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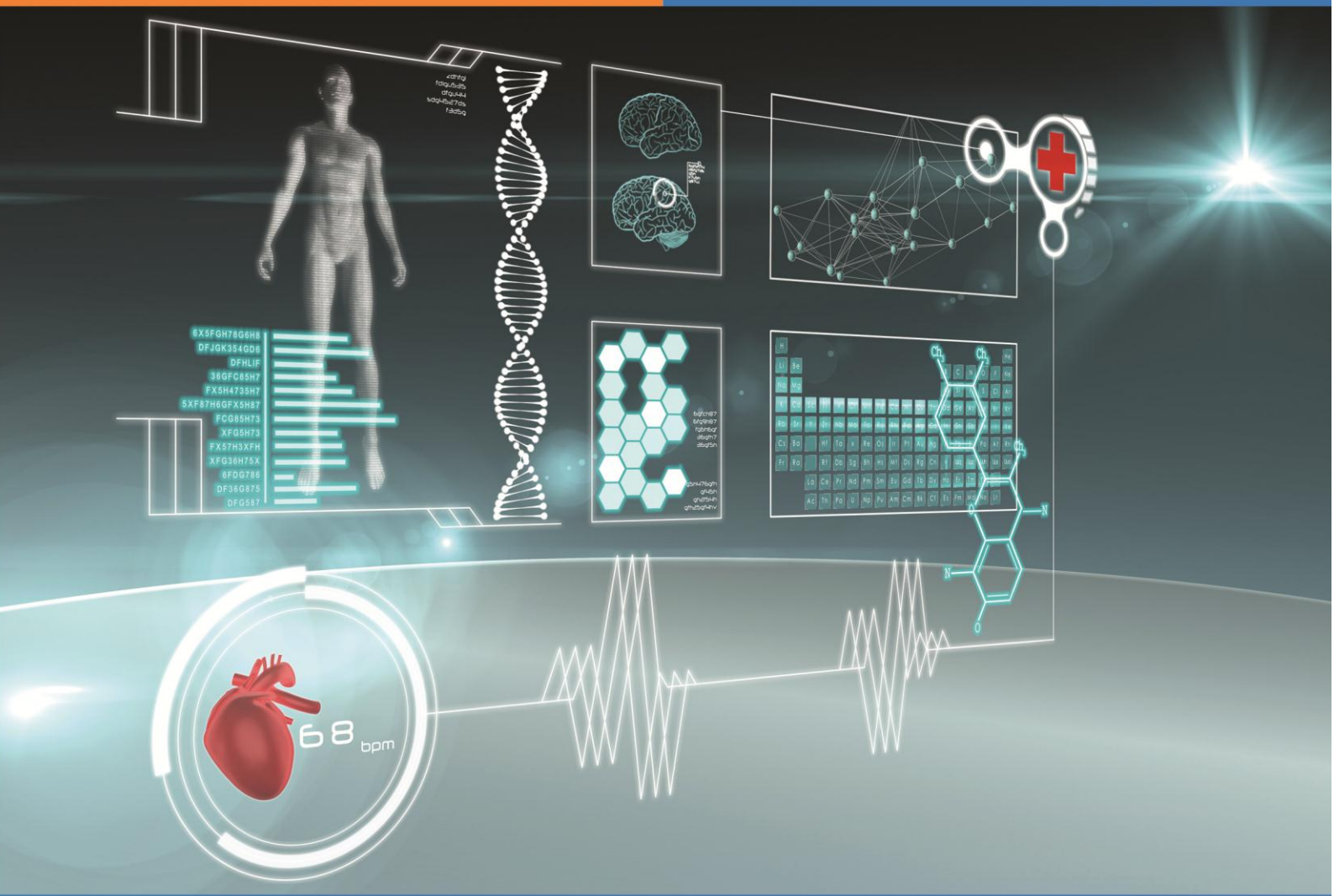

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Prevalence of Bacterial Hands Contamination among Al-Razi University Students in Sana'a City, Yemen

