



## Effectiveness of portable hand rubbing sanitizers during Hajj-A pilot study

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Received: November 11, 2016; Accepted: November 21, 2016

Available online: 1<sup>st</sup> December 2016

**Abstract:** Hands are the main pathways of germ transmission during Hajj. Hand hygiene results in the reduction of microorganisms on hands when performed regularly. The study evaluated the effectiveness of the using a portable hand rubbing sanitizers on reducing the number of bacteria loads of hand during Hajj. Fifteen hajji participants volunteered to be a part of the Pilot Study. They were asked to rub their hands frequently during the study period. Their hands were tested and ATP levels were recorded before and after rubbing for three days. The results of the first day testing showed that ATP levels on the participants' hands ranged from higher levels before rubbing and changed to a lower level after rubbing. The average readings of ATP before rubbing in the first, second and third day were of 312, 104 and 71 RLU while after rubbing the hands were 34, 26 and 8 RLU respectively. It was concluded that the using of portable hand rubbing dispensers significantly reduces the number of bacteria, require less time, act more rapidly and therefore reducing the infection rates that can be spread throughout Hajj community.

**Key words:** Hand hygiene; Hajj; ATP; Rubbing; Microorganisms; Contamination

### Introduction

Hand hygiene is defined as any method that removes or destroys microorganisms on hands [1]. It is a general term that applies to either handwashing, antiseptic hand wash, antiseptic hand rub, or surgical hand antisepsis. The aims of hand hygiene practices are to eliminate rapidly, as far as possible, the transient (contaminating) flora and also to have persistent antimicrobial activity on the resident flora [2]. Personal hygiene is a key component of human well-being regardless of religion, culture or place of origin. While the earlier guidelines recommended the washing hands with the use of a water and soap or a soap solution [3] in preference to waterless antiseptic solutions, recent guidelines have recommended the use of waterless antiseptic agents in preference to handwashing with soap and water [2,4-6]. Over the time disinfectant based hand rubs have replaced hand washing. Whatever the method is, correct performance of hand hygiene should result in a reduction of microorganisms on hands. The amount of time spent in washing or rubbing hands is important to reduce the transmission of pathogens to others. Proper hand hygiene involves rubbing hands vigorously for at least 15 to 20 seconds [1]. It has been estimated that hand hygiene could save a million lives a year [2]. In community or hospitals, the hands of the people come in frequent contact together resulting in colonization of the hands with transient flora and a higher bacterial load [7,8]. Hajj

is one of the largest annual gatherings in the world. Approximately 2.5 million people from different parts of the world with diverse medical and social backgrounds gathered there. In 1438H (2016) Hajj season, a campaign has been launched by The Custodian of the Two Holy Mosques Institute for Hajj and Omrah to promote the message: "wash your hands". The campaign aimed to prevent the spread of infections during Hajj rituals. Hand hygiene is a key component of good hygiene practice in the Hajj gatherings and can produce significant benefits in terms of reducing the incidence of infection. Although hand hygiene is regularly carried out by pilgrims under a ritual purification, often called ablution [9], the practices such sanitizer-based hand rubs are important in infection control in such communities where people are in constant contact with one another and surfaces covered with microorganisms [10,11,12]. Quaternary ammonium compound hand sanitizers are fungistatic, bacteriostatic against Gram-positive bacteria, as well as most Gram-negative bacteria. They are positively charged derivatives composed of a nitrogen atom linked directly to four alkyl groups, which may vary in their structure and complexity [13]. Of this large group of compounds, alkyl benzalkonium chlorides are the most widely used as antiseptics. Other compounds that have been used as antiseptics include benzethonium chloride, cetrimide, and

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<http://dx.doi.org/10.21746/ijbio.2016.12.004>



cetylpyridium chloride. They are neither flammable, nor alcoholic. The Centers for Disease Control and Prevention (CDC) declared that, if hands are not visibly soiled, use an alcohol-based hand rub for routinely decontaminating hands [14]. Alcohol-based products contain one of two active ingredients; alcohol or isopropanol. Both are effective antiseptic products, but both of them are highly flammable and they need to consult their local fire authorities and following the instructions of the civil defense in Holy places because flammable substance poses a serious health or fire danger if not used and stored properly.

Quaternary ammonium compound hand sanitizers require no access to water and sinks and have multiple uses in clinical, food line and domestic household biocides [15,16]. They were designed for application in hand hygiene to inactivate microorganisms and/or temporarily suppress their growth. They are rapid in action, cheap, safe for hands, easy to use. The aim of this pilot study was to evaluate the effectiveness of using portable quaternary ammonium compound hand sanitizers on reducing the number of bacteria loads of hands during Hajj rituals.

## Materials and Methods

### Evaluation design

Fifteen Hajji participants volunteered to be part of the pilot study during the Hajj Hand Hygiene Campaign which was undertaken by The Custodian of the Two Holy Mosques Institute for Hajj and Omraa at Makkah from 4 to 19 of September 2016. They were instructed verbally to perform hand hygiene at the right moments, every time during their Hajj rituals for three days. Initially, each one was tested using the Hygiena EnSURE system and the ATP levels were recorded. Participants then rubbed their hands according to the verbal

instructions for 15-20 seconds and the hands were tested again. One day later, the participants returned to have the ATP levels tested again, before and after hand rubbing and the ATP results were recorded. One day later or two days after the initial test, the participants returned to have the ATP levels tested again before and after hand rubbing and the results were recorded.

