

**TO STUDY THE EFFECT OF HAND SANITIZERS USED IN KINGDOM
OF SAUDI ARABIA AGAINST THE COMMON BACTERIAL
PATHOGENS**

Dr. Yousuf Adam Ali

Associate Professor, College of Applied Medical Sciences, Jazan University, Jazan, Kingdom of Saudi Arabia.

ABSTRACT

Washing of hand is utmost important to reduce the microbial contamination in hospital, laboratories, toiletries and at home. The strong religious belief irrespective of any religion is to wash your hand before any intake of food. This old age belief was scientifically proven and now we have absolute proof of contamination of food and food borne diseases caused due to unwashed hands. Most of the hospital acquired infections are caused due to the unhygienic condition of the hands of both the patient and the hospital staff. The common opportunistic pathogens which cause hospital acquired infections are Staphylococcus aureus, E.coli and Pseudomonas aeruginosa. The most common use to disinfect the hands is to wash it with clean water. However the water used may not be safe all the times and therefore the use of soap and detergents have been introduced in addition to the water. Still in recent times the hand sanitizers have been introduced in the market which claims to have great bactericidal activity and safe for use. The hand sanitizers available in the market are both alcohol based and non-alcohol. The alcohol based hand sanitizer claims to kills 99.99% microorganisms including the most resistant form. The alcohol free hand sanitizer viz. povidone-iodine, benzalkonium chloride or triclosan have persistent antimicrobial activity for a prolonged period and claim to be effective in killing microorganism. In the present study the effectiveness of hand sanitizers both Alcohol / non-alcohol based are tested against the standard Staphylococcus aureus and E.coli. The evaluation of the hand sanitizer is done by Kirby-Bauer technique. The non-alcoholic sanitizer viz. Alemlaq (Alkyl Dimethyl Benzyl Ammonium chloride) was found to be more effective than other alcoholic sanitizer against Staphylococcus aureus. Similarly Lux (Sodium laurate) was found to be more effective than other alcoholic sanitizer against E.coli.

Key words: *Staphylococcus aureus, Escherichia.coli, Hand sanitizer, Alcoholic, Non-alcoholic.*

Introduction:

One of the most important scientific reason and religious belief is to wash hands before eating the meals. This is to avoid the unwanted and undesirable microorganism to enter the body and cause infectious diseases.

Most of the hospital acquired infections are caused due to the unhygienic condition of the hands of both the patient and the hospital staff. It is therefore the strict instruction of the medical council and W.H.O to clean the hands by the approved hand sanitizers available in the hospital. Because of the poor hand hygiene the people suffers from majority of nosocomial infections including gastrointestinal and respiratory infections. Thus it is important to decontaminate the hands using safe water or wearing gloves. However it is not always possible to make available the safe water and the gloves which are present only in the hospitals. Thus the best and easy available source to disinfect the hands is the use of hand sanitizers which can be easily installed in hospitals, laboratories, restaurants and in toiletries.

The common opportunistic pathogens which cause hospital acquired infections are *Staphylococcus aureus*, *Escherichia.coli* and *Pseudomonas aeruginosa*. The most common sites through which these bacteria are transferred are the urinary tract, wounds, burns, blood, gastrointestinal tract etc. These bacteria in addition to the multidrug resistant bacteria are involved in nosocomial infections and the hands of health care workers are the primary mode of transmission of infection. Thus it is important for health-care workers to maintain proper hand hygiene to minimize the possible transfer of pathogenic agents.

In school the first lesson taught to the students is how to keep the hygienic condition? What are the possible modes of transmission of infection and how to avoid it? The students not only learn in the school but also instructed by the parents to keep themselves and their hands clean. This is to avoid the transmission of infection. Centre of Disease Control and Prevention (USA) has singled out Hand-washing as the most important means of preventing spread of infectious diseases. The man goes out to work and uses several commodities by his hand. The doctors and pathologists handle several pathogenic samples daily. The children play with toys and in open field spoiling their hands. The people working in the sanitary department handle the garbage containing pathogenic microorganisms. For all this and in general therefore is very important to clean the hands before consuming any eatables or even just touching the mouth.