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Abstract

Background: Harmful microorganisms can be transferred to hands from contaminated surfaces people come into contact in daily life. Contaminated hands can transmit the disease to oneself as well as to others. **Aim**: to determine the prevalence of bacterial hands contamination among Al-Razi University students in Sana'a City, Yemen. **Methods:** A descriptive cross-sectional study was conducted among students of Al-Razi University. Swabs were taken from a randomly selected sample of 162 students for the bacterial count from both hands. The structured questionnaire was administered as face to face interview. Data were tabulated and analyzed using SPSS. **Results:** 64.2% of the students were males while 35.8% females. The mean age was 23.9±1.67 years. Regarding hands hygiene practices, (50.6%) of students used soap and water after toilet (6.2%) used soap and water after touched contaminated articles and (22.8%) were washed their hands by soap and water after a meal. The prevalence of bacterial hands contaminated among students showed that 60.5% was Staphylococcus aureus 6.8% Staphylococcus epidermis and 32.7% no bacterial growth. A statistically significant difference was found, by sex, marital status, college ($p< 0.001$) and by departments ($p<0.05$). There were significant differences in the prevalence of bacterial hands contamination by hands hygiene before the hands swab was taken ($p<0.01$) and by finger nails status ($p<0.001$). **Conclusion:** We conclude that, staphylococcus bacteria was the most prevalent bacteria among students. Hands washing technique must be encourage and the hands washing procedure becomes habitual among students.

Keywords: Prevalence of bacteria, Students; hands Contamination; Hands hygiene; Yemen. .

Introduction

Contaminated hands play an important role in the oral-faecal transmission of infection. Hands hygiene practices is reduce transmission of infection by washing off potential microorganisms. Hand washing is the most effective single behavior that can stop the spread of infection and removing the contamination, which could also harbor microorganisms and allow their survival for long periods of time[1]. Failure to perform appropriate hand hygiene practices is a leading cause of health care associated infections and the spread of multiresistant organisms and has been recognized as a significant contributor to outbreaks of infectious diseases by the World Health Organization[2]. Hand hygiene with soap is not a common practice. Worldwide, there is a wide variation in

the prevalence of handwashing behavior and the use of soap for hand washing is not widespread[3]. A range of strategies for the promotion and improvement of hand hygiene is recommended in the hand hygiene guidelines published by the Centre for Disease Control (CDC)[4] and WHO[2]. A study was conducted in West Bengal from rural, urban slums and non-slum areas reported that in the urban slums, 98% of the participants were washed their hands with soap after defecation compared to rural areas, 71% washed hands with soap after defecation[5]. Therefore, to have a real impact, particularly in reducing the incidence of diseases, three aspects of hand hygiene seem to be important: washing hands with soap and following all steps diligently, using clean water and drying hands with a clean cloth. A study in Karachi, Pakistan[6] has revealed that regular hand hygiene with soap is effective in preventing both diarrhea and pneumonia.

Aim of the study: to determine the prevalence of bacterial hands contamination among Al-Razi University students in Sana'a City, Yemen.

Subjects and Methods

The study was carried out at Al-Razi University, Sana'a city-Yemen. Al-Razi University is a private University which consists of the college of medical sciences, computer and information technology and humanistic and administrative college. A descriptive, cross-sectional was conducted from January to June 2017. One hundred and sixty-one students were selected during their attendance to study in the college of medical sciences, computer and information technology and humanistic and administrative college by Simple random sampling. Study participants were selected by lottery method from the students' lists in students' affair of Al-Razi University. The Inclusion criteria were included students who are attending to Al-Razi University at the time of data collection, willing to participate in the study and without skin irritation, eczema, and inflammation**.** The sample size was determined using EpiCalc 2000, considering the following: 10% the prevalence of Klebsiella sp. among students in Bangalore and Kolkata[7], Precision (5%), and 95% Confidence level. The sample size was 138 with 15% for non-response rate, the final sample size was 162 student.

Data were collected as face to face interview method using structured questionnaire. The questionnaire consisted of demographic characteristics of study subjects which include (age, sex, marital status, grade and department) and hands washing practices (hands washing after touching contaminated articles, before meals and after toilet).

Isolation and identification of bacterial pathogens: A station to take hands swabs as per standard aseptic procedures was established. Dominant hands of the students were swab, beginning from palm and up all the five fingers (beginning with thumb) including the creases and nail beds, ending in the dorsal aspect.

The swabs were collected in Amies' Transport Media swabs and transport to the lab. within 1–2 hours. At the lab, inoculation was done on Blood and MaCconkay agar. After 24 hours of incubation, the following pathogens were identified: Enteric bacteria or coliforms like Escherichia coli, Klebsiella, Enterobacter, Proteus, enterococci-(diarrheal diseases)-detection by characteristic colored colonies on MaCconkay agar. Staphylococcus aureus

(diarrheal+respiratory +skin diseases): detection by colonies on blood agar, Gram stain and coagulase test Pneumococci, Group A streptococci (respiratory diseases): detection by colonies on blood agar and Gram stain morphology. Subculture on special media + biochemical tests if suspicion of Salmonella or Shigella (enteric and diarrheal diseases). Usually non-pathogenic commensals like coagulase-negative staphylococci, viridans streptococci, diphtheroids were detected by colonies on MaCconkay and blood agar + Gram stain. Usually, non-pathogenic environmental flora like Micrococcus sp., Bacillus sp., Pseudomonas sp., Acinetobacter sp.-detection by colony morphology on MaCconkay and/or blood agar and/or Gram stain material were used.

