

Inhibitory Effect of Different Hand Sanitizer Against *Staphylococcus Aureus*

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ABSTRACT

The aim of the present study is to analysis the impact of alcohol-based hand sanitizer on the growth of *Staphylococcus aureus*. Three multinational alcohol based hand sanitizers were used in the study and marked A, B, C. Four different concentration of hand sanitizer i.e. 25, 50, 75, 100 % were prepared. The antimicrobial activity showed that all three hand sanitizer showed effective antibacterial activity against *Staphylococcus aureus*. Maximum inhibition zone was observed in 100% of the concentration of hand sanitizer of company B which was 5.10% more inhibition zone as compared to company A and C. So the present study revealed that alcohol-based hand sanitizers of the multinational company are effectively inhibited the growth of *Staphylococcus aureus*. The authors suggested to analysis the mode of action of hand sanitizer against *Staphylococcus aureus* in the future.

Keywords: *Staphylococcus aureus*, antibacterial activity, Hand sanitizer

INTRODUCTION

It is estimated that at any one time, more than 1.4 million people worldwide are suffering from infections acquired in hospitals. These nosocomial infections are also, in most cases, the result of poor hand hygiene.^[1] Traditionally, microbes habitation on hands is divided into resident and transient floras. Involved resident floras are commonly *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Enterococcus faecalis* that colonize the deeper skin layers and are resistant to mechanical removal. The transient floras consist of *Staphylococcus aureus*, *Escherichia coli*, and *Klebsellia pnuemoniae* that colonize the superficial layers of skin in a short period of time.^[2]

Hands are considered to be the primary route for transmitting microbes and infections to the individuals.^[3] Hand sanitizer is an alternate way to hand washing and it can be used after hand wash or when soap or water is not available. Antimicrobial property of sanitizer is based on its active ingredient and normally every sanitizer has an active ingredient, maybe

ethanol or isopropanol.^[4] Besides these, some inactive ingredients like polyacrylic acid, glycerin, propylene glycol, or extract of plants are added in hand sanitizers.^[4], ethyl alcohol or ethanol.^[5] Further, alcohol based hand sanitizers may reduce the chances to spread infections in the community and it has great demand in health care facilities, schools, food processing areas etc.^[6] Such alcohol-based hand sanitizers are recommended by WHO as the preferred method of cleaning hands, especially for hospitals and clinics.^[7,8] *Staphylococcus aureus* is Gram-positive bacteria (stain purple by Gram stain) that are cocci-shaped and tend to be arranged in clusters that are described as “grape-like and other biochemical tests have been described.^[9] *Staphylococcus aureus* is normal human flora, located on the skin and mucous membranes (most often the nasal area) of most healthy individuals and it does not normally cause infection on healthy skin.^[10] In particular, *S. aureus* has gained considerable attention from the medical community due to its involvement in the increasing number of nosocomial and community-

acquired infections resulting in nearly half a million hospitalizations and 50000 deaths each year in the USA alone.^[11-13] This bacterial species is armed with an array of virulence factors including toxins and immune avoidance strategies for invading and destroying host tissue during infection.^[13-15]

In fact, despite a label claim of reducing “germs and harmful bacteria” by 99.9%, some studies have observed an apparent increase in the concentration of bacteria in handprints impressed on agar plates after cleansing.^[16] However, and common man faces the dilemma while choosing the best among the lot.^[16] Therefore, the aim of the present study is to evaluate the impact of alcohol-based hand sanitizer on the growth of *Staphylococcus* strains.

MATERIALS AND METHODS

(i) **Culture:** Characterized *Staphylococcus aureus* strains were used in the present study.

(ii) **Hand sanitizer:** Three alcohol-based standard company hand sanitizers are selected and marked their name in code A, B, C.

(iii) **Treatment:** Treatment I - 100 % hand sanitizer, Treatment II - 75 % hand sanitizer, Treatment III - 50 % hand sanitizer, Treatment IV - 25 % hand sanitizer, control – sterilized distilled water. Sterilized distilled water was used for dilution of hand sanitizer.

