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## Comparative study of handwash and sanitizer on the removal of faecal bacteria

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### ABSTRACT

*This study was carried out to check the effect of different hand wash products on faecal bacteria, it is a fact that hand hygiene prevents diarrhea infection. But compliance with recommended instruction is poor. In this experiment, we picked up faecal bacteria from hands by swabbing method they were then allocated randomly to 1. swab of beforehand washing 2. handwash with Dettol liquid hand wash and Patanjali with hot water and cold water and with Sanitizer (DETTOL) and other products such as savlon and lifebuoy. In this experiment we used 40 swabs, bacteria of potential faecal origin mostly enterococcus and enterobacteria spp were found after no hand washing in of sample. PATANJALI didn't inhibit faecal bacteria while DETTOL inhibits faecal bacteria and it is effective product than PATANJALI hand wash. Hand washing with DETTOL is more effective for the removal of faecal bacteria as compared to other products like PATANJALI. PATANJALI contain herbal ingredients NEEM-2mg and TULSI- 2mg which has antibacterial properties but concentration was not enough to inhibit faecal bacteria as it was confirmed with MIC and MBC. The concentration should be increased for good result of PATANJALI hand wash, whereas DETTOL showed excellent results against faecal bacteria and SANITIZER showed a moderate effect*

**Keywords:** Hygiene, Faecal bacteria, infection, Dettol, Patanjali, Lifebuoy, Savlon, Hand sanitizer (Lifebuoy, Dettol)

### 1. INTRODUCTION

A faecal coliform (British: faecal coliform) is a facultative anaerobic, rod-shaped, gram-negative, non-sporulating bacterium. Coliform bacteria generally originate in the intestines of warm-blooded animals. Fecal coliforms are capable of growth in the presence of bile salts or similar surface agents, are oxidase negative, and produce acid and gas from lactose within 48 hours at  $44 \pm 0.5^\circ\text{C}$ . The term "thermo tolerant coliform" is more correct and is gaining acceptance over "faecal coliform". Coliform bacteria include genera that originate in feces (e.g. Escherichia) as well as general not of fecal origin (e.g. Enterobacter, Klebsiella, Citrobacter). The assay is intended to be an indicator of fecal contamination; more specifically of E. coli which is an indicator microorganism for other pathogens that may be present in feces. Presence of fecal coliforms in water may not be directly harmful and does not necessarily indicate the presence of feces

#### Faecal bacteria:

The word hygiene derives from the ancient Greek goddess Hygeia, the goddess of healing. Today, hygiene is associated with disease prevention and health promotion. The importance of hygiene is universally recognized and evidence-based. Physical contact between people and between people and objects is a key vehicle for the transmission of pathogens. Therefore, effective hand hygiene is a key intervention in disease prevention. It is an integral procedure in the healthcare environment, with health care workers receiving regular training in hand hygiene procedures. In the community, outside of the healthcare environment, studies have reported an association between improvements in hand hygiene and reductions in rates of infectious diseases. It is estimated that simple hand washing could save one million lives a year and many public health campaigns worldwide have addressed "hand hygiene" with varying success. However, studies show that after hand washing, as many as 80% of individuals retain some pathogenic bacteria on their hands. Hand washing with soap removes the body's own fatty acids from the skin, which may result in cracked skin that provides an entry portal for pathogens, In contrast, high-quality hand disinfectants contain additional skin care products, like emollients. They also do not require the use of water, which makes the application easy and uncomplicated. Adherence to hand hygiene practices amongst healthcare professionals has been regularly audited and investigated. Whereas to our knowledge, hand hygiene practices amongst the general population have rarely been examined. Furthermore, the efficacy of different formulations of hand disinfectants for bacterial load reduction in non-healthcare settings has not been previously

investigated. Normal human skin is colonized by bacteria, with total aerobic bacterial counts ranging from more than  $1 \times 10^6$  colony forming units (CFU)/cm<sup>2</sup> on the scalp,  $5 \times 10^5$  CFUs/cm<sup>2</sup> in the axilla, and  $4 \times 10^4$  CFU/cm<sup>2</sup> on the abdomen to  $1 \times 10^4$  CFU/cm<sup>2</sup> on the forearm. Total bacterial counts on the hands of HCWs have ranged from  $3.9 \times 10^4$  to  $4.6 \times 10^6$  CFU/cm<sup>2</sup>. Fingertip contamination ranged from 0 to 300 CFU when sampled by agar contact methods. Price and subsequent investigators documented that although the count of transient and resident flora varies considerably among individuals, it is often relatively constant for any given individual.