The most common use to disinfect the hands is to wash it with clean water. However the water used may not be safe all the times and therefore the use of soap and detergents have been introduced in addition to the water. Still in recent times the hand sanitizers have been introduced in the market which claims to have great bactericidal activity and safe for use.

The hand sanitizers available in the market are both alcohol based and non-alcohol. The alcohol based hand sanitizer claims to kills 99.99% microorganisms including the most resistant form. The alcohol free hand sanitizer viz. povidone-iodine, benzalkonium chloride or triclosan have persistent antimicrobial activity for a prolonged period and claim to be effective in killing microorganism.

The hand sanitizers are available in the form of liquid, foam or easy flowing gel formulations, which can be applied on palm of the hand, rub the product over all surfaces of hands and fingers until hands are dry. The product is widely used by the doctors, surgeons before and after the surgery, pathologists, and researchers and is also used at restaurants, toiletries etc. The medical and applied medical science colleges in their laboratories also have hand sanitizer which the students use after every practical class.

Review of Literature:

The hand plays an important role in transmission of infectious agents as suggested by Semmelweis (9) particularly when people live in close contact with each other. The contagious agents can be spread through hands in families, schools, college dormitories. In close contact the infectious agents are not only transferred by hand to hand contact but also indirectly by inanimate objects like door knobs sitting ground etc (2, 7).

In 2007, a study was conducted to review the effectiveness of hand sanitizer in reducing the respiratory infection (5)

Currently hand hygiene is considered as one the most important measure to prevent any hand transmitted infection (8).

Since hand washing was not considered as the standard method to eliminate all microorganisms, alcohol based hand sanitizers are recommended for disinfection of hand. This is due to its

efficiency, applicability and tolerability. These hand sanitizers are recommended throughout the world including America and Europe (6).

Alcohol based hand sanitizers are proved to be the best for gastrointestinal and respiratory infections caused by viruses and gram negative bacteria (3). The side effect of alcohol based hand sanitizer is its dryness of the skin. However it can be prevented by addition of humectants and skin conditioning agents (4).

Non-alcohol based hand sanitizer viz. benzalkonium chloride is known to have weak activity against gram negative bacteria as compared to alcohol and is prone to contamination by these bacteria (1).

Hand sanitizer is better option than the soap and water. It is safe and easy to handle and can be used in the community.

Material and Method:

The Alcohol and non-alcohol based hand sanitizer selected for the current study are the following Dettol, Biopad, Casanova, Lux, Higeen, Strellium, Lifebuoy, Ninu, Energy and Alemlaq. The ingredients in these hand sanitizer are as shown in table 1.

Table 1: Ingredients present in the hand sanitizer.

S.No	Name	Ingredients	Alcoholic / Non Alcoholic
1	Alemlaq	Alkyl Dimethyl benzyl ammonium chloride, pine oil.	Non-Alcoholic
2	Lux	Sodium laurate sulfate, glycerine	Non-Alcoholic
3	Casanova	Ethyl alcohol(60%), glycerine.	Alcoholic
4	Energy	Ethanol(60%), glycerine.	Alcoholic

5	Nunu	Ethanol(70%), glycerine.	Alcoholic
6	Dettol	Alcohol(Denatured), Propylene glycol	Alcoholic
7	HiGeen	Alcohol(70%), glycerine	Alcoholic
8	Lifebuoy	Alcohol(Denatured), glycerine	Alcoholic
9	Strellium	2-propanol, glycerol	Alcoholic
10	Biopad	Isopropyl alcohol(70%)	Alcoholic

The standard culture of *Staphylococcus aureus*(ATCC 29213) and *Escherichia.coli* (ATCC 8739) are sub-cultured on nutrient agar and gram stained to identify the pure culture.

The above test organisms are inoculated in nutrient broth and incubated at 37⁰c for 18-20 hours and are used for their resistant / susceptibility test against different alcoholic / non-alcoholic hand sanitizers.

The Muller-Hinton agar is prepared and the test organism is swabbed to prepare lawn culture. The evaluation of the hand sanitizer is done by Kirby-Bauer technique.

