Efficacy of tap water or tap water and soap on Handwashing to remove hands contaminated bacteria

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Abstract: This study was conducted to identify the efficacy of handwashing by using tap water alone and soap with tap water together at the self-contaminated hands. Handwashing is stated to be influential for the prevention of transmission of several contaminated microorganisms.One hundred twenty (120) volunteer students were participated in self-contaminated hands by touching door handles and other public handles at the college of medicine and teaching hospital buildings. Then, the volunteers were asked to wash their hand with only tap water or tap water and soap together; no handwashing samples were also collected. One hundred forty six different isolates were identified; Escherichia coli 30.82%, Staphylococcus epidermidis 19.18%, and Candida spp. 10.96% were the most organisms isolated. Enterobacter spp. 8.91%, Staphylococcus aureus 6.16%, and Klebsiella spp. 6.16% were also isolated in this study.However, Klebsiella spp. and Enterobacter sppwere the most organisms affected in handwashing procedure in a percent reduction of 50% and 42.9% respectively as compared with other organisms which shows little efficacy of handwashing responses using tap water only. In contrast with the other attempted using soap and tap water to wash hands of self-contaminated volunteers which shows high effected responses. Using soap and tap water were more effective than using tap water alone to remove the bacteria from the contaminated hands.

Key words: Handwashing, Tap water, soap, Bacteria

Introduction:

Hand hygiene has been considered an important act for public health and as good personal hygiene promotion. Hands can be cleaned in order to remove dirt, soil, and/or microorganisms (1). Careful care to hand hygiene can lower rates of infections that might be transmitted from the contaminated hands or hands in contact with the health care facilities, child care centers and households areas (1, 2, 3). With adequate hands hygiene, removal of pathogenic microorganisms can be disrupted and the transmissions of infectious disease are also reduced. Administration of good hygienic practices can prevents or minimizes disease and/or the spreading of disease. Hand washing experience is one of very good practice for people who handle food or work in the medical field, but it is also an important habit for the general public. People can be exposure to the infection with respiratory illnesses such as (influenza or the common cold), if they don't wash their hands before contacting their mouth, nose oreyes. Indeed, the Centers for Disease Control and prevention (CDC) has mentioned:"It is well

documented that one of the most important measures for preventing the spread of pathogens is effective hand washing." 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. It protects best against diseases transmitted through fecal-oral routes (such as many forms of stomach flu) and direct physical contact (such as impetigo). (4).

High percentage of the children around the world had been dead because of the diarrheal diseases (5). The WorldHealth Organization (WHO) recognizes the spread of diarrheal diseases as a serious globalproblem and estimates that each year (6), there are more than 2.2 million lives lost due to theseinfections, more than from malaria, HIV/AIDS and measles combined (7).The majority of thesedeaths are in children under 5 years of age (8). It has been suggested that hand washing maysubstantially reduce the risk of diarrheal diseases (7).

In 2007, a great collaboration work was done to analyze the relationship between handwashing behavior and the subsequent experience of child diarrhea in households.

The study was targeted 20 million people in rural Bangladesh which identified that the handwash practice were associated with fewer diarrheas (9, 10).

A number of studies have compared hand hygiene methods (11). Whereas, restricted of these have been published showing the effect of water and soap on hand wash on bacterial contamination of hands in the public. Therefore, this study was aimed to identify the efficacy of handwashing by tap water alone and soap with tap water together at the self-contaminated hands.

Materials and Methods:

Bacteriologic Media and chemicals:

MacConkey agar (MAC), MacConkey broth, and Mannitol Salt Agar (M.S.A) were purchased from HiMediaLaboratories (Mumbai, India). These media were prepared according to the manufacturer's instructions. API 20E biochemical test to determine the identity of the bacteria as well as Gram stain, Catalase and oxidase were also purchased from HiMedia Laboratories.

Experimental Design:

A total of 120 volunteer students from college of medicine were participated in this study. The volunteers were divided for four groups of 30 volunteers. The participates were asked to clean their hands with alcohol gel and dry it with paper tissues before they asked to touch and wipe their hands to contact surfaces such as door handles, seats, handrails and other public surfaces at the teaching hospital and the college buildings. They asked to do that in order to contaminating their hands with any bacteria were present on the surfaces. Then, every individual of the volunteers hands were wiped with normal saline wetted swab and prepared for culture on MacConkey broth and mannitol salt agar. Each group of participated volunteers were then also divided for two groups of 15 and asked to wash their hands as they would normally do every time without instruction on length of time. Each one group of 15 were washed their hands with tap water only and the other group with soap and tap water. The volunteers that were participated to handwashing were then provided with paper tissues to dry their hands. Normal saline wetted swab were wiped across the fingers and whole of the contaminated

area of the rest of hand for each individual and then were given a disinfectant to clean and disinfect their hands. The swabs were directly processed and cultured on MSA agar and then a piece of that swab was cut into a universal tube containing 10 mL of MacConkey broth. The plates and the broth were then incubated at 37° Cfor 48 hours. Samples from MAC broth were streaked onto MAC agar and incubated for 24 hours at37° C. A total of 146 isolates were identified. Colonies that were appeared on MSA agar were processed for further identification using techniques mentioned by (12). For all other colonies appeared on MAC agar were also processed for getting their identity following inoculation on API 20E biochemical test and according to the criteria mentioned by (12). However, a total of (60 swabs taken form volunteers washed their hand with tap water only and 60 swabs from volunteers washed their hand with soap and tap water) were submitted for statistical analysis to check the prevalence of bacterial contamination and the effect of the hand wash using the percent reduction test according to the formula of percent reduction= (A-B) *100/A; where A is the number of isolates before handwashing and B is the number of isolates after handwashing.