## 2. NORMAL BACTERIA FLORA ON HANDS

In 1938, Price established that bacteria recovered from the hands could be divided into two categories, namely resident or transient. The resident flora (resident microbiota) consists of microorganisms residing under the superficial cells of the stratum corneum and can also be found on the surface of the skin. *Staphylococcus epidermidis* is the dominant species, and oxacillin resistance is extraordinarily high, particularly among HCWs. Other resident bacteria include *S. hominidis* and other coagulase-negative staphylococci, followed by coryne form bacteria (propionic bacteria, coryne bacteria, dermobacteria, and micrococci). Among fungi, the most common genus of the resident skin flora, when present, is *Pityrosporum* (*Malassezia*) spp. Resident flora has two main protective functions: microbial antagonism and the competition for nutrients in the ecosystem. In general, resident flora is less likely to be associated with infections but may cause infections in sterile body cavities, the eyes, or on the non-intact skin. Transient flora (transient microbiota), which colonizes the superficial layers of the skin, is more amenable to removal by routine hand hygiene. Transient microorganisms do not usually multiply on the skin, but they survive and sporadically multiply on the skin surface. They are often acquired by HCWs during direct contact with patients or contaminated environmental surfaces adjacent to the patient and are the organisms most frequently associated with HCAs. Some types of contact during routine neonatal care are more frequently associated with higher levels of bacterial contamination of HCWs' hands: respiratory secretions, nappy/diaper change, and direct skin contact. The transmissibility of transient flora depends on the species present, the number of microorganisms on the surface, and the skin moisture. The hands of some HCWs may become persistently colonized by pathogenic flora such as *S. aureus*, Gram-negative bacilli, or yeast.



**Hand washing**, also known as hand hygiene, is the act of cleaning hands for the purpose of removing soil, dirt, and microorganisms. If water and soap are not available, hands can be cleaned with ash instead. A substitute for tap water is pouring water from a hanging jerry can or gourd. Hand washing is a simple and effective infection control intervention. Hand hygiene is the single most important procedure for preventing the transmission of diseases and infections. The most important thing to stay fit and healthy is frequent hand washing. Frequent hand washing in the right manner helps you wash away germs such as bacteria and viruses that you have picked from other surfaces.

**Germ on Hand:** Global Handwashing Day is observed every year on October 15. Washing your hands frequently is one of the most cost-effective interventions. Most of the infectious diseases can be prevented by simple hand washing. Think of the huge savings in terms of the health budget, whether, it is the country's health budget or the family's health budget. Medical hand hygiene refers to hygiene practices related to medical procedures. Hand washing before administering medicine or medical care can prevent or minimize the spread of disease. The main medical purpose of washing hands is to cleanse the hands of pathogens (like bacteria or viruses) and chemicals which can cause harm or disease. This is especially important for people who handle food or work in the medical field, but also an important practice for the general public. Hand washing with soap consistently at critical moments during the day prevents the spread of diseases like diarrhea and cholera which are transmitted through fecal-oral routes. People can become infected with respiratory diseases such as influenza or the common cold, for example, if they do not wash their hands before touching their eyes, nose, or mouth. As a general rule, hand washing protects people poorly or not at all from droplet and airborne diseases, such as measles, chickenpox, influenza, and tuberculosis. Hand hygiene is important for interrupting transmission of viruses through hands. The effectiveness of alcohol-based hand disinfectant has been shown for bacteria but their effectiveness in reducing transmission of viruses is ambiguous

Washing

## 3. PROCEDURE

1. The swab was taken before and after using hand wash of different hand wash product Savlon, Dettol, Patanjali, lifebuoy Dettol sanitizer and lifebuoy sanitizer
2. The different swab was isolated on TSI, Macconkey, Sabarauds .and incubated 24 hrs for 37
3. After incubation colonies were observed on a different plate.
4. Fecal bacterial colonies were isolated and gram staining performed.

