

## ARTICLE

# Effect of the Muslims' Ablution Practice on Nasal Colonization of *Staphylococcus aureus*

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## Abstract

**Background:** The human nose contains many different types of bacteria including *Staphylococcus aureus* (*S. aureus*). It is possible to get rid of this pathogen using many topical antiseptics or antibiotics. However, good washing using clean water may be valuable to decrease colonization by this organism. **Objectives:** This study determined the effect of daily repeated nasal washing in the ablution process performed by Muslims before every prayer on the presence and density of *S. aureus* nasal colonization. **Material and methods:** Two groups of volunteers were selected from the students and staff who were selected from Taif University, Saudi Arabia and Menoufia University, Egypt. The first group included 200 subjects who are practicing ablution and prayer and the second group included 100 subjects who do not do ritual ablutions. Personal data were collected and swabs were obtained from inside of the nostrils from all volunteers. Swabs were obtained from worshipers before, directly after, and 2-hours after ablution. Cultures were

performed on suitable media and identification of *S. aureus* was performed according to the standard bacteriological methods. **Results:** The rate of colonization by *S. aureus* was 62% among non-worshipers and 38% among worshipers before ablution with a non-significant difference. Among worshipers, the rate of isolation of *S. aureus* just before ablution was 38% and significantly reduced to 20% directly after ablution ( $p < 0.01$ ). It rises to 32% 2-hours after ablution. The microbial density of *S. aureus* was significantly ( $p < 0.001$ ) lower among worshipers than non-worshipers. **Conclusion:** Nasal washing in ablution can reduce *S. aureus* nasal colonization. It can be a simple, easy and effective way to reduce colonization by this organism and thereby decrease the occurrence of serious staphylococcal diseases.

**Keywords:** Ablution, nasal colonization, nasal washing, *Staphylococcus aureus*

## Introduction

*Staphylococcus aureus* (*S. aureus*) is one of the most prevalent and clinically significant pathogens. It is an extraordinarily versatile pathogen that can survive under hostile external environmental conditions and colonize mucous membranes and skin (1). *S. aureus* causes a broad spectrum of acquired infections ranging from benign superficial skin infections to life-threatening conditions, such as bacteremia, endocarditis, pneumonia and toxic shock syndrome (2). The ecological niches of *S. aureus* strains are the anterior nares of humans (3). Nasal carriage of *S. aureus* is a well-defined risk factor for infection with this bacterium in selected populations (4). Nasal *S. aureus* colonization is found in 30% of the general population (5). The causal relationship between nasal *S. aureus* carriage and infection is supported by studies demonstrating that strains causing the infection are identical to those carried by patients (6).

The mechanisms leading to nasal *S. aureus* colonization are multiple and involve both host- and bacteria-related factors (7). Advanced age, male gender, Caucasian ethnicity and genetic predisposition have all been reported to increase the frequency of colonization. Hormonal contraception, medical conditions, such as diabetes, hemodialysis, human immunodeficiency virus, and obesity may also increase the risk of nasal carriage and consequently the risk of infection (8-11). It has been demonstrated that intensity and quality of bacteria on the skin and nasal cavity is affected by many factors, including personal habits and human traditions, as well as age, gender, profession, the surrounding environment, and the use of topical antiseptics or antibiotics. Good washing using clean water or topical antiseptics can eliminate the majority of these microorganisms (12).

The teachings of Islam provide a great deal of care to human

health. Personal hygiene is important for various openings especially the nose that is the main source of harmful bacteria. Muslims practice 26 cleansing actions (commonly known as ablution) before every prayers (14,15). Repeating performance of ablution five times a day is commended. In each time nasal wash is done by inhalation of water three consecutive times according to the instructions of the Prophet Muhammad (PBUH). The present study aimed to evaluate the effects of daily nasal repeated washing in the ablution process on the density of *S. aureus* nasal colonization.

## Material and Methods

### Subjects

This study included 300 healthy volunteers who were selected from students and staff of the Faculty of Applied Medical Sciences, Taif University, Saudi Arabia and the Faculty of Medicine, Menoufia University, Egypt. They represented both genders from different age groups. An informed consent to participate in the study was obtained from all the studied subjects. They were divided into two groups matched for age and gender. The first group included 200 subjects who were practicing ablution and prayer, and who washed the nose by inhalation of water and *Astntharh* three times. The second group included 100 subjects who did not do ritual ablutions, and those who did not wash their nose or inhale water only rarely. Personal data and health history were recorded for all volunteers to identify the number of daily times, and the method of conducting of ablution. Clinical examination was performed for all volunteers and those having medical problems in the nose were excluded from the study.

### Specimen collection

The traditionally established technique of ablution was used as previously described (13,14). Swabs were obtained

**Table 1.** Rate of isolation of staphylococci from non-worshippers and worshippers

The isolated organism	Non-worshippers (100)		Worshippers (200)		X <sup>2</sup>	p value
	No	%	No	%		
<i>S. aureus</i>	62	62%	76	38	1.31	NS
Coagulase-negative staphylococci	28	28%	48	24		

*Swabs were obtained from both groups before nasal washing. Non-worshippers showed that they had higher percentage of S. aureus compared to worshippers.*

from inside of the nostrils. The swab was inserted into one nostril to a depth of 1 cm, rotated three times on the nasal lining. The obtained swabs were put in sterile tubes until cultured on appropriate media. All the studied subjects were swabbed at baseline and the density of *S. aureus* was calculated (15). Further swabs were collected from the first group who do regular ablution and prayer directly and 2 hours after ablution.