The whatman filter paper of standard size are cut and sterilized separately in an autoclave. Each hand sanitizer is taken in a sterilized petridish and the above filter paper is soaked in it and kept on the surface of the lawn culture. The plates are kept at room temperature for 30 minutes before incubating it at 37⁰c for 18-20 hours. The results are observed and zone of inhibition are measured for each test. The experiment is done in triplicate and the zone of inhibition is recorded as average of three readings. The negative control was put as filter disc soaked with sterilized distilled water.

Result and Discussion:

The plates incubated at 37⁰c show lawn culture of *E.coli* and *S.aureus*. However zone of inhibition was observed around the disc impregnated with different hand sanitizers. The effectiveness of hand sanitizer from higher to lower levels for *E.coli* are Lux (16mm), Lifebuoy (15mm), Dettol (13mm), Alemlaq (12mm), Biopad (12mm), Higeen (11mm), Energy (11mm), Casanova (10mm), Strellium (10mm), and Nunu (10mm) (Photos 1-4).

Photo 1: Effect of Hand sanitizer Lux on *Escherichia.coli*

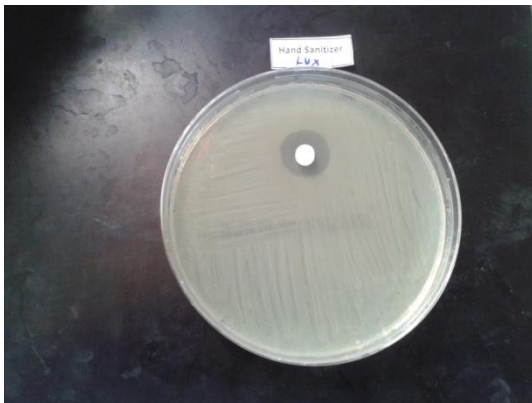


Photo 2: Effect of Hand sanitizer Lifebuoy on *Escherichia.coli*

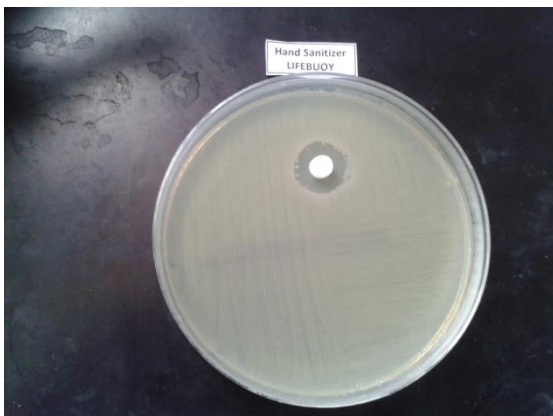


Photo 3: Effect of Hand Sanitizer Alemlaq on *Escherichia.coli*

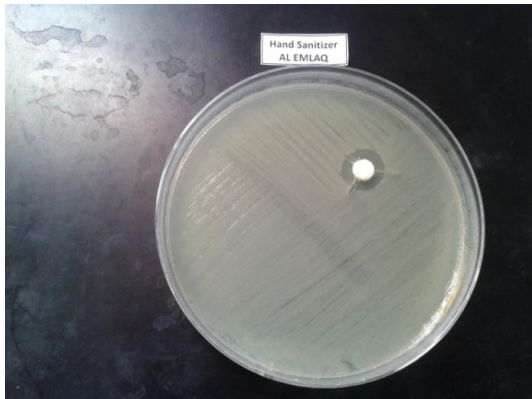
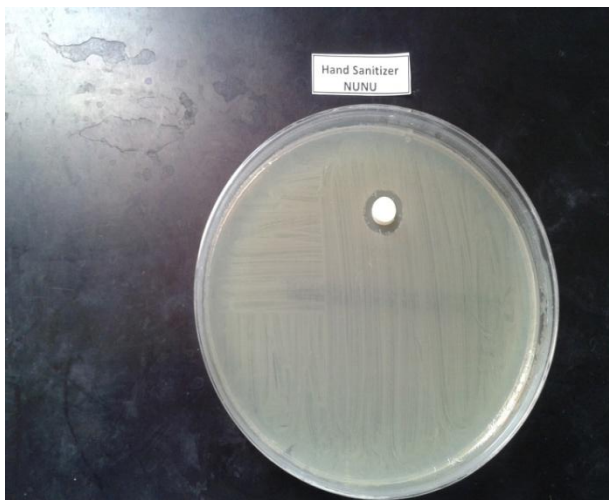