All components of data were entered and cleaned, coded and analyzed using SPSS Computer software. Data were organized, summarized, and presented in simple descriptive statistical methods. Chi-square test was used to examining any possible association between various categorical variables, and p-value <0.05 considered as significant. Ethical approval was obtained from the college of Medical Sciences, Al-Razi University. The purpose of the study was explained to all study participants and rights of participants like the right to withdraw anytime, in the whole study was used and confidentially of the patient's information was taken in consideration. Verbal consent was taken from students before the questionnaire distribution.

Results

Demographic characteristics

Out of 162 students, 104 (64.2%) were males while 58(35.8%) females. The mean age was 23.9±1.67) years. About 150 (92.6%) were unmarried and 12(7.4%) married. As regards to educational grade, first grade was 60 (37.0%), second 32 (19.8%), third 36 (22.2%), forth was 25 (15.4%) and fifth was 9(5.6%). As regards their colleges the medical sciences represents 111 (68.5%), Computer and information technology 28(17.3%) and human administrative sciences 23(14.2%). Regarding to departments, pharmacy department represents 47(29.0%), medical laboratory16 (9.9%), anesthesia 19 (11.7%), midwifery 6 (3.7%) nursing 15 (9.3%), community health 5(3.1%). health administration 3(1.9%), accounting 17(10.5%), computer sciences, 3(1.9%), information systems 3(1.9%), information technology 22 (13.6%) and business administration 6 (3.7%). Table 1.

Table 1: Demographic characteristic of the study participants (N = 162)

Demographic Characteristics		F	%
Sex	• Male	104	64.2
	• Female	58	35.8
Marital status	• Married	12	7.4
	• Unmarried	150	92.6
College	• Medical sciences	111	68.5
	• Computer& information technology	28	17.3
	• Human and administrative sciences	23	14.2
	• Pharmacy	47	29.0

Department	• Medical Laboratory	16	9.9
	• Anesthesia	19	11.7
	• Midwifery	6	3.7
	• Nursing	15	9.3
	• Community health	5	3.1
	• Health administration	3	1.9
	• Accounting	17	10.5
	• Computer Sciences	3	1.9
	• Information systems	3	1.9
	• Information technology	22	13.6
	• Business administration	6	3.7
Grade level	• 1st year	60	37.0
	• 2nd year	32	19.8
	• 3rd year	36	22.2
	• 4th year	25	15.4
	• 5th years	9	5.6

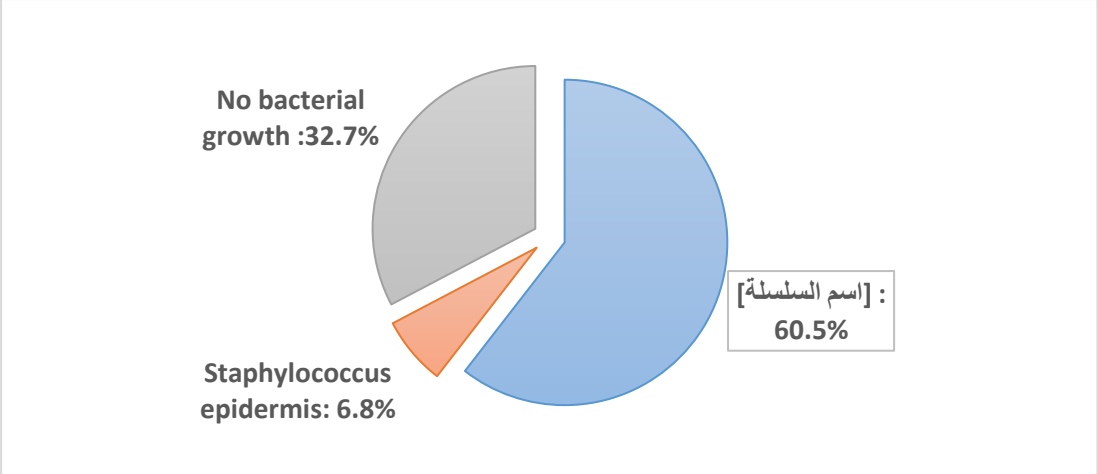
Table 2: Hands hygiene practices among study participants (N = 162)

