



Research Paper

# COMPARATIVE EVALUATION OF EFFICACY OF ALCOHOLIC Vs NON-ALCOHOLIC HAND SANITIZERS

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With respect to the realization that hand hygiene is a prerequisite for the prevention of diseases, the conventional method of washing hand with soap is not quite popular these days. Instead it is the use of handsanitizer, which has gradually become the method of choice due to its various advantages. In the present work, alcoholic and nonalcoholic hand sanitizers were prepared in the form of polymer based gels and their antiseptic efficacy was evaluated. Microbiological methods revealed that alcoholic hand sanitizers were more efficacious in providing hand hygiene.

**Keywords:** Hand Safety, Alcoholic Hand Sanitizer, Gel, Isopropyl alcohol

## INTRODUCTION

Hands are regarded as a major source of transmitting infection. It has been estimated that there are not less than 10000 organisms per cm<sup>2</sup> of normal skin. This include both nonpathogenic resident flora as well as pathogenic transient flora (Carter *et al.*, 2000). On the other hand, health care-associated infections constitute one of the greatest challenges of modern medicine (Mathur, 2011). Pandemic and avian influenza are known to be transmitted via human hands (Pickering *et al.*, 2011). Hands contamination also causes a number of episodes of illness for the majority of the registered symptoms with the strongest effects for common cold, coughing, fever, and diarrhoea (Hubner *et al.*, 2010). Further,

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. Thus, hand hygiene is a key component of good hygiene practices in the home and community and can produce significant benefits in terms of reducing the incidence of infection, most particularly gastrointestinal infections but also respiratory tract and skin infections (Bloomfield, 2007). It also prevents the transmission of pathogens to food.

Decontamination of hands can be carried out by various means. This include either by washing hands with soap or by the use of various agents such as gloves, skin protectants and waterless

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hand sanitizers (HS), which reduce contamination on hands by removal or by killing the organisms in situ. Washing hands with soap is not feasible all times due to unavailability of resources. It is not practical to find purified water and soap at all places. Similarly the use of gloves is limited to hospitals and that too require use of aseptic technique before and after using gloves. Thus amongst these, HS have gradually become the most effective means of preventing spread of diseases and were the subject of present study.

A hand sanitizer is a supplement or alternative to hand washing with soap and water. HS, sometimes also referred to as rub, can be presented in the form of either a gel, as foam or as liquid solutions. Further, the vehicle for HS may be either alcohol (alcoholic) or aqueous (called non-alcoholic). For preparation of alcoholic hand sanitizers(AHS), ethanol, isopropanol, and/or n-propanol are used (listed in order of increasing antibacterial activity at equal concentrations). The antimicrobial activity of alcohols is based on its capacity to induce microbial protein denaturation. These were reported to have excellent and rapid germicidal activity against vegetative bacteria, fungi, and many viruses. On the other hand, non-alcoholic hand sanitizer (NAHS) incorporate small concentrations of the nitrogenous cationic surface-acting agent such as benzalkonium chloride or the chlorinated aromatic compound triclosan or povidone-iodine.

In the present study, iso propyl alcohol based alcoholic and benzalkonium chloride(BKC) based nonalcoholic HS were formulated in the form of polymer based gel and their efficacy was tested against microbial contamination.

## MATERIALS AND METHODS

Carbomer was received as a gift sample from

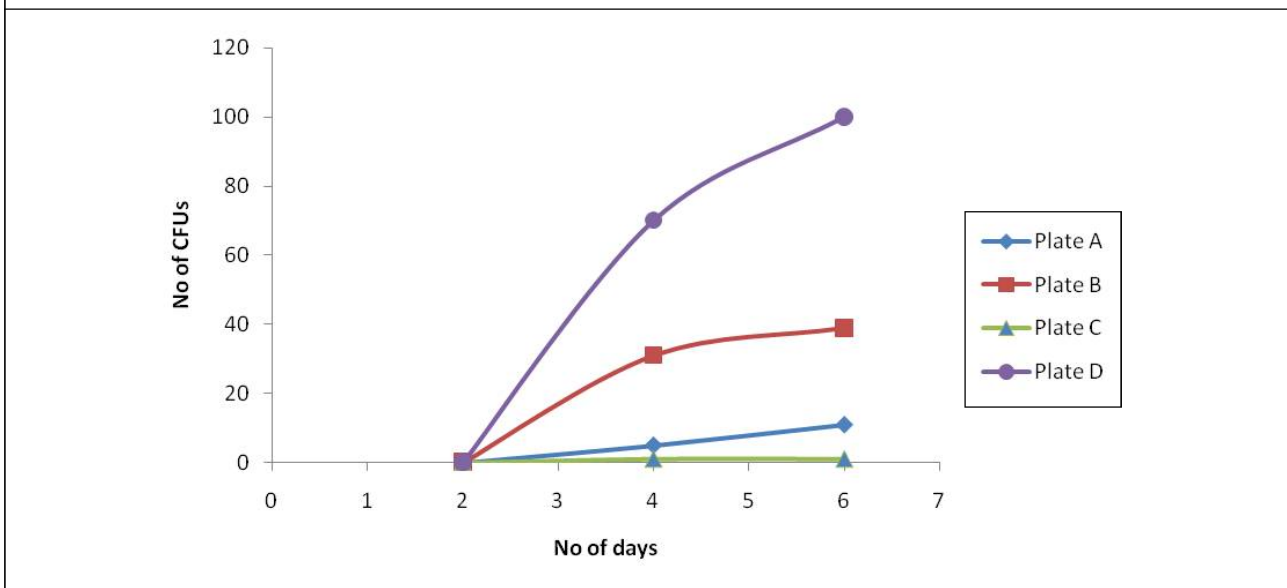
Laborate Pharmaceutical Ltd., Panipat. Benzalkonium Chloride (BKC) and iso propyl alcohol IPA was used as antiseptic in NAHS and AHS respectively. All the reagents used were of analytical grade.

