

Knowledge and Attitude of Meningitis Belt Country Passengers Arriving at King Abdul-Aziz International Airport – Jeddah, Saudi Arabia toward Ciprofloxacin as a Meningococcal Disease Prophylaxis

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Abstract

Meningitis belt countries of sub-Saharan Africa are highly endemic of *Neisseria meningitidis*. Passengers traveling from meningitis belt countries and arriving in Jeddah, Saudi Arabia should receive one dose of ciprofloxacin upon their arrival if they are not vaccinated with the quadrivalent (ACYW) conjugate meningococcal vaccine. This study aims to assess the knowledge and attitude of those passengers regarding the preventive measures taken at the point of entry toward meningococcal disease. A cross-sectional study was conducted among 394 passengers who arrived from meningitis belt countries in Jeddah, Saudi Arabia from April to June 2022. The study shows that 51% of the participants were aware of the purpose of ciprofloxacin use, 64.7% of them were vaccinated with the meningococcal vaccine. About 77.2 % of the passengers were not informed about the preventive measures regarding meningococcal disease and the obligation of receiving ciprofloxacin if they are not vaccinated with conjugate type. The study finding demonstrates that there is a lack of information among the passengers who are arriving from meningitis belt countries regarding the preventive measures for meningococcal disease and it should be conveyed to them before the issuance of the visa in their home countries.

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1. Introduction

Meningococcal disease is a severe life-threatening disease with sudden onset. It is typically present as meningitis (infection of the lining of the brain and spinal cord) or meningococemia (bloodstream infection). Meningococcal disease is caused by a gram-negative bacterium known as *Neisseria meningitidis* which inhabits the nasopharyngeal mucosa of about 10 % of healthy people without causing disease and hence these people are known as disease carriers. But when the bacteria invade their bodies, it causes meningococcal disease. *Neisseria meningitidis* imposes a challenging public health situation as it is responsible for meningitis epidemics all over the world, mainly in the meningitis belt countries of Sub-Saharan Africa [1,2,3,4 &5].

Many studies showed that the pharyngeal carriage of *Neisseria meningitidis* reaches up to 30 % of people living in meningitis belt countries of sub-Saharan Africa, which include 26 countries, from Ethiopia in the east to Senegal in the west [6, 7&8].

There are at least 12 serotypes (serogroups) of *Neisseria Meningitidis*. Six of these serotypes are found to be responsible for most of the diseases across the world which include A, B, C, W, X, &Y, and their transmission occurs through respiratory droplets or throat secretions [9].

Meningococcal meningitis patients present with sudden onset of headache, fever, and neck stiffness, and about 40% of the patients may present with sepsis. It is a rapidly progressive disease; death can occur within 24 hours of disease onset. The case-fatality ratio may reach up to 20 %, even with using antibiotics for treatment. A prophylactic antibiotic is given to close contact of patients with meningococcal disease to protect them from getting the disease [4&5].

Prevention of meningococcal disease can be done through effective, safe, and affordable vaccines which are available in two types; polysaccharides and conjugate meningococcal vaccines which give long-lasting immunity [1&5].

Many studies showed that there was a high and noticeable decrease in the pharyngeal carriage of *Neisseria meningitidis* when they were vaccinated with the conjugate meningococcal vaccine, but this observation was not observed in people who were vaccinated with the polysaccharide meningococcal vaccine [10].

About two million Muslim pilgrims from more than 140 countries, in addition to Saudi citizens, are coming annually to perform Hajj in Makkah city, which includes dedicated sites for pilgrims to do their obedience, and those areas become congested with pilgrims representing a huge mass gathering. Also, Umrah pilgrims from those countries can perform their obedience at any time of the year [11].

During these events, the risk of a meningococcal outbreak is remarkably high, and the carriage rate of *Neisseria meningitidis* can reach up to 86% in these closed and crowded areas which can lead to a large intercontinental outbreak of meningococcal

disease.