Results:

Different organisms were isolated in this study which was displayed in Table 1. *Escherichia coli* 30.82%, *Staphylococcus epidermidis* 19.18%, and *Candida spp.* 10.96% were respectively the most organisms isolated from the total of 146 isolates reported from the self-contaminated trails. *Enterobacter spp.* 8.91%, *Staphylococcus aureus* 6.16%, and *Klebsiella spp.* 6.16% were also isolated in this study. On the other hand, mixed organisms were also isolated in a percentage of 17.81% from the total isolates and it was not processed for further identification. Table 2, shows the organisms isolated from hands of self-contaminated volunteers, and the efficacy of handwashing with tap water only. *Klebsiella spp.* and *Enterobacter spp*were the most organisms affected in handwashing procedure in a percent reduction of 50% and 42.9% respectively as compared with other organisms which shows little efficacy of handwashing responses. In contrast with the other attempted, the researchers were using soap and tap water together to wash hands of self-contaminated volunteers (Table 3). It shows more efficacy results for most of the

isolated organisms from the percent reduction test as compared with using tap water only to eliminate organisms contaminated the self-contamination hands of the volunteers (Table 3).

Table 1. Organisms isolated from hands of self-contaminated volunteers, by touch and wipe their hands oncontact surfaces such as door handles, seats, handrails and other public surfaces.

Organisms	Isolates after self-contamination	Percentage %
Escherichia coli	45	30.82%

Staphylococcus epidermidis	28	19.18%
Enterobacter spp.	13	8.91%
Candida spp.	16	10.96%
Staphylococcus aureus	9	6.16%
Klebsiella spp.	9	6.16%
Mixed Isolates	26	17.81%
Total	146	100%

Table 2. Organisms isolated from hands of self-contaminated volunteers, and handwashing with tap water only.

Organisms	Isolates after self-contamination	Isolates after wash with tap water only	% Reduction
Escherichia coli	20(33%)	15(25%)	25%
Staphylococcus epidermidis	16(27%)	10(17%)	37.5%
Enterobacter spp.	7(12%)	4(7%)	42.9%
Candida spp.	8(13%)	7(12%)	12.5%
Staphylococcus aureus	5(8%)	3(5%)	40%
Klebsiella spp.	4(7%)	2(3%)	50%
Total	60(100%)	60(100%)	

Table 3. Organisms isolated from hands of self-contaminated volunteers, and handwashing with tap water and soap.

Organisms	Isolates after self-contamination	Isolates after soap & water wash	% Reduction
Escherichia coli	25(42%)	6(10%)	76%
Staphylococcus epidermidis	12(20%)	2(3%)	83%
Enterobacter spp.	6(10%)	1(2%)	83%

Candida spp.	8(13%)	4(7%)	50%
Staphylococcus aureus	4(7%)	1(2%)	75%
Klebsiella spp.	5(8%)	0(0%)	100%
Total	60(100%)	60(100%)	

Discussion:

Health care-associated infections and cross transmission of nosocomial infections have ranked in the top of death causative agents around the world and united states and it is estimated as responsible for several infections (13, 14). The most common pathogens involved are Gram-negative bacteria such as *E. coli* and *pseudomonas* as well as aerobic Gram-positive bacteria such as coagulase negative Staphylococci and *Staphylococcus aureus* besides of several viruses which are well described in the health care setting (15, 16, 17, 18). In this study, the researchers were isolated several organisms (Table 1) which come in agreement with criteria mentioned by the health care-association and some were nosocomial organisms that might cause serious infections through the transmission procedure and through the contamination of public used utensils.

Hand hygiene and proper handwashing measurements have been shown to reduce the level of transient microorganisms on the hands (19, 20). For that the Centers for Disease Control and Prevention (CDC) and other health organizations recommend using hand antiseptic as a key measure for reducing the incidence of hand transmission infections (21). However, many studies have been done to demonstrate the effectiveness

of antiseptic and detergent on hands (22, 23). This study has shown reducing the prevalence of contamination between the handwashing procedures as compared with no handwashing (Table 2 &3). Overall, using tap water alone slightly reduces the contamination as compared with using soap and tap water together. The reason for these differences seems to be due to using the soap as detergent which might cause the volunteers to wash their hands longer than using the water alone which were given a chance to remove bacteria more than using water alone. Burton et al., (23) has also reported similar findings as compared with using soap or water alone but unlikethe same study we have isolated *E.coli* from the hands of self-contaminated volunteers as these bacteria can play very important roles in diarrheal disease (5, 24). Most of the bacteria that were isolated in this study were a candidate to cause disease in human beings and isolation of bacteria such as *Staphylococcus aureus* is considered as big health associated problem for transmission of such pathogenic organism.

Conclusion:

This study has shown the efficacy of using soap with tap water to remove self-contaminated hand with bacteria through wipe the hands over the surfaces of public's handles. Using soap and tap water were more effective than using tap water alone to remove the bacteria from the contaminated hands. These results are support the other findings which had been mentioned in using soap with water to remove bacteria from any contaminated hands (25, 26).

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Conflict of interest: None

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