### ATP Testing System

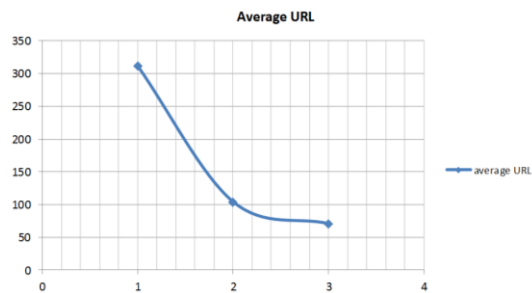
The Hygiena EnSURE was the instrument used to collect, analyze, and report the ATP levels. The Ultra snap swab tests made for the Hygiena EnSURE system were utilized to measure the ATP levels on each hand of volunteer. The Hygiena EnSURE numeric readings are displayed as Relative Light Unit (RLU) values. The higher the RLU readings are the higher the amount of contamination on the sample. To perform each ATP test, a swab is removed from a new test tube and rotated on the surface of hand of each participant. Once the swab (sample) was placed back in the test tube, the plastic Snap Valve was broken to release the buffer down the swab shaft. While in the buffer reagent, any ATP contained on the swab is released. The test tube was shaken for 5 seconds and then placed in the Hygiena EnSURE device.

## Results

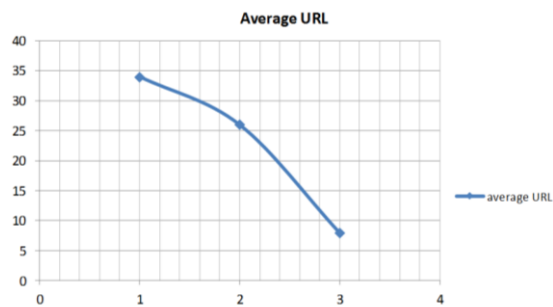
The results of the first day testing showed that ATP levels on the participants' hands ranged from high levels before cleaning changed to lower level after cleaning (Table 1). The average reading before rubbing in the first, second and third day, was an ATP score of 312, 104 and 71 RLU (Table 1 and Figure 1). After rubbing the hands in the first, second and third day, the average reading of ATP was 34, 26 and 8 RLU respectively (Table 1 and Figure 2).

**Table 1:** The testing of the participants hands before and after rubbing

Participants	First day		Second day		Third day	
	Pre-rubbing RLU	Post-rubbing RLU	Pre-rubbing RLU	Post-rubbing RLU	Pre-rubbing RLU	Post-rubbing RLU
1	121	11	75	25	55	7
2	201	32	115	45	88	11
3	117	9	35	12	31	4
4	815	89	220	59	102	9
5	84	5	43	11	36	5
6	112	10	31	7	43	4
7	221	13	135	25	99	8
8	176	14	102	23	85	10
9	64	4	19	4	17	2
10	418	59	174	24	111	11
11	1119	123	145	35	131	14
12	118	11	80	23	66	7
13	189	17	65	12	45	4
14	230	27	95	18	72	8
15	702	85	233	65	120	10
Average	312	34	104	26	71	8



**Figure 1:** The average reading before rubbing in the first, second and third day,



**Figure 2:** The average reading after rubbing in the first, second and third day,

## Discussion

The study conducted to evaluate the efficacy of the newly portable hand rubbing sanitizers on reducing the amount of bacteria loads of hand during Hajj. In addition to evaluate Hajj Hand Hygiene Campaign that was undertaken by The Custodian of the Two Holy Mosques Institute for Hajj and Omraa at Makkah over the first fifteen days of Dhu al-Hijjah 1437 H period (from 4 to 19 of September 2016) under sponsorship of Umm alquraa University. The participants were enabled on how to use portable hand rubbing dispensers to perform hand hygiene during their Hajj rituals. Proper hand hygiene is a fundamental element of infection control strategies in mas gatherings community. After verbal orientation, the results of the first day testing showed that ATP levels on the participants' hands ranged from high before cleaning to low after cleaning. The hands serve as a medium for the propagation of pathogenic microorganisms which may lead to chronic or acute illness during mas gathering [17]. The pilot study showed that the average reading before and after rubbing in the first day, was an ATP score of 312, 34 respectively indicating a reduction in bacterial contamination within only 15-20 seconds. That is in agreement of a range of studies which has been carried out to determine the efficacy of hand hygiene [15,18,19]. They estimated that practicing hand hygiene produced a mean reduction of up to 2.4 log within 1 minute. In a similar study, 80% of the samples before application of hand rub solution showed high level bacterial growth while after hand hygiene the samples yielded very low bacterial growth [20]. It has been shown that hand rubs were

proven to be microbiologically more effective [15,21,22]. In the present study, the average reading before rubbing in the first, second and third day in comparison to the average reading after rubbing in the same days, would suggest an equivalent good rating of sanitary especially when quaternary ammonium compound hand rubs have been applied and proven microbiologically in-vitro and in-vivo to be more effective [20]. The health impact of hand hygiene within a given community can be increased by using products and procedures, either alone or in sequence, that maximize the log reduction of both bacteria and viruses on hands [23]. In conclusion, hand hygiene practices using portable nonalcoholic hand sanitizers require less time than traditional hand washing, act more rapidly. It reduces the number of bacteria on the hand and therefore, reducing the infection rates with pathogenic bacteria that can be spread throughout the community of Hajj.

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**Cite this article as:**

Bassam H. Mashat. Effectiveness of portable hand rubbing sanitizers during Hajj-A pilot study. *International Journal of Bioassays* 5.12 (2016): 5134-5137.

**DOI:** <http://dx.doi.org/10.21746/ijbio.2016.12.004>

**Source of support:** Nil

**Conflict of interest:** None Declared