5. MIC and MBC were performed for the determining the optimum concentration of hand wash product
6. Antibiotic susceptibility test was performed for different products of hand wash and sanitizer.
8. After incubation zone of inhibition was measured, a large zone of inhibition means more effective hand wash product.
9. Normal flora of hand also isolated on different media to check the effect of different hand wash products.
10. Antibiotic susceptibility test was performed for the normal flora of hand

#### **4. RESULTS**

##### **DAY 1:**

Colonies were observed on an agar plate. With different hand wash with hot and cold water as given in observation table

##### **Day 2:**

Colonies were isolated from faecal bacterial colonies which grown on agar plates. Gram staining of isolated fecal bacteria was performed. Gram-negative enterococcus pink color colonies were observed.

##### **Day 3:**

By using cup agar method we compared the different hand wash products. Dettol showed excellent effect (95% effect) against fecal bacteria whereas Patanjali showed very bad effect (20% effect ), savlon also showed the good effect as compare to a lifebuoy, lifebuoy Sanitizer and (Dettol ) showed 65% of effectiveness for inhibiting faecal bacterial colonies.

##### **Day 4:**

Zone of inhibition shown by Dettol hand wash and Dettol sanitizer but Patanjali has not shown any zone of inhibition. Only little bit inhibition was observed by Patanjali product. It means that concentration of Patanjali is not enough for bacteriocidal.

We have to perform the further test with a MIC.

##### **DAY 5:**

MIC and MBC were performed. Patanjali contains neem and tulsi which has a antibacterial activity. After increasing the concentration of neem and tulsi, the inhibitory effect was seen MIC was found to be 8 compared to a normal concentration which is only 2

##### **Day 6:**

Normal hand flora was isolated and Isolated on an agar plate. Large no. of bacterial colonies (staphylococcus epidermis, propioni bacteria, corynebacteria were observed



**Fig. 1: Plates of Macconkey, MH Agar, TSI agar plates after incubation**

#### **5. GRAM STAINING**

Colony isolated and further gram staining was performed.

Gram staining of isolated faecal bacteria was carried out and observed pink color colonies.



**Fig. 2: Gram staining**

Table 1: Observations

Hand wash	Mac Conkey agar (cold water)	Mac conkey (hot water)	TSI agar (cold water)	TSI (hot water)	MHA Agar(cold water)	MHA Agar (hot water)
Dettol	+	-	+	-	+	-
Patanjali	+++	+++	+++	+++	+++	+++
Savlon	++	+	++	+	++	+
Lifebuoy	+++	+++	+++	+++	+++	+++
Dettol sanitizer	++	+	++	+	++	+
Lifebuoy sanitizer	+++	+++	+++	+++	+++	+++

Key- +++: Large no. of growth  
 ++: Optimum growth  
 +: Less growth  
 -: No growth



Fig. 3: Results

6. RESULT

As per the observation table very less no. of growth were observed after hand washing with Dettol hot water and less no. of growth was seen in Dettol with cold water while large no. of growth were observed after a hand washes with Patanjali hand wash and lifebuoy whereas savlon showed moderate effect. So it is concluded that hand washing with Dettol with hot water is more effective than other hand wash.

6.1 MIC and MBC: (Patanjali hand wash)

MIC (Minimum Inhibitory concentration, MBC (Minimum Bacterial Count)

Table 2: Patanjali

Concentration(mg) (Neem and Tulsi)	MIC Results	MBC Results
2	+++	+++
4	++	++
6	++	++
8	-	-
10	-	-
12	-	-

Result: the MIC of Patanjali product was found to be 8

Key- +++: Large no. of growth  
 ++: Optimum growth  
 +: Less growth  
 - : No growth

Patanjali hand wash MIC was found to be 8:



Fig. 4: Antibiotic susceptibility test of different hand wash product (Dettol hand wash, Dettol sanitizer, and Patanjali)

**6.2 Antibiotic sensitivity test:**

Antibiotic susceptibility test of different hand wash product (Dettol and Patanjali)

**Table 3: Effects of different products**

Product	Dettol	Patanjali	Dettol sanitizer	Savlon
Zone of inhibition	+++	-	+	++

Result: On antibiotic susceptibility test it was found Dettol more effective

Key- +++: maximum zone of inhibition

++: optimum zone of inhibition

-: no zone of inhibition

Maximum zone of inhibition was shown by Dettol hand wash therefore it is concluded that Dettol is more effective against faecal bacterial while Patanjali showed very less zone of inhibition, therefore, it is concluded that Patanjali is very less effective against faecal bacteria. And Dettol sanitizer showed a moderate zone of inhibition.