Three major outbreaks of invasive meningococcal disease occurred during Hajj in 1987, 2000, and 2001. After the first outbreak in 1987, all pilgrims were required to receive a bivalent (A&C serotypes) meningococcal vaccine before arriving for Hajj, this preventive measure controlled the diseases for almost 13 years when other outbreaks occurred in 2000 and 2001, which were mainly due to another serotype (W serotype) ; the W serotype was not known before to cause large epidemics; Another vaccine policy was introduced to control the disease by switching the vaccination requirements from bivalent (A&C serotypes) to quadrivalent (A, C, W, and Y serotypes) .In 2002, meningococcal vaccination requirements were coupled with chemoprophylaxis for all pilgrims arriving from meningitis belt countries, and since that time, no more Hajj-related meningococcal outbreaks have occurred [11]. During the entire year, passengers coming from meningitis belt countries and arriving at King Abdel Aziz International Airport -in Jeddah, Saudi Arabia who are not vaccinated with the quadrivalent (ACYW) conjugate vaccine should receive one dose of Ciprofloxacin as a prophylactic antibiotic at the point of entry [12&13].

This study aimed to assess the knowledge, practice, and attitude of meningitis belt country passengers who arrived at King Abdel Aziz International Airport -in Jeddah, Saudi Arabia regarding the preventive measures taken at the point of entry toward meningococcal disease ; Specifically, it was designed to 1) identify the knowledge, practice, and attitude of meningitis belt country passengers about using one dose of Ciprofloxacin as meningococcal meningitis prophylaxis upon arrival, 2) estimate the proportion of vaccinated passengers arriving from meningitis belt countries with either polysaccharide or conjugate meningococcal vaccine, 3) assess their willingness to be vaccinated with the conjugate meningococcal vaccine in order to avoid receiving ciprofloxacin at the point of entry to Jeddah-Saudi Arabia.

2. Materials and Methods

2.1 Study Design

We performed a cross-sectional study among passengers who arrived from meningitis belt countries at King Abdul-Aziz International Airport, in Jeddah, Saudi Arabia, between April and June 2022. Any passenger who is 18 years old or older was eligible for the study with no exclusion criteria.

2.2 Sample Size Estimation

We calculated the required sample size using the Cochran formula:

$$n_{sz} = \frac{Z^2 \hat{p}\hat{q}}{d^2}$$

In this equation, n represent the sample size required, Z denotes the standard deviation with a confidence interval of 95% which is equal to 1.96, and p represents the hypothesized frequency of passengers' knowledge about ciprofloxacin use which was set as 50% & d represents the acceptable margin of error for proportion

being estimated which was set as 0.05, $q = 1-p = 0.5$. So, the required sample size calculated was 384 passengers arriving from meningitis belt countries [14].

2.3 Sampling Methodology

A simple random sample was used to recruit the participants. The primary sampling units were flights arriving from meningitis belt countries. The secondary sampling units were passengers 18 years old or older arriving from meningitis belt countries. From each flight, 5-10 passengers were randomly selected. There was no need for stratification.

2.4 Data Collection

The data collection tool was a structured, interviewer-based questionnaire. The questionnaire developed by the authors contained three sections covering the socio-demographic characteristics of participants, their knowledge, attitude, and practice toward ciprofloxacin use, and the third section was about their knowledge, attitude, and practice toward the meningococcal vaccine.

The questionnaire form was bilingual (Arabic / English) with the same corresponding code. A pilot study was conducted on twenty participants to check the clarity of the question and the expected time required for data collection.

Four trained public health practitioners conducted face-to-face interviews after they obtained written informed consent from the participants between April and June 2022 at the international arrival terminals of King Abdul-Aziz airport, Jeddah, immediately after the passengers swallowed the ciprofloxacin tablet, and each interview lasted about 5 minutes. Participation in the survey was voluntary, the participant had the right to withdraw at any time, and confidentiality was maintained by using a deidentified questionnaire.

