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ORIGINAL ARTICLE

Moraxella catarrhalis as a Respiratory Tract Pathogen during Umrah and Hajj Seasons

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Key words:
Moraxella catarrhalis, nationalities, Pilgrims, Umrah, Respiratory tract infection

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ABSTRACT

Background: *Moraxella catarrhalis, is one of the causative organisms of respiratory tract infection (RTI) of human. It colonizes the respiratory tract (RT) and causes infections including pneumonia otitis media, sinusitis and bronchitis due to its ease of transmission by air droplets from infected or carrier people.* ***Objective:*** *determination of the prevalence of M. catarrhalis as potentially pathogenic bacteria (PPB) in the respiratory tract, among Umrah visitors and pilgrims from different ethnic groups.* ***Methodology:*** *This study was carried out on 1592; 979/613 Umrah visitors / Pilgrims from different nationalities, in the period from Rabi-Al-Awwal to end of Zo-Alhejja 1430H.* ***Results:*** *Moraxella catarrhalis was isolated from 109 (11.1%) Umrah visitors before performing Umrah and 217 (22.2%) Umrah visitors after performing Umrah and isolated from 59 (9.6%) pilgrims before performing Hajj and 121 (19.7%) pilgrims after performing Hajj.* ***Conclusion:*** *The current study showed that Mass gatherings during Hajj and Umrah seasons helps to increase the spread of M. catarrhalis infection from both symptomatic patients and asymptomatic carriers.*

INTRODUCTION

Health risks increased greatly during Umrah and Hajj Seasons, in both local and international sides. Many studies published regarding health during Hajj has stated that respiratory tract infections (RTIs) in Hajj are of great burden and concern to the Saudi health authorities. *Moraxella catarrhalis* is one of the potentially pathogenic bacteria (PPB) of the respiratory system, it causes respiratory tract infection (RTI) due to its ease transmission by respiratory droplets in crowding conditions from symptomatic patients or asymptomatic carriers. *M. catarrhalis* is a Gram negative bacteria, diplococci, aerobic, oxidase positive. Genus Moraxella contains 15 different species and it belongs to the family Moraxellaceae, that includes the genera *Psychrobacte*r and *Acinetobacter.* It exists in biofilms on mucosal surfaces with high rates of pharyngeal colonization[1,2].

M. catarrhalis is now considered as an important cause of RTI, including , pneumonia, sinusitis and acute bronchitis in the elderly[3,4]. In adults. *M. catarrhalis* mainly causes lower respiratory tract infections and in the children it causes upper respiratory tract infections (sinusitis and otitis media)[5,6]. It spread easily from the nasopharynx to the middle ear among the children[7,8]. *M. catarrhalis* is the third most common cause of lower respiratory tract infections after *Streptococcus K. pneumoniae* and *H. influenzae*[9,10]. Since 1970s, *M. catarrhalis* was the common cause of RTI and about 10% of chronic obstructive pulmonary disease in the old ages and heavy smokers [11-16]. Some studies reported that *M. catarrhalis* causes nosocomial respiratory tract infections[17,18]. In the past thirty years, several studies showed a steady increase of the β lactamase producing strains o*f M. catarrhalis.*[19-21].From this time *M. catarrhalis* strains recorded the highest dissemination of beta-lactamases between bacterial species[22-25]. Therefore, *M. catarrhalis* becomes the important pathogen in patients with chronic pulmonary diseases and immunodeficiency[26]. Based on the previous facts, the current study focused on determination of the prevalence of *M. catarrhalis* as potentially pathogenic bacteria in the respiratory tract, among Umrah visitors and pilgrims from different ethnic groups during umrah and hajj seasons.

METHODOLOGY

The current study was carried out in Microbiology Department, Faculty of Medicine, Umm al-Qura University. Out of 1592; 979/613 Umrah visitors / Pilgrims from different nationalities including; 232 Indian, 200 Nigerian, 222 Indonesian,117 Libyan,167 Syrian,102 British,164 Turkish, 11 Australian, 17 Swedish, 79 Iranian,102 Pakistani,79 Egyptian, 56 Iraqi, 39 Malaysian, 4 American and 1 Jordanian, in the period from Rabi-Al-Awwal to end of Zo-Alhejja 1430H.

Specimens collection and transportation:

Around 1958/1226 samples were collected from nasopharyngeal swab of 979/613 Umrah visitors/ Pilgrims, one swab from each visitor and Pilgrim at arrival to Saudi Arabia and one swab before leaving the country, with a data form for every one including; nationality, age, sex, smoking, swabbing group (before

or after Umrah or Hajj), coughing, sore throat, antibiotic usage (yes or no) if yes; type used, date of collection and contacts numbers for the group's leaders. All Samples were collected on Amie's transport media and transported to the Microbiology Research Laboratory without any delay.

