventative measure [9].

This is a small study, and while it has made some headway into this experiment, ultimately a larger, wider, multifactorial study is needed to conclusively prove the results we have concluded upon. I look forward to building upon this project in the future.

Acknowledgements

My mom, for the late-night talks about science, as well as helping me learn about commensals. My mentor, Karthikeyan Sivashanmugam, for helping me conduct this experiment from halfway across the world :). Vellore Institute of Technology, for my amazing mentor and its lab.