2.5 Study Variables

The study variables included the sociodemographic of the passengers arriving from meningitis belt countries (country, age, sex, education level, frequency of visiting Jeddah). The second part of the questionnaire was designed to assess knowledge, attitude, and practice toward ciprofloxacin antibiotic, including swallowing ciprofloxacin tablet at the point of entry to Jeddah-Saudi Arabia, knowing the purpose of ciprofloxacin swallowing, any side effects of ciprofloxacin, and the frequency of swallowing ciprofloxacin. The third part of the questionnaire was designed to assess knowledge and practice toward the meningococcal vaccine, including their vaccination status with meningococcal vaccine either polysaccharide or conjugate type, their awareness about swallowing ciprofloxacin if they were not vaccinated with the conjugate meningococcal vaccine type, and finally, their willingness to be vaccinated with conjugate meningococcal vaccine type to avoid swallowing the ciprofloxacin at the point of entry to Jeddah-Saudi Arabia.

2.6 Statistical Analysis

The collected data were entered using an Excel file and analyzed using SPSS version 25. A descriptive analysis of data was conducted. The data were expressed as mean \pm SD for continuous variables, percentages, and frequencies for non-continuous variables. We used the chi-square test to determine the associations between variables, and the associations were statistically significant when the P-value was < 0.05 .

2.7 Ethics

The study was conducted after we obtained ethical approval from the Institutional Review Board - Directorate of Health Affairs-Jeddah, Saudi Arabia with IRB Log number: A0292.

3. Results

3.1 Sociodemographic Characteristics

A total of 394 travelers from thirteen different countries were included in our study. The vast majority were from Sudan (50.5%) followed by Uganda and Nigeria (14.2%, and 11.9% respectively) [Figure 1].

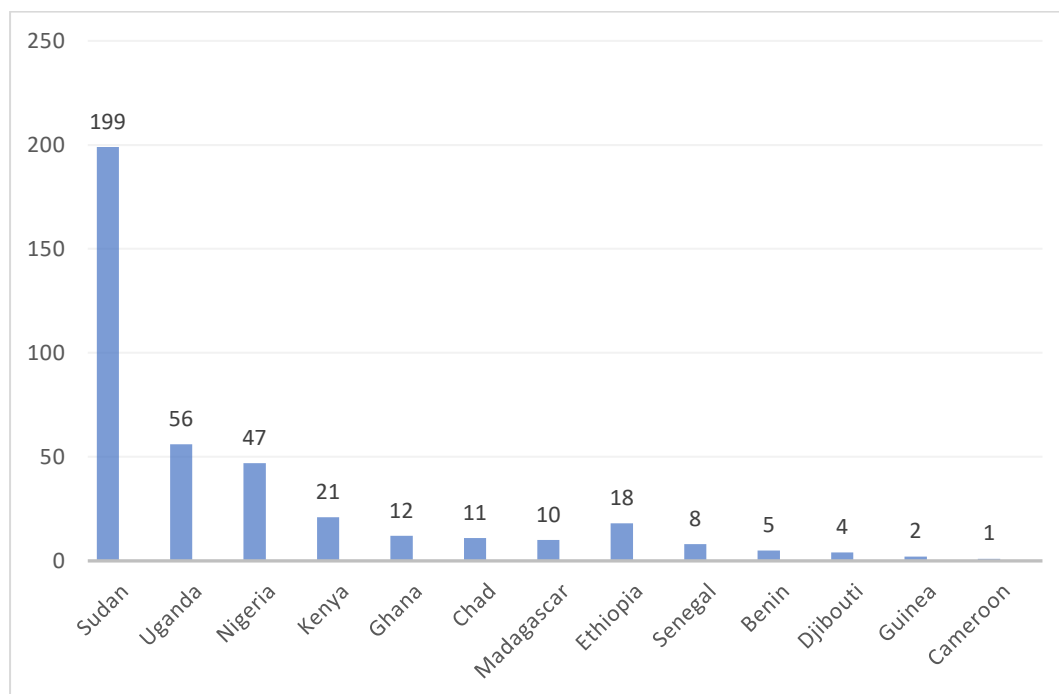


Figure 1: Number of participants according to their nationalities

Out of the 394 participants, 221 were males (56.1%) while 173 were females (43.9%) [Figure 2].