Cultivation of specimens:

All samples were processed under aseptic conditions. Swabs were inoculated on Columbia agar with 5% sheep blood and chocolate agar and incubated at 37ºC for 24 hrs. *M. catarrhalis* isolates, were identified by the colonial morphology, Gram staining, as well as production of oxidase, reduction of nitrate, DNase production and their inability to ferment carbohydrates.

Antibiotic susceptibility testing:

It was determined by Kirby Bauer testing according to the clinical and laboratory standard institute guideline (CLSI), using seven different antibiotics, Azithromycin, Cefotaxime, Ceftriaxone, Ciprofloxacin, Rifampicin, Meropenem, and Levofloxacin[27].

Statistical Analysis:

Data processing and analysis were performed with SPSS- 10 software. All tests of significance were 2-sided, and a P value of less than .05 was statistically significant.

RESULTS

Prevalence of *Moraxella catarrhalis* isolated from Umrah visitors during the Umrah season

Out of the 979 Umrah visitors tested in our study for the presence of the potentially pathogenic bacteria, *M. catarrhalis* was isolated from 109 (11.1%) Umrah visitors before performing Umrah and 217 (22.2%) Umrah visitors after performing it. The difference in the prevalence of positive *M. catarrhalis* from the Umrah visitors before and after performing Umrah was high statistically significant (p-value = <0.0001).

Distribution of *M. catarrhalis* prevalence in Umrah visitors during the Umrah season according to different nationalities

In this study 326 *M. catarrhalis* strains were isolated from Umrah visitors. These isolates were distributed as the followings according to different nationalities: 35 isolates were isolated from Turkish visitors, (5 before Umrah and 30 after Umrah), 25 isolates were isolated from Indonesian visitors, (12 before Umrah and 13 after Umrah), 30 isolates were isolated from Pakistani visitors, (15 before Umrah and 15 after Umrah), 29 isolates from Syrian visitors, (9 before Umrah and 20 after Umrah), 28 isolates were isolated from Nigerian visitors, (14 before Umrah and 14 after Umrah), 33 isolates from Egyptian visitors, (11 before Umrah and 22 after Umrah), 25 isolates from Iranian visitors, (3 before Umrah and 22 after Umrah), 31 isolates from Indian visitors, (9 before Umrah and 22 after Umrah), 12 isolates from British visitors, (3 before Umrah and 9 after Umrah), 49 isolates from Iraqi visitors, (25 before Umrah and 24 after Umrah), 12 isolates from Malaysian visitors (2 before Umrah and 10 after Umrah), 9 isolates from Libyan visitors (1 before Umrah and 8 after Umrah), 5 isolates from Swedish visitors (zero before Umrah and 5 after Umrah) and 3 isolates only from American visitors after Umrah. The results is shown in table 1.

Table 1: Prevalence of *Moraxella catarrhalis* isolated from different nationalities of the Umrah visitors during the Umrah season

Nationality	Number of Umrah visitors tested	Before Umrah				After Umrah				P-value of difference between positive Umrah visitors after performing Umrah and positive Umrah visitors before performing Umrah
		+ Umrah visitors		- Umrah visitors		+ Umrah visitors		- Umrah visitors		
		No.	%	No.	%	No.	%	No.	%	
Nigerian	98	14	14.29	84	85.71	14	14.29	84	85.71	P = 1.2 Not Significant
Egyptian	79	11	13.92	68	86.08	22	27.85	57	72.15	P = 0.05 Significant
Iranian	77	3	3.90	74	96.10	22	28.57	55	71.43	P = <00001 highly Significant
Indian	71	9	12.68	62	87.32	22	30.99	49	69.01	P = 0.01 Significant
British	56	3	5.36	53	94.64	9	16.07	47	83.93	P=0.1239 Not Significant
Turkish	129	5	3.88	124	96.12	30	23.26	99	76.74	P = <0.0001 highly Significant
Indonesian	127	12	9.45	115	90.55	13	10.24	114	89.76	P = 1.0 Not Significant
Pakistani	102	15	14.71	87	85.29	15	14.71	87	85.29	P = 1.2 Not Significant
Syrian	99	9	9.09	90	90.91	20	20.20	79	79.80	P = 0.04 Significant
Turkish	129	5	3.88	124	96.12	30	23.26	99	76.74	P = <0.0001 highly Significant
Sweden	14	0	0.00	14	100.00	5	35.71	9	64.29	P = 0.04 Significant
American	4	0	0.00	4	100.00	3	75.00	1	25.00	P = 0.1 Not Significant
Jordanian	1	0	0.00	1	100.00	0	0.00	1	100.00	-
Iraqian	56	25	44.64	31	55.36	24	42.86	32	57.14	P = 1.0 Not Significant
Malaysian	39	2	5.13	37	94.87	10	25.64	29	74.36	P = 0.02 Significant
Libyan	27	1	3.70	26	96.30	8	29.63	19	70.37	P = 0.02 Significant
Total	**979**	**109**	**11.1**	**870**	**88.87**	**217**	**22.17**	**762**	**77.83**	**P = <0.0001Highly Significant**