Bothe AHS and NAHS sanitizers were formulated using carbomer 940, as the polymeric component. While, AHS contained 60% IPA, NAHS contained 0.1% BKC. Both sanitizers were tested against agar plate incubation method as follows. Nutrient agar media was prepared and sterilized using autoclave. Four agar plates, labeled as A,B,C and D were prepared. Plate C was kept aside as the control. Both AHS and NAHS were applied in sufficient quantity to separate visibly non dirty hands and rubbed for around 25 seconds. A cotton swab sample was taken from the hands and applied to sterilized agar plates A and B respectively. Plate D was also taken as control where cotton swab rubbed on dirty hands was applied. All the plates were kept for incubation and growth of micro- organism was observed at interval of 2,4 and 6 days. Colony Forming Units (CFU) were observed and counted with the help of a colony counter.

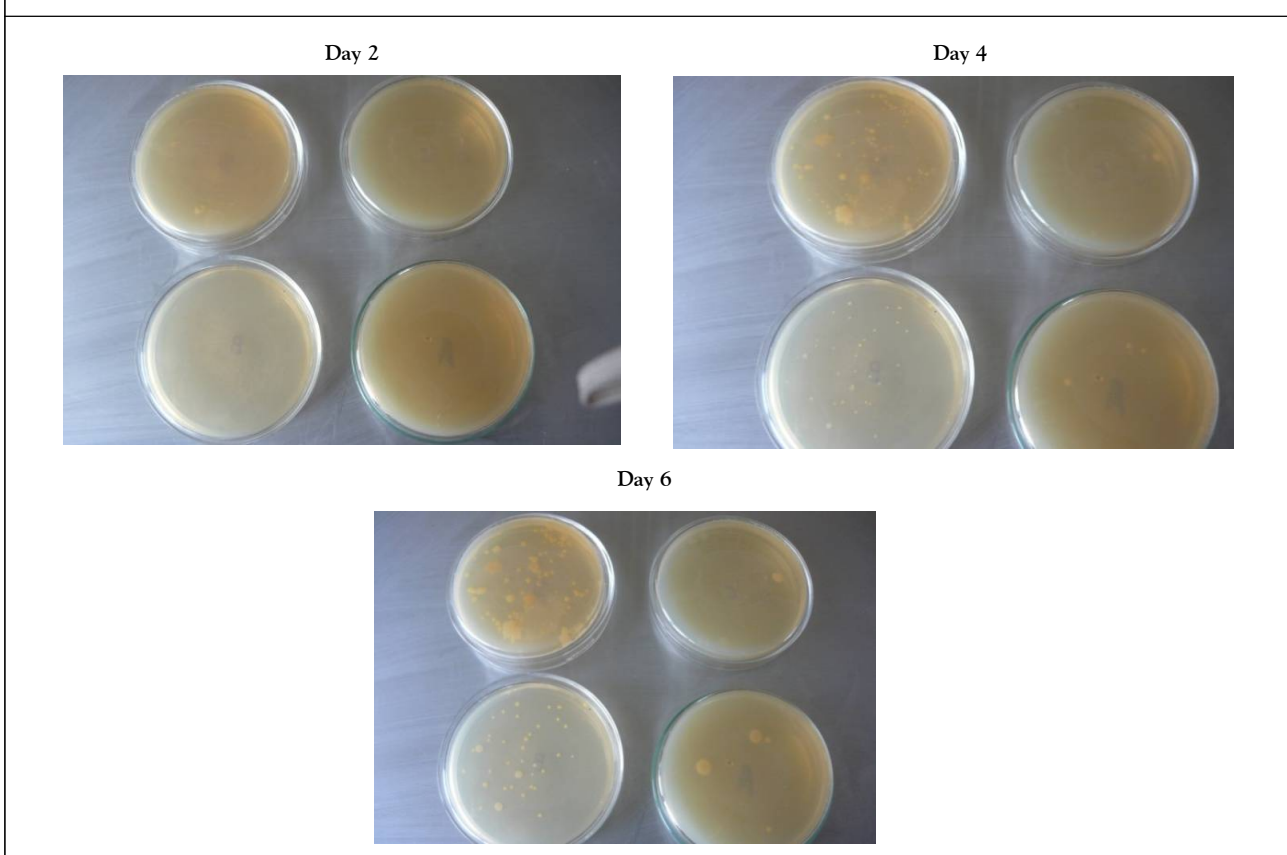
## RESULTS AND DISCUSSION

The results obtained as number of CFUs observed on different agar plates on various days were presented in Figure 1. Figure 2 shows a photograph depicting microbial growth on different plates during incubation period. As evident from the figures, no growth was observed in all the plates after a period of 2 days. However, on 4<sup>th</sup> day, formation of few microbial CFU's was noticed on some plates. By the 6<sup>th</sup> day, the size of colonies increased and few more were also observed. Plate D showed maximumCFUs, which was expected since no sanitizer was

**Figure 1: Figure Showing no of CFUs Formed on Different Plates During the Incubation Period**



**Figure 2: Photograph Showing Development of CFUs in Various Agar Plates on Different Days**



applied. Minimum CFU were observed on the plates AHS when applied to hands. It is expected that AHS killed microbes and hence very few CFUs

were observed in plate A. Plates applied with cotton swabs rubbed on NAHS, on the other hand, showed considerable number of CFUs, which

reveals lesser efficacy to contain microbial growth as compared to AHS.

Washing hand with soap is the best method for hand safety which is a debatable issue when compared with practice of hand sanitizer usage as far as hand safety is concerned. But it is not always practical to wash the hands every time because of lack of adequate facilities. Different researches have different opinions. The Centers for Disease Control and Prevention (CDC) released the 2002 guidelines "recommending alcohol-based gel as a suitable alternative to hand washing for health-care personnel in health-care settings." The statement is meant for Health Care personnel. On the contrary, The FDA Model Food Code Rules and Regulations make the provision that hand sanitizers may be used by foodworkers in addition to, but not in place of proper hand washing (Simonne, 2005). It is also proposed by some research groups that alcohol based hand sanitizers are effective only when hand surface is not covered with soil. However, a research study disapproved the above. According to this study, no significant difference in efficacy was detected between hands that were clean versus dirty or oily and hence AHS may be an appropriate hand hygiene method for hands that are moderately soiled (Pickering, 2011).