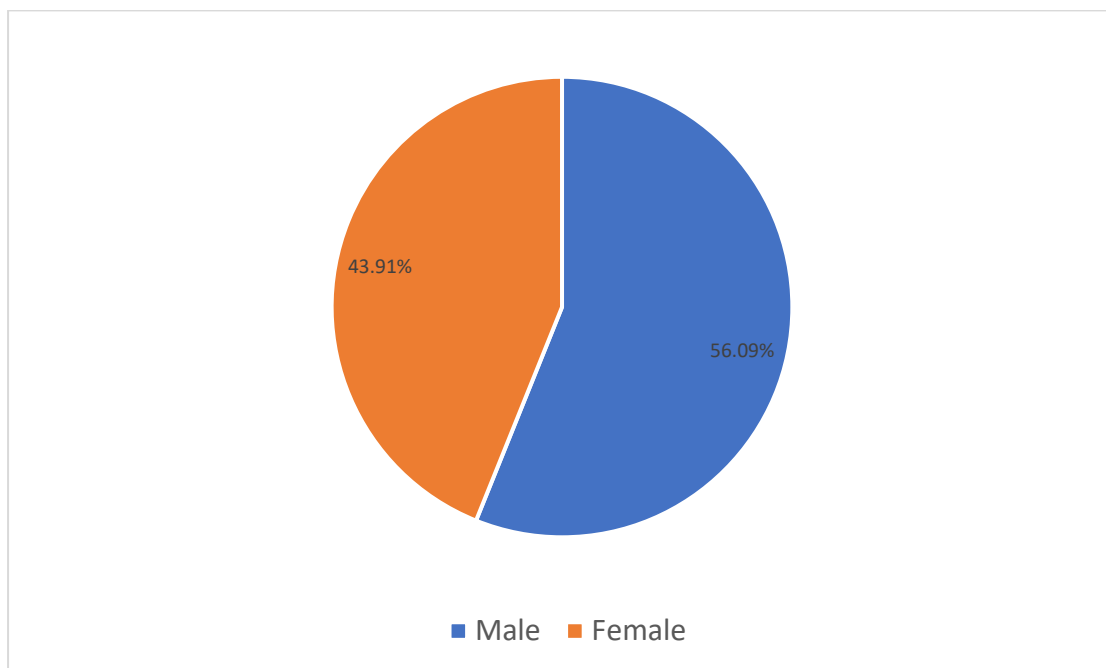


Figure 2: Percentage of participants according to their gender

Only ten females were pregnant and 8 were breastfed. About 41.4% of the participants were within the age bracket of 26-35 years, and the overall mean age was 35.35 years (SD=10.76) [Figure 3].