### **Bacteriological methods**

The obtained swabs were cultured on suitable media including nutrient agar, blood agar and mannitol salt agar. Identification of *S. aureus* was performed according to the standard microbiological methods (16). All cultures were incubated aerobically at 35° C. The plates were viewed at 24 hours and again after 48 hours. Putative *S. aureus* colonies were identified on the basis of positive Gram stain,

catalase test, coagulation tube test, and Pastorex Staph Plus rapid agglutination slide test (Bio-Rad, Montreal, Quebec, Canada).

### **Statistical analysis**

The Statistical Package for Social Science (SPSS, release 7.5.1) (SPSS Inc, Chicago, IL, 1996) was used for data analysis. The Chi-square test was performed at 5% level of significance.

### **Results**

The rates of colonization of *S. aureus* in non-worshippers and worshippers are shown in table 1. *S. aureus* was isolated from 62% of non-worshippers and from 38% of worshippers before ablution. However, the difference between groups was not statistically significant. Coagulase-negative staphylococci were found among 28% and 24% of non-worshippers and

**Table 2.** The rate of staphylococci isolation from worshippers in relation to ablution

The isolated organism	Ablution						X <sup>2</sup>	p value
	Before (n=200)		Directly after (n=200)		2 hours after (n=200)			
	No	%	No	%	No	%		
<i>S. aureus</i>	76	38	40	20	64	32	13.59	<0.01
Coagulase-negative Staphylococci	24	24	40	20	44	22		

*Swabs were obtained before and after nasal washing in ablution. There was a significant decrease of S. aureus after ablution.*

**Table 3.** Microbial density of *S. aureus* in non-worshippers and worshippers

Microbial density	Non-worshippers (100)		Worshippers (200)		X <sup>2</sup>	p value
	No	%	No	%		
+	8	8	48	24	54.57	<0.001
++	18	18	24	12		
+++	28	28	4	2		
++++	8	8	0	0		
Total	62	62	76	38		

*The density of S. aureus was lower among worshippers compared to non-worshippers (Nouwen et al, 2004).*

worshippers respectively. Among worshippers, the rate of isolation of *S. aureus* before ablution was 38% and it significantly reduced to 20% immediately after ablution ( $p < 0.01$ ). It rose to 32% 2 hours after ablution (Table 2).

The coagulase-negative staphylococci were found in 24%, 20 and 22% before, immediately after and 2-hours after ablution respectively (Table 2). The microbial density of *S. aureus* among worshippers before ablution was significantly ( $p < 0.001$ ) lower compared to that of non-worshippers (Table 3).

### Discussion

The nose is the main reservoir for *S. aureus* which can be distributed into the respiratory tract and to the surface of the skin and even to the surrounding air during exhalation (17). Although multiple body sites can be colonized in the human beings, the anterior nares are the most frequent carriage site for *S. aureus* (18). *S. aureus* grows in the nose and spread to the skin and in the atmosphere. If these bacteria are eliminated or decreased in the nose, the quantities on the skin surface and in the atmosphere will decrease (19).

In this study, *S. aureus* was isolated at a higher rate from non-worshippers compared to worshippers before ablution although the difference was not statistically significant. However, an interesting finding was that the density of *S. aureus* was significantly lower in worshippers than in non-worshippers. These results may indicate the importance of ritual ablutions in decreasing colonization of the nose by this organism (1).

This study showed that, among worshippers, there was a significant reduction of *S. aureus* isolation when specimens were obtained immediately after ablution when compared to that obtained before ablution. After 2 hours, an increase in the rate of isolation was demonstrated. This important finding indicates that nasal washing in ablution has a significant effect on *S. aureus* nasal colonization. A remarkable reduction in the number of skin surface bacteria as well as in the surrounding air was reported after ablution by Shehata *et al* (15). Moreover, it was concluded that performing proper ablution, combined with mupirocin intranasal application, was an effective measure against *S. aureus* carriage and decreased the incidence of continuous ambulatory peritoneal dialysis-associated *S. aureus* peritonitis (20).

Antibiotic resistance of *S. aureus* was previously reported

in many countries by several studies (21-24). *S. aureus* is not only resistant to antibiotics, but also has several other mechanisms of resistance including: staphylokinase (25) membrane lipid modification (26), cationic antimicrobial peptides, including defensins and cathelicidins, present in the nasal mucosa. Furthermore, all *S. aureus* strains are also lysozyme-resistant since they possess the peptidoglycan-specific O-acetyltransferase (27). Therefore, mechanical removal of *S. aureus* by the proper act of ablution seems to be an appropriate solution for colonization by this tough and resistant organism.

The act of ablution performed properly not only cleans the vital parts of the body from dust and dirt but also softens and refreshes the skin. According to a study conducted in Alexandria University, germs trapped in the nostrils can be mechanically dislodged by the cleansing act. Moreover, ablution can positively affect the inner coating of the nostrils (20,26), and rinsing of the mouth may protect from many infections (28). Furthermore, hand hygiene is currently advocated as the single most important infection-control measure, and is recommended to be performed as frequent as possible to avoid the transfer of microorganisms (29,30). Therefore, it is possible to get rid of nasal microorganisms which can cause disease using topical antiseptics or antibiotics. However, nasal washing with clean water by inhalation and then *Alastnhar* several times can be used to decrease colonization by *S. aureus*.

In conclusion, the rates of colonization and the microbial density of *S. aureus* were lower among worshippers than non-worshippers. The rate of isolation of *S. aureus* was lower after than that before ablution. Therefore, nasal washing in ablution can decrease the organism in the nose and ablution if performed by proper technique can be a simple, easy and effective way to decrease colonization by *S. aureus*.

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