Items	**F**	**%**
Hands washing after toilet		
• Yes with soap & water	83	51.2
• Yes without soap	79	48.8
Hands washing after touching contaminated articles		
• Yes with soap & water	10	6.2
• Yes with water only	57	35.2
• No	95	58.6
Hands washing after meal		
• Yes with soap & water	37	22.8
• Yes with water only	119	73.5
• No	6	3.7
Hands washing on the last occasion before the hand's swab was taken		
• Yes with soap & water	14	8.6
• Yes with water only	35	21.6
• No	113	69.8
Fingernails status		
• Trimmed	66	40.7
• Non-trimmed	96	59.3

Prevalence of bacterial hands contamination

The prevalence of bacterial hands contaminated among study participants showed that 98 (60.5%) was Staphylococcus aureus, 11 (6.8%) Staphylococcus epidermis and 53 (32.7%) no bacterial growth. Figure 1.

Figure 1: Prevalence of bacterial hands contamination among students (N = 162)



Association between bacterial hands contamination and demographic data

Bacterial hands contaminated (Staphylococcus aureus and Staphylococcus epidermis) was spread in male 70 (43.2%) more than female 39 (24%). A statistically significant difference was found. (*P*< 0.001). The prevalence of bacterial hand contaminated by marital status showed that 100 (61.8%) in unmarried students and 9 (5.5 %) was married. There were statistically significant differences in the prevalence of bacterial hands contaminated by marital status (*P* < 0.001). The results of the study showed that more than half 85(52.4%) of medical sciences college students had bacterial hands contaminated compared to 14 (8.6%) in computer & information technology and 10 (6.2%) in human & administrative sciences, statistically significant differences were found. (*P* <0.001). As regards to departments, 39 (24.1%) of pharmacy students had bacterial hands contaminated follow by anesthesia students 14 (8.7%) and medical laboratory students 13(13.3%).There were statistical differences in the prevalence of bacterial hands contaminated by departments (*P* <0.05). Table 3.

Table 3: Prevalence of bacterial hands contaminated by demographic data (N = 162)

Demographic data	Bacterial hands contamination						
	Staphylococcus aureus		Staphylococcus epidermis		No growth		*P*-value
	F	%	F	%	F	%	
Sex							
Male	62	38.3	8	4.9	34	21	<0.001**
Female	36	22.2	3	1.8	19	11.7	
Marital status							
Married	7	4.3	2	1.2	3	1.9	<0.001**
Unmarried	91	56.2	9	5.6	50	30.9	
Colleges							
Medical sciences	77	47.5	8	4.9	26	16.1	<0.001**
Computer &	14	8.6	-	-	14	8.6	

information technology							
Human & administrative sciences	7	4.3	3	1.9	13	8	
Departments							
Pharmacy	36	22.2	3	1.9	8	4.9	
Medical laboratory	13	8.0	-	-	3	1.9	
Anesthesia	11	6.8	3	1.9	5	3.0	
Midwifery	3	1.9			3	1.9	
Nursing	9	5.6	2	1.2	4	2.5	
Community health	3	1.9	-	-	2	1.2	
Health administration	2	1.2	-	-	1	0.6	<0.05*
Accounting	5	3.0	3	1.9	9	5.6	
Computer sciences	-	-	-	-	3	1.9	
Information systems	3	1.9	-	-	-	-	
Information technology	11	6.8	-	-	11	6.8	
Business administration	2	1.2	-	-	4	2.5	

***Highly significant; *significant*

Association between bacterial hands contamination and hands hygiene practices

Bacterial hands contamination (Staphylococcus aureus and Staphylococcus epidermis) was spread in students who non-washing their hands on the last occasion before the hands swab was taken 87 (53.7%) compared to18 (11.1%) who washed their hands by water only and 4 (2.5%) who washed their hands with soap and water. There were significant differences in the prevalence of bacterial hands contamination by hands washing before the hand swab was taken ($p<0.01$). As regards fingernails status 42 (26%) of the students were terminated their fingernails compared to 67 (41.3%) did not-trimmed their fingernails. Statistical significant differences were observed among students by fingernails status ($p<0.001$). More details presenting in table 4.