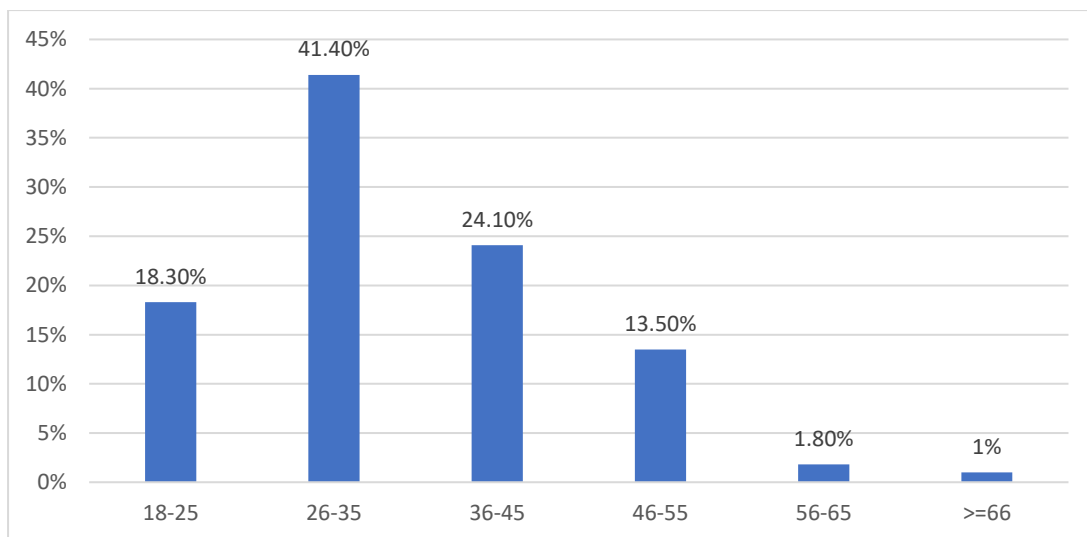


Figure 3: Percentage of participants according to their age group

Regarding educational status, about 24.6% have Secondary education while 18% were not educated [Figure 4].

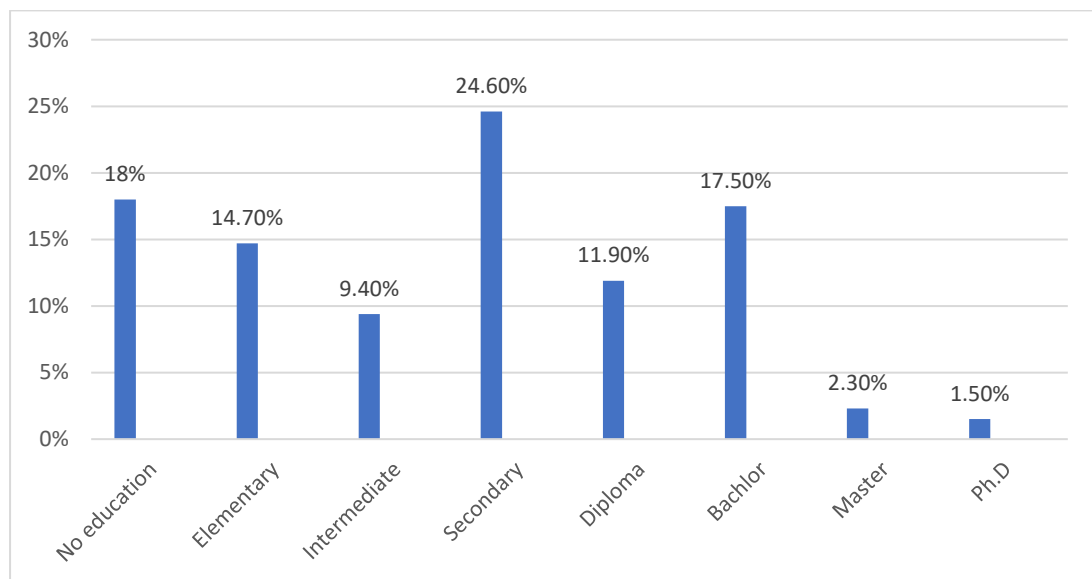


Figure 4: Distribution of the participants according to their level of education

3.2 Knowledge, Attitudes, and Practices Concerning Ciprofloxacin Use

The study showed that 51% of the participants were aware of the purpose of ciprofloxacin use. Male participants had significantly higher knowledge than female. Also, participants in the age group 56-65 years had better knowledge (71.4%) followed by the age group 36-45 years (62.1%).

In terms of education, participants with higher education showed better knowledge than the other level of education, the highest was among Ph.D. participants (83.3%) who were aware of ciprofloxacin use followed by participants with a bachelor's level of education (79.7%), whereas participants with an elementary level of education were the least (20.7%).

Regarding the nationalities, we observed in our study that the highest percentage (88.8%) of awareness of ciprofloxacin use was among the passengers who arrived from Ethiopia. On the other hand, no participant who arrived from Senegal and Guinea was aware of ciprofloxacin use, which was the lowest among the nationalities who arrived from meningitis belt countries [Table 1].