Photo 4: Effect of Hand sanitize Nunu on *Escherichia.coli*



The result for *Staphylococcus aureus* are Alemlaq (13mm), Dettol (12mm), Lifebuoy (12mm), Higeen (12mm), Strellium (10mm), Casanova (10mm), Energy (10mm), Lux (9mm), Nunu (9mm) and Biopad (7mm) (Photos 11-20)

Photo 5: Effect of Hand sanitizer Lux on *Staphylococcus aureus*

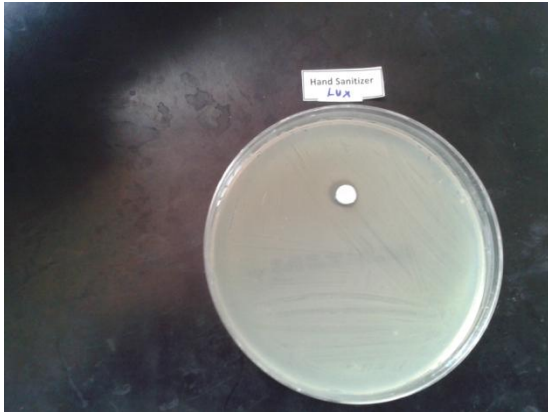


Photo 6: Effect of Hand sanitizer Lifebuoy on *Staphylococcus aureus*

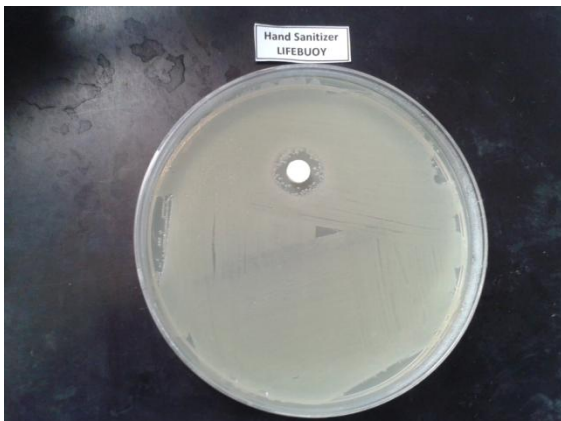
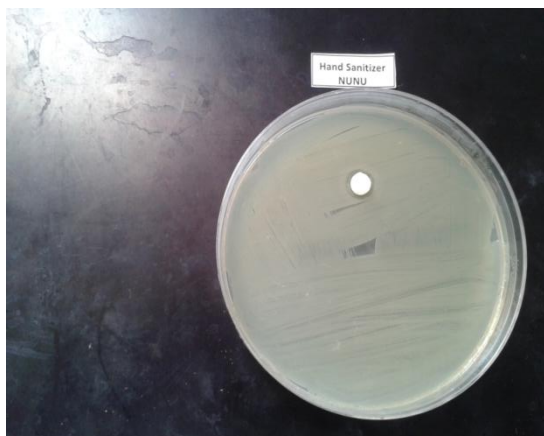


Photo 7: Effect of Hand Sanitizer Alemlaq on *Staphylococcus aureus*



Photo 8: **Effect of Hand sanitizer Nunu on *Staphylococcus aureus***



A comparative account of *Escherichia.coli* and *Staphylococcus aureus* against the above hand sanitizers is as shown in table 2 (a) and 2 (b).

Table 2 (a): Effectiveness of Hand Sanitizer against *Escherichia.coli* (Average of triplicate measured in millimeters).