Prevalence of *Moraxella catarrhalis* isolated from Pilgrims during the Hajj season

Out of the 613 pilgrims tested in our study, *M. catarrhalis* was isolated from 59 (9.6%) pilgrims before performing Hajj and 121 (19.7%) pilgrims after performing Hajj. The difference in the prevalence of positive *M. catarrhalis* from the pilgrims before and after performing Hajj was statistically highly significant (p-value = < 0.0001).

Distribution of *Moraxella catarrhalis* prevalence in Pilgrims during the Hajj season according to different nationalities

In this study 180 *M. catarrhalis* isolates were isolated from Pilgrims . These isolates were distributed as the following according to different nationalities: 63 isolates were isolated from Indian pilgrims, 9 before performing Hajj and 54 after performing Hajj, 22 isolates were isolated from Nigerian pilgrims, 16 before performing Hajj and 6 after performing Hajj, 26 isolates from Indonesian pilgrims, 8 before performing Hajj and 18 after performing Hajj, 29 isolates from Libyan pilgrims, 14 before performing Hajj and 15 after performing Hajj, 22 isolates were isolated from Syrian pilgrims, 7 before performing Hajj and 15 after performing Hajj, 10 isolates were isolated from British pilgrims, 4 before performing Hajj and 6 after performing Hajj, 7 isolates were isolated from Turkish pilgrims, 0 before performing Hajj and 7 after performing Hajj, 2 isolate were isolated from Swedish pilgrims, 2 before performing Hajj and 0 after performing Hajj, one isolated from Iranian pilgrims, 1 before performing Hajj and 0 after performing Hajj (Table 2).

Table 2: Prevalence of *Moraxella catarrhalis* isolated from different nationalities of the Pilgrims during the Hajj season

Nationality	Number of Pilgrims tested	Before Hajj				After Hajj				P-value of difference between positive pilgrims after performing Umrah and positive Umrah visitors before performing Umrah
		+ Pilgrims		- Pilgrims		+ Pilgrims		- Pilgrims		
		No.	%	No.	%	No.	%	No.	%	
Syrian	68	7	(10.3%)	61	(89.7%)	15	(22.1%)	53	(77.9%)	0.1 not significant
British	46	4	(8.7%)	42	(91.3%)	6	(13%)	40	(87%)	0.7 not significant
Turkish	35	0	(0%)	35	(100%)	7	(20%)	28	(80%)	0.01 significant
Australian	11	0	(0%)	11	(100%)	0	(0%)	11	(100%)	-
Swedish	3	2	(66.7%)	1	(33.3%)	0	(0%)	3	(100%)	1.0 not significant
Iranian	2	1	(50%)	1	(50%)	0	(0%)	2	(100%)	1.0 not significant
Indian	161	7	(4.3%)	154	(95.7%)	54	(33.5%)	107	(66.5%)	< 0.0001 extremely significant
Nigerian	102	16	(15.7%)	86	(84.3%)	6	(5.9%)	96	(94.1%)	0.04 significant
Indonesian	95	8	(8.4%)	87	(91.6%)	18	(18.9%)	77	(81.1%)	0.05 not quite significant
Libyan	90	14	15.6%)	76	84.4%)	15	(16.7%)	75	(83.3%)	1.0 not significant
Total	**613**	**59**	**(9.6%)**	**554**	**90.4%)**	**121**	**(19.7%)**	**492**	**(80.3%)**	**< 0.0001 highly significant**

Antibiotics susceptibility testing of *Moraxella catarrhalis* isolated from Umrah Visitors during the Umrah season

A total of 326 isolates from *M. catarrhalis* were isolated from Umrah Visitors in this study, most of them (95.4%) before Umrah and (94%) after Umrah were sensitive to Meropenem. While, in the other hand, (34.9%) before Umrah and (55.3%) after Umrah were resistant to Cefotaxime. (Table 3).