Table 1: Respondent's demographic characteristics and their knowledge of Ciprofloxacin use

Demographic Characteristics	Knowledge about Ciprofloxacin use			Chi-square	p-value
	Yes n=201 (%)	No n=193 (%)	Total n=394 (%)		
Gender				10.89	0.001
Male	129 (58.4%)	92(41.6%)	221(56.1%)		
Female	72(41.6%)	101(58.4%)	173 (43.9%)		
Female				17.71	0.003
18-25	23(31.9%)	49 (68.1%)	72 (18.3%)		
26-35	84 (51.5%)	79 (48.5%)	163 (41.4%)		
36-45	59 (62.1%)	36 (37.9%)	95 (24.1%)		
46-55	29 (54.7%)	24 (45.3%)	53 (13.5%)		
56-65	5 (71.4%)	2 (28.6%)	7 (1.8%)		
>65	1 (25%)	3 (75%)	4 (1 %)		
Education				52.19	< 0.001
Uneducated	39 (54.9%)	32 (45.1%)	71 (18 %)		

Table 2: Respondent's demographic characteristics and their knowledge of Ciprofloxacin use (continuation)

Demographic Characteristics	Knowledge about Ciprofloxacin use			Chi-square	p-value
	Yes n=201 (%)	No n=193 (%)	Total n=394 (%)		
Education (continuation)					
Elementary	12 (20.7%)	46 (79.3%)	58 (14.7%)		
Intermediate	13 (35.1%)	24 (64.9%)	37 (9.4%)		
Secondary	46 (47.4%)	51 (52.6%)	97(24.6%)		
Bachelor	55 (79.7%)	14 (20.3%)	69 (17.5%)		
Ph.D.	5 (83.3%)	1 (16.7%)	6 (1.5%)		
Nationality				36.67	0.00025
Sudan	105 (52.8%)	94 (47.2%)	199 (40.5%)		
Uganda	31 (55.4%)	25 (44.6%)	56 (14.2%)		
Nigeria	18 (38.3%)	29 (61.7%)	47 (11.9%)		
Kenya	7 (33.3%)	14 (66.6%)	21 (5.3%)		

Table 3: Respondent's demographic characteristics and their knowledge of Ciprofloxacin use (continuation)

Demographic Characteristics	Knowledge about Ciprofloxacin use			Chi-square	p-value
	Yes n=201 (%)	No n=193 (%)	Total n=394 (%)		
Nationality (continuation)					
Ghana	3 (25%)	9 (75%)	12 (3.1%)		
Chad	9 (81.8%)	2 (18.2)	11 (2.8%)		
Madagascar	5 (50%)	5 (50%)	10 (2.5%)		
Ethiopia	16 (88.8%)	2 (11.2%)	18(4.6%)		
Senegal	0 (0%)	8 (100 %)	8 (2%)		
Benin	2 (40%)	3 (60%)	5 (1.3%)		
Djibouti	3 (75%)	1 (25%)	4 (1.01%)		
Guinea	0 (0 %)	2 (100 %)	2 (0.5%)		
Cameroon	0 (0 %)	1 (100%)	1 (0.25%)		

While 301 (76.4%) swallowed the ciprofloxacin at the point of entry, only 61.5% of them knew the purpose of taking the pill.

Concerning the side effects of ciprofloxacin, about 99 (25.1%) of the participants do not know if they have any side effects from ciprofloxacin or not, and only 14 (3.6%) declared that they have had side effects (2 of them had an allergy).

228 (57.9%) participants were their first-time visiting Jeddah, 166 (42.1%) have visited Jeddah before (Mean=4.2, SD=3.37, Mode=2), and about 43.3% of the participants have taken ciprofloxacin before [Table 2].