Table 4: Prevalence of bacterial hands contaminated by hands hygiene (N = 162)

Hands washing	**Bacterial hands contamination**						
	Staphylococcus aureus		Staphylococcus epidermis		No growth		*P*-value
	F	%	F	%	F	%	
Hands washing on the last occasion before the hands swab was taken							
Soap & water	4	2.5	-	-	10	6.2	
Water only	16	9.9	2	1.2	17	10.4	<0.01*
Non-hands washing	78	48.1	9	5.6	26	16	
Fingernails status							
Trimmed	38	23.5	4	2.5	24	14.8	<0.001**
Non-trimmed	60	37.0	7	4.3	29	17.9	

***Highly significant; *significant*

Discussion

Hands hygiene is the primary measure to reduce infections. It has been suggested that hands washing may substantially reduce the risk of diarrheal diseases[8] Hands-contamination measurement seems promising as a proxy method for measuring hands washing behavior because persons specifically instructed to wash hands with a cleansing agent have been shown to have substantially fewer fecal bacteria contaminating their hands compared with people who have not washed hands with a cleansing agent[9]. Some studies have shown a correlation between reduced hands contamination and reduced diarrhea risk[10, 11].

The study demonstrated the prevalence of hand contamination with Staphylococcus aureus and Staphylococcus epidermis among students were 67.3%. The study from Maharashtra, had demonstrated the presence of potential pathogens on hands of students were Staphylococcus sp. (23%), E. coli (20%), Klebsiella sp. (10%), Micrococcus sp. (9%), Proteus sp. (7%), Citrobacter sp. (7%), Streptococcus sp. (7%), Enterobacter sp. (6%), Enterococcus sp. (4%), Pseudomonas sp. (3%) and Salmonella sp. (2%). The authors also reported a reduction in hand contamination after hand washing[12]. In the current study, the practice of hand washing with water and soap was found to be low, however, soap usage was found to be suboptimal, as has been seen in other studies from other countries[3]. Numerous studies have documented that subungual areas of the hands harbor high concentrations of bacteria, most frequently coagulase-negative staphylococci, Gram-negative rods (including Pseudomonas spp.), Corynebacteria, and yeast[13].

The present study findings are similar to a study[14] on knowledge, attitude and practices of school children conducted in Ethiopia, which found that though most students reported hand washing before meals, i.e. 99.0%, only 36.2% reported using soap during hand washing. Availability of soap at handwashing facilities, especially in schools, was low. This study more or less corroborated with the present study findings. About 50% of students exhibited the knowledge that hand washing removes germs. About 30% students did not know that nails or web spaces can be dirty areas in hands.

It is not clear if the length of natural or artificial nails is an important risk factor since most bacterial growth occurs along the proximal 1 mm of the nail, adjacent to the subungal skin[15]. The natural nails should be kept short (0.5 cm long or approximately ¼ inch long).there is increased in prevalence medical student as compared to non- medical student, increased in the first and fourth levels as compared to other levels.

However, measured hands contamination can vary based on a number of factors, including the type of sampling and the microbial quantitation methods used[8], the subject's skin characteristics[16] and hygiene behaviors temporally related to the hands-contamination measurement[17]. Presumably, the dose of pathogens on hands at critical events impacts the degree to which pathogens are actually transmitted, at those times, from hands to other hands, mouths, or food or water vehicles. There was no significant increase in growth of Staphylococcus epidermis in hands that washed with water and soap as compared to that was washed with water only this agreed with study said that People who wash their hands with contaminated soap from bulk-soap-refillable dispensers can increase the number of disease-causing microbes on their hands and may play a role in transmission of bacteria in public settings[18].

Further, the present study also corroborated with the other studies on bacterial content in hands as well as diseases caused by the improper hand washing practices[19] observed a decrease in colony count following hand washing with soap in 60% of the samples in a study conducted in areas around Kolkata. The evidence suggested that hand washing with soap reduced the bacterial count in the majority of the respondents. At the same time, an increase in colony count was seen in 30% samples that were either

pond water users or food servers from a canteen using dirty clothes for drying hands after washing. Therefore, to have a real impact, particularly in reducing the incidence of diseases, three aspects of hand washing seem to be important: washing hands with soap and following all steps diligently, using clean water and drying hands with a clean cloth. A study in Karachi, Pakistan[6] has demonstrated that regular hand washing and bathing with soap is effective in preventing both diarrhea and pneumonia.

Conclusion

We conclude that more than half of students had hands contaminated with Staphylococcus aureus and Staphylococcus epidermis. Approximately half of the students were used soap and water after toilet, but a low proportion of students were used soap and water after touched contaminated articles and washed their hands with soap and water after a meal. Less than half of students have trimmed their fingernails.

Recommendations

Educational sessions regarding hand hygiene practices should be introduced to students.

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