Table 3: Antimicrobial Susceptibility of *Moraxella catarrhalis* isolated from Umrah visitors during the Umrah season

ANTIBIOTICS	Before Umrah Total (109)				After Umrah Total (217)			
	Susceptible		Non-susceptible		Susceptible		Non-susceptible	
	No.	%	No.	%	No.	%	No.	%
Azithromycine	94	86.24	17	13.76	183	84.33	34	15.67
Cefotaxime	71	65.14	38	34.86	97	44.70	120	55.30
Ceftriaxone	70	64.22	39	35.78	116	53.46	101	46.54
Ciprofloxacin	95	87.16	14	12.84	165	76.04	52	23.96
Levofloxacin	98	89.91	11	10.09	180	82.95	37	17.05
Meropenem	104	95.41	5	4.59	204	94.01	13	5.99
Rifampicin	102	93.58	7	6.42	202	93.09	15	6.91

Antibiotics susceptibility testing of *Moraxella catarrhalis* isolated from Pilgrims during the Hajj season

A total of 180 isolates from *M. catarrhalis* were isolated from pilgrims in this study, most of them (94.9%) before Hajj and (95.9%) after Hajj were sensitive to Meropenem. While, in the other hand, most of them (50.8%) before Hajj and (46.3%) after Hajj were resistant to Ceftriaxone, (Table 4).

Table 4. Antimicrobial Susceptibility of *Moraxella catarrhalis* isolated from Pilgrims during the Hajj season

ANTIBIOTICS	Before Hajj Total (59)				After Hajj Total (121)			
	Susceptible		Non- Susceptible		Susceptible		Non-susceptible	
	No.	%	No.	%	No.	%	No.	%
Azithromycine	38	(64.4%)	21	(35.6%)	98	(81%)	23	(19%)
Cefotaxime	34	(57.6%)	25	(42.4%)	81	(66.9%)	40	(33.1%)
Ceftriaxone	29	(49.2%)	30	(50.8%)	65	(53.7%)	56	(46.3%)
Ciprofloxacin	41	(69.5%)	18	(30.5%)	96	(79.3%)	25	(20.7%)
Levofloxacin	47	(79.7%)	12	(20.3%)	109	(90.1%)	12	(.9%)
Meropenem	56	(94.9%)	3	(5.1)	116	(95.9%)	5	(4.1%)
Rifampicin	52	(88.1%)	7	(11.9%)	113	(93.4%)	8	(6.6%)

DISCUSSION

M. catarrhalis was considered a nonpathogenic organism in the past, although it is a part of normal flora of the nasopharynx. In recent years, *M. catarrhalis* is considered a pathogen and an important cause of upper respiratory tract infections in elderly people and children. Moreover, the bacterium has emerged as an important cause of lower respiratory tract infections in adults [28,29]. Recognition of *M. catarrhalis* as a lower respiratory tract pathogen has been delayed for several reasons. One of these reasons is that the organism was considered commensal in upper respiratory tract [30,31]. Some studies have shown that the colonization and adherence of *M. catarrhalis* to epithelial cells in oropharynx increased in the winter season in the elderly people, especially those with underlying diseases, this adherence and colonization facilitate the infection of the upper and lower respiratory tract[32]. The infection is transmitted between individuals mainly through respiratory droplets and enhanced by crowding conditions during the Hajj and Umrah seasons. Transmission of the infection occurs from symptomatic patients and asymptomatic carriers of potentially pathogenic organism. The current study was performed on 1592 Umrah visitors/Pilgrims from different nationalities. The carriage rate of *M. catarrhalis* as a potentially pathogenic bacteria was (11.1%) among the Umrah visitors before performing Umrah and (22.2%) after performing Umrah, the carriage rate of *M. catarrhalis* among the pilgrims was (9.6%) before performing Hajj and (19.7%) after performing Hajj. The prevalence of *M. catarrhalis* isolation in this study was 15.7%. This result is similar to a recent study done in Australia, which reported that 17.1% of adult patients with respiratory tract infections were due to *M. catarrhalis*[33]. A study from Egypt had, reported that *M. catarrhalis* isolates were 11.5% in patients having respiratory tract infection [34]. The present study showed

that the Iraqi Umrah visitors were the most ethnic group carrying *M. catarrhalis* before performing Umrah (44.6%), while the American Umrah visitors were the most ethnic group carrying *M. catarrhalis* after performing Umrah (75%). However, the Swedish pilgrims were the most ethnic group carries *M. catarrhalis* before performing Hajj (66.7%). While the Indian pilgrims were the most ethnic group carries *M. catarrhalis* after performing Hajj (33.5%).

CONCLUSION

The current study shows that the carriage rate of *M. catarrhalis* among the Umrah visitors was higher after performing Umrah than before performing it. Similarly the carriage rate of *M. catarrhalis* among the pilgrims was higher after performing Hajj than before performing Hajj. Results of this study reveal that Mass gatherings during Hajj and Umrah seasons help to increase the spread of *M. catarrhalis* infection from symptomatic patients and asymptomatic carriers. The prevalence of *M. catarrhalis* isolation in our study was 15.7% among Umrah visitors and pilgrims. Most of *M. catarrhalis* isolates from Umrah visitors and pilgrims were susceptible to all tested antibiotics.

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Conflict of interest

There is no conflict of interest.

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