Table 2: Practice and attitude of participants to Ciprofloxacin usage and Meningococcal vaccine

Attitudes to Ciprofloxacin usage	Yes (%)	No (%)
Have you swallowed the pill?	76.4	23.6
Is this the first time you swallow the pill?	56.6	43.4
Have you been vaccinated with the meningococcal vaccine?	64.7	35.3
Are you willing to take the vaccine?	81.5	18.5

3.3 Knowledge, Attitudes, and Practices Toward Meningococcal Vaccine

Regarding the vaccination status of Meningococcal vaccines, 64.7% of the participants are vaccinated, where 76 % of them were vaccinated with the polysaccharide vaccine type and 24% with the Conjugate vaccine [Figure 5].

Only ninety travelers (22.8%) have declared that they were informed before arrival in Jeddah that it is mandatory to swallow the prophylactic antibiotic if they are not vaccinated with the Meningococcal conjugate vaccine. However, most travelers

(81.5%) have shown a willingness to receive the Conjugated vaccine type if they have the chance before arrival.

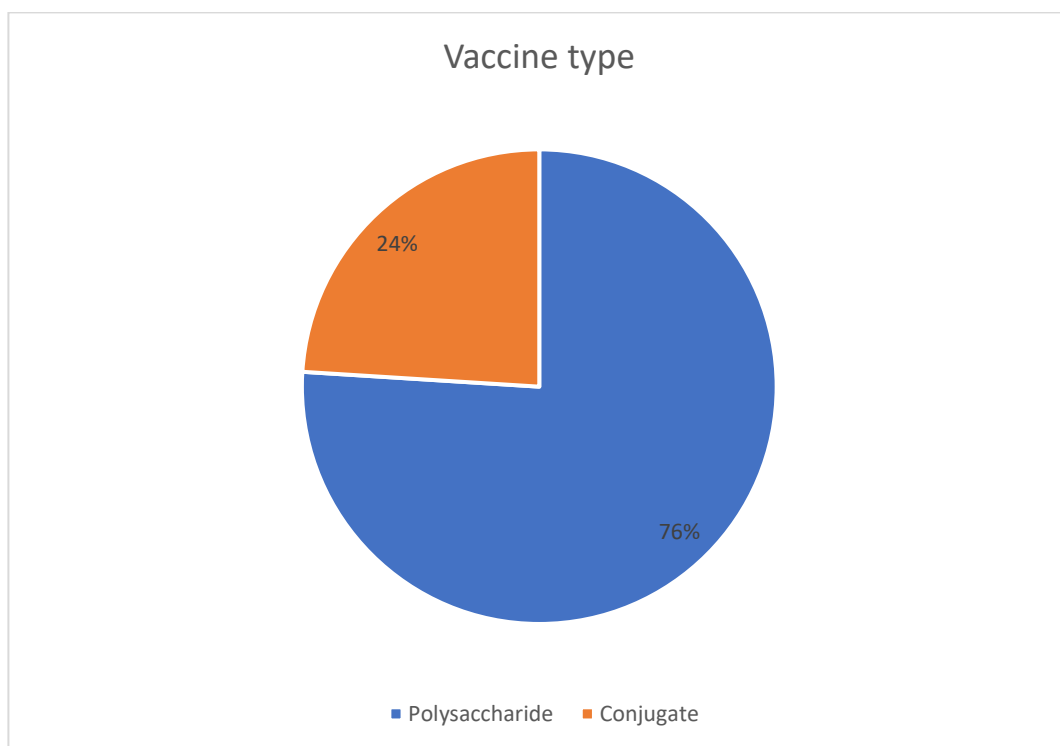


Figure 5: Percentage of vaccine type

4. Discussion

Passengers traveling from meningitis belt countries and arriving in Jeddah, Saudi Arabia who are not vaccinated at all for meningococcal disease or those who are vaccinated with polysaccharide meningococcal vaccine type should receive one dose of ciprofloxacin at the point of entry. On the other hand, there is no need for passengers who are vaccinated with a conjugate meningococcal vaccine to receive ciprofloxacin as the conjugate vaccine is highly immunogenic and highly effective in controlling the nasopharyngeal carriage of *Neisseria meningitidis* but unfortunately is more expensive [15&16].