**6.3 Normal flora:**

Swabs were taken of normal hand flora and isolated on agar medium and further antibiotic susceptibility test and gram staining were performed



**Fig. 5: Gram staining of normal hand flora**

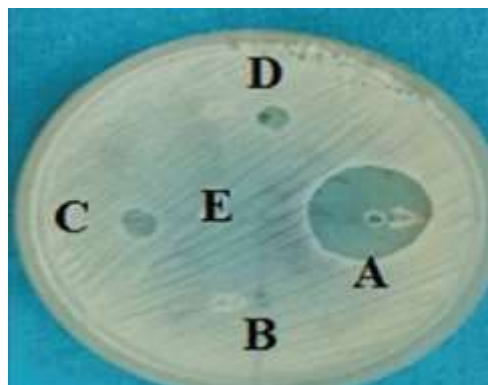
Gram stain of a species of Microcococcus, commonly isolated from the skin. Pink and purple color colonies were observed.

**6.4 Antibiotic susceptibility test of normal hand flora:**

Sterilized Mueller-Hinton agar plates inoculated with standardized test organisms (normal hand flora). Four equally spaced holes in the agar plate with the fifth hole in the center. Zone of inhibition and antimicrobial efficacy of different hand wash and sanitizer were observed.

Labeling on the side of the respective zone of inhibition as A, B, C, D, E.

- A-Dettol Hand wash
- B and E-Patanjali Hand wash
- C and D- Dettol Hand Sanitizer



**Fig. 6: Antibiotic susceptibility test of normal hand flora Product Dettol Patanjali Dettol Sanitizer**

Result: Dettol showed good inhibition of normal hand flora as compare to sanitizer and Patanjali. Dettol was effective against normal hand flora. Maximum zone of inhibition was seen by Dettol hand wash.

## 7. CONCLUSION

Effect of different hand wash product against faecal bacteria were observed Isolated on different agar plate TSI agar plate, MH agar plate, Macconkey agar plate .large number of colonies were observed on different plate ,hence we can conclude that a large number of faecal bacteria are present on our hands after using washroom and when we use good product hand wash it kills faecal bacteria, but using hot water is more effective than cold water and different hand wash product shows different effect . Using Dettol with hot water is gave maximum effect result. whereas Patanjali has given not satisfactory result hence the concentration of bacteriocidal neem and tulsi which is component of Patanjali was not enough to inhibit organisms, on the basis of this result further MIC was carried out to check the inhibitory concentration of neem and tulsi and result was shocking as Patanjali contain 2mg of neem and tulsi which is not enough concentration and our showed MIC value 8mg which indicate that antibacterial activity of Patanjali should be increased to be effective agent to kill faecal bacteria for better results ,hence claim of Patanjali is not authentic and it should be sent for further processing. On another hand, Dettol sanitizer showed a moderate effect for inhibiting faecal bacteria. We observed different normal hand flora which is present on contaminated hand (staphylococcus epidermis, coryne bacteria, propioni bacteria) and we concluded that Dettol hand wash is more effective against normal hand flora whereas Patanjali hand wash was not good. Effect of savlon lifebuoy and different sanitizers was also observed. We grade Dettol as the best hand wash product, the claim of Dettol is authentic as kills 99% of bacteria.

## 8. FUTURE PROSPECT

Patanjali product concentration should be increased to kill all pathogens. In future, we can check the chemical composition of Dettol on growth and inhibition at the molecular level. by studying at what molecular level it inhibits bacteria we can further come to conclusion about the inhibitory activity of Dettol and classify as which type of bactericidal activity.

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