S.No	Name	E.coli
1	Lux	16mm
2	Lifebuoy	15mm
3	Dettol	13mm
4	Alemlaq	12mm
5	Biopad	12mm
6	Energy	11mm
7	HiGeen	11mm
8	Casanova	10mm
9	Strellium	10mm
10	Nunu	10mm

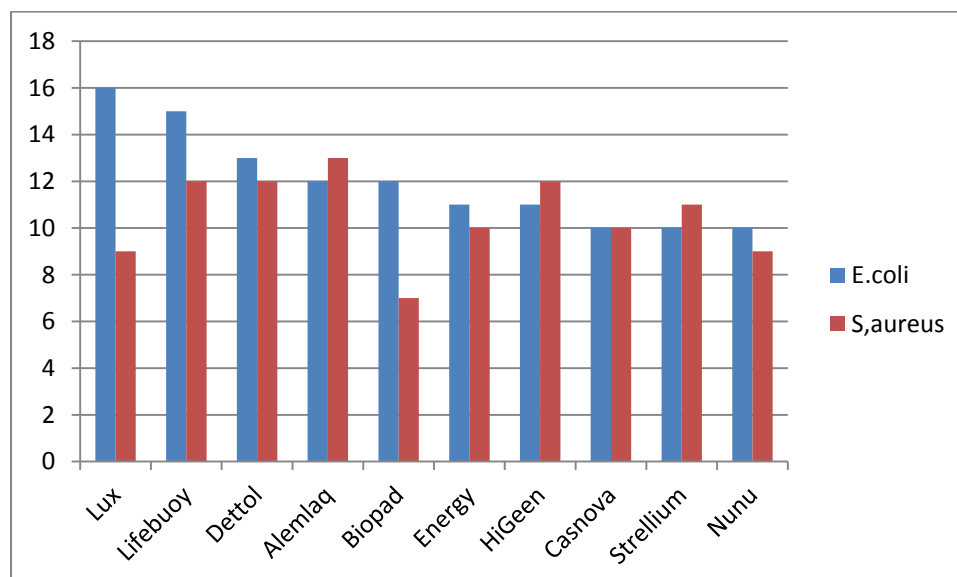
Table 2 (b): Effectiveness of Hand Sanitizer against *Staphylococcus aureus* (Average of triplicate measured in millimeters).

S.No	Name	S.aureus
1	Alemlaq	13mm
2	Dettol	12mm
3	HiGeen	12mm
4	Lifebuoy	12mm
5	Strellium	11mm
6	Casanova	10mm

7	Energy	10mm
8	Lux	09mm
9	Nunu	09mm
10	Biopad	07mm

All the hand sanitizers used in the market are found to be effective against the common bacteria and other microorganisms which can be contagious. The efficacy of the sanitizer varies both in its composition and its effect on the test organism. In our present study the two bacteria used (*E.coli* and *S.aureus*) were found to be sensitive to the above mentioned sanitizers. However the efficacy of sanitizers was found to be different for both the bacteria and *E.coli* was found to be more sensitive than *S.aureus* (graph 1).

Graph 1: Comparative efficiency of hand sanitizer for *E.coli* and *S.aureus*.



Among the sanitizers used against *Escherichia.coli* the one which was most effective with highest zone of inhibition was Lux (16mm) and the least effective was Nunu (10mm). Similarly for *Staphylococcus aureus* Alemlaq (13mm) was found to be most effective and the least effective was Biopad (7mm). The effect of all the sanitizers were compared with the negative control in which the sterilized distilled water was used having no effect on test organism.

The non-alcoholic sanitizer viz. Alemlaq (Alkyl Dimethyl Benzyl Ammonium chloride) was found to be more effective than other alcoholic sanitizer against *Staphylococcus aureus*. Similarly Lux (Sodium laurate) was found to be more effective than other alcoholic sanitizer against *Escherichia.coli*.

Conclusion:

In our present study hand sanitizers irrespective of alcoholic / non-alcoholic are found to be effective in controlling the bacteria. It is therefore recommended to use the hand sanitizer before and after the practical in laboratory, toiletries even before the meals. Since Alemlaq and Lux were the most effective against the bacteria, are the best choices.

References:

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