This study aimed to assess the knowledge and attitude of those passengers regarding the preventive measures taken at the point of entry toward the meningococcal disease, and it is the first study conducted to identify their awareness regarding receiving one dose of chemoprophylaxis before their entry if they are not vaccinated with conjugate meningococcal vaccine.

In our study, about half of the participants were from Sudan and this is explained by the number of flights arriving from Sudan which may reach more than 10 flights daily compared to few flights coming from other countries which may be less than one flight weekly and even for some countries there were no direct flights and only

transit flights through airlines arriving from other countries. Furthermore, there were no passengers arriving from the rest of the meningitis belt countries.

We observed in this study that the knowledge and awareness regarding ciprofloxacin use were strongly associated with male gender passengers, age group 56-65 years, those with high education levels, and passengers who arrived from Ethiopia.

About 165 (92.7%) of passengers who visited Saudi Arabia more than once know the purpose of taking ciprofloxacin at the point of entry which represents 76.2% of the total passengers from meningitis belt countries who were aware of swallowing Ciprofloxacin at the point of entry to Jeddah, Saudi Arabia and this could explain their knowledge about ciprofloxacin use as they had previous experience. Only about 3.6% declared that they have had side effects from ciprofloxacin and about 25.1% of the participants do not know if they have any side effects from ciprofloxacin or not.

Meningococcal vaccine is compulsory for hajj pilgrims, and this is one of the prerequisites of visa issuance for performing Hajj before arriving to Saudi Arabia. Although Compliance with meningococcal vaccine among international Hajj pilgrims reached 98.2% in 2013 and 100% in 2014 as shown in studies conducted by (Ziad A. Memish et al) at King Abdul-Aziz international airport [11,17&18], We observed only about 64.7% of the passengers who arrived from meningitis belt countries have been vaccinated, 76 % of them were vaccinated with the polysaccharide vaccine compared with only 24 % vaccinated participants with Conjugated vaccine.

However, most travelers (81.5%) have shown a willingness to receive the Conjugate vaccine if they have the chance before arrival to avoid receiving ciprofloxacin at the point of entry to Saudi Arabia, and in consequence, will reduce ciprofloxacin resistance where many of the passengers had multiple visits to Saudi Arabia.

Most of the passengers (77.2 %) who arrived from meningitis belt countries declared that they are not informed about the preventive measures regarding meningococcal disease and the obligation of receiving ciprofloxacin upon their arrival in Jeddah, Saudi Arabia if they are not vaccinated with conjugate meningococcal vaccine.

The strength of our study is that it is the first study to examine the awareness and the knowledge of passengers arriving from meningitis belt countries to Jeddah, Saudi Arabia regarding receiving one dose of chemoprophylaxis before their entry if they were not vaccinated with conjugate meningococcal vaccine. Nevertheless, we acknowledge a few limitations; for example, there was a large variation in flights number arriving from different meningitis belt countries, which in consequence affected the passengers' nationalities who participated in our study. Another limitation was the language barrier as many of the passengers were not speaking English or Arabic language which was used in our questionnaire.

The study finding may be useful to inform health policymakers in Saudi Arabia about the need to raise awareness of preventive measures regarding meningococcal disease for passengers traveling from meningitis belt countries done at the point of

entry upon their arrival in Jeddah, Saudi Arabia during the entire year and not merely for Hajj season, before issuance of the visas in their home countries.

5. Conclusion

This survey demonstrates that most travelers from meningitis belt countries were not aware of the preventive measures regarding meningococcal disease and the obligation of receiving ciprofloxacin upon their arrival to Saudi Arabia if they are not vaccinated with the conjugate meningococcal vaccine type, and most of them have shown a willingness to receive the Conjugate vaccine rather than polysaccharide vaccine if they have the chance before their arrival to Saudi Arabia to avoid receiving ciprofloxacin at the point of entry. There is a lack of information regarding the preventive measures for meningococcal disease, and it should be conveyed to the passengers before the issuance of the visa in their home countries.

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Conflict of Interest

There are no conflicts of interest.

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