Moreover, a study was designed to compare the efficacies of bland soap hand wash and isopropyl alcohol hand rinse in preventing transfer of aerobic gram-negative bacilli to urinary catheters via transient hand colonization acquired from direct patient contact (Ehrenkranz and Alfonso, 1991). The results revealed that Bland soap handwash was generally ineffective in preventing hand transfer of gram-negative bacteria to catheters following brief contact with

a heavy-contamination patient source and alcohol based hand rinse was generally effective.

Prospective, randomized, double-blind study of acceptability of alcohol hand rinse with and without emollients revealed that skin condition of hands was significantly better when volunteers used the alcohol rinse containing emollients (Rotter *et al.*, 1991). Thus, AHS not only provided more efficacious hand hygiene, these are also supplemented by improving hand skin condition. One among the important limitations of AHS is its abuse liability. The number of new cases per year for ingestion of alcohol based hand sanitizer reportedly increased significantly during the period 2005-2009 (Gormley *et al.*, 2012). Such practices however should be avoided as they are a hindrance in establishment of AHS as a superior hand hygiene method. Thus hand washing can be replaced by AHS as supported by its scientific and clinical evidence (Widmer, 2000). Thus the present study supplements the fact that AHS provide an economical and convenient efficacious mean of achieving appropriate hand hygiene. It is regarded that various formulation and process parameter such as concentration of sanitizing agents, spectrum of microorganism killed, different dosage forms of hand sanitizer need to be optimized for further establishment of the results obtained in the present study. Moreover the guidelines for the dispenser must be followed before dispensing this agent and a proper training for its effective use must be given.

## CONCLUSION

In the present research work, HS gels were formulated and compared using IPA and BK Gas antiseptic agent respectively. The results revealed better efficacy of AHS in comparison to NAHS at the concentration levels used in the present study.

An alcohol-based handrub requires less time, is microbiologically more effective, and is less irritating to skin than traditional handwashing with soap and water. Therefore, alcohol-based hand sanitizer is an effective measure to control the spread of diseases and in maintaining the hand hygiene.

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