(iv) **Preparation of sterilized disc:** Sterilized 6mm blank discs soaked in the membrane filter-sterilized hand sanitizer solution. Discs were allowed to stand for a period of one hour to ensure full saturation of the sanitizer preparations. The discs were then aseptically removed from the sanitizer solution and allowed to dry in an oven at 25°C.

(v) **Antibiotics sensitivity test:** Bacterial culture was activated by inoculating a loopful of the strain in Muller Hinton broth (30 ml) and incubated at 37°C for 24 h at 120 rpm until it achieves or exceeds the turbidity of the 0.5 McFarland standard. The turbidity of the actively growing broth culture is adjusted with sterile Muller Hinton broth to obtain turbidity optically comparable to that of the 0.5 McFarland standard. This standard is equal to 1 to 2 x 10⁸ CFU/ml. Add 0.2 ml inoculum into molten Muller Hinton agar media. Mixed well and it was poured into sterilized Petri plates. Placed prepared antibiotic disc on inoculated plates and were incubated at 37°C for 24 h. The inhibition zone was determined by measuring the diameter of the zone of inhibition around the antibiotics disc.

RESULTS AND DISCUSSION

Hand sanitizers are available in a variety of forms mostly in gel or liquid preparations. Every sanitizer has an active ingredient, maybe ethanol or isopropanol. The antimicrobial property of sanitizer is based on its active ingredient. Four different concentrations were made of all three samples i.e 25, 50, 75, and 100% against *Staphylococcus aureus*. Three-hand sanitizers of the multinational companies were selected for the present study to evaluate the impact on growth and activity of *Staphylococcus aureus*. All three company coded name A, B, C showed maximum growth in 100% concentration but company B showed 5.10% more inhibition zone as compared to company A and C. But 75% hand sanitizer of company C showed 18.76 % as compared to company A and B. This is little surprising that 75% hand sanitizer of company C was more effective when the result of other concentrations was different. The 50% and 25% hand sanitizer of all companies showed 4.66 and 3.66 mm respectively (Table 1). This inhibition zone is measured in a radius of the inhibition zone around the disc. Each result confirmed that alcoholic based hand sanitizer effectively inhibited the growth of *Staphylococcus aureus*. Similarly, there was a significant decrease in transient *S. aureus* on the fingertips of HCWs in the BZK hand sanitizer use week as compared with the 70% ethanol hand sanitizer use week.^[17] Alcohol-based hand sanitizers (ABHS) and antiseptic hand soap for handwashing is 2 components of the current guidelines for hand hygiene for HCWs recommended.^[18] All observation confirmed that alcohol-based hand sanitizer of Multinational companies is effective against *Staphylococcus aureus*.

Conclusion: The present study revealed that alcohol-based hand sanitizers of the multinational company are effectively inhibited the growth of *Staphylococcus aureus*. As we decreased the concentration of hand sanitizer than there is a gradual reduction in inhibition zone against *Staphylococcus aureus*. The authors suggested to analysis the mode of action of hand sanitizer against *Staphylococcus aureus* in the future.

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Table 1: Inhibitory effect of different sanitizer as detected by Agar disc diffusion technique against *Staphylococcus aureus*.

Treatment	Inhibition zone (mm)- Radius			
	I	II	III	Mean value
Company A (100%)	7	7	6	6.66
Company B (100%)	8	6	7	7.0
Company C (100%)	7	7	6	6.66
Company A (75%)	5	6	5	5.33
Company B (75%)	6	5	5	5.33
Company C (75%)	6	7	6	6.33
Company A (50%)	5	4	5	4.66
Company B (50%)	5	5	4	4.66
Company C (50%)	5	5	4	4.66
Company A (25%)	4	4	3	3.66
Company B (25%)	4	3	4	3.66
Company C (25%)	4	3	4	3.66
Control (water)	0	0	0	0

* Values are mean of 10 replicate

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