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Research Article

FREQUENCY OF ABO BLOOD GROUPS IN THE MAKKAH CITY AND THEIR ASSOCIATION WITH DISEASES

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Abstract:

Background: The ABO blood groups are A, B, AB and O. There is a relationship between ABO blood group and different disease. **The aim of this study** was to detect the frequency of ABO blood group in Saudi Arabia in the Makkah city and to detect their relation to diseases. **Methods:** This study included 607 subjects, 583 were Saudi, and 24 were non-Saudi. They were 341 men and 266 women. All were subjected to multiple questionnaires which include, age, sex, marital status, number of children if married, blood group, history of malaria infection, history of dengue fever infection and history of ABO hemolytic disease of the newborn in mothers of blood group O. **Results.** 49.5% were blood group O, 28.6% were blood group A, 17.9% were blood group B and 3.8% were blood group AB. 91.9% being Rh positive and 7.9% were Rh negative. The highest frequency of malaria infection was observed in blood group AB (8.7%) followed by O (2.7%). Whereas, the highest frequency of dengue fever infection was observed in blood group B (10.1%) followed by O (8%). **Conclusion:** The frequency of blood group in the Makkah city are O followed by A then B and lastly AB. Blood group AB and B are more liable to malaria and dengue fever infection respectively. They are followed by O blood group in both conditions.

Keywords: ABO, malaria, dengue fever.

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INTRODUCTION:

The ABO blood groups are A, B, AB and O. They are the most common of all the blood group antigens. The frequencies of different ABO blood types vary among different populations, suggesting that a certain blood group reflected a selection advantage (e.g., resistance against an infectious disease) (Bashwari et al.,2001; Sarhan et al.,2009). There is a significant relationship of ABO blood group with different diseases. The ABO hemolytic disease of the newborn (ABO HDN) is the most common maternofetal blood group incompatibility. ABO HDN is restricted almost entirely to group A or B babies born to group O mothers with immune anti-A or anti-B antibodies. (Alani et al.,2015)

Malaria is transmitted via the bites of infected female anopheles' mosquitoes to the human being. According to the WHO estimates, there is an increasing in the number of the affected cases with malaria. In 2016, there were 216 million cases of malaria and in 2015, there were 211 million cases infected with malaria. The number of deaths from malaria was 445 000 and 446 000 in 2016 and 2015 respectively. (WHO.,2018). The association of ABO blood group with malaria has been discussed in several studies (Tewodros et al .,2011; Deepa et al.,2011; Tadesse and Tadesse .,2013; Anjomruz et al.,2014; Afoakwah et al.,2016).

Dengue fever is caused by Dengue virus. Also, the transmission is via the bites of mosquito. Dengue viruses are members of the genus Flavivirus, and there are 4 dengue virus serotypes (DEN-1, DEN-2, DEN-3 and DEN-4). Flaviviruses are lipid-enveloped, single stranded RNA viruses ((WHO.,2016). Once the infected mosquito bites the human being, the virus replicates in dendritic cells of the skin followed by invasion of macrophages and activation of lymphocytes then entry into the bloodstream (WHO.,2016). The infection causes a flu-like illness, and occasionally develops into a fatal condition called severe dengue. Criteria for severe dengue include any sign of severe plasma leakage leading to shock or fluid accumulation with respiratory distress, severe bleeding, or severe organ impairment ((WHO.,2016). The WHO reported increase in the number of cases from 2.2 million in 2010 to 3.2 million in 2015 (WHO). The association of dengue fever with certain blood group was discussed in different previous studies. They suggested that a certain blood group may be a risk factor or a predisposing factor for dengue fever or severe dengue disease (Khode et al.,2013; Kalayanarooj et al.,2007).

Aim of study

The aim of this study was to detect the frequency of ABO blood group in Saudi Arabia in the Makkah city and to detect their relation to diseases such as hemolytic disease of the newborn, malaria and dengue fever.

Subjects & methods

Subjects

This study was carried out from April 2017 to May 2018; it included 607 subjects.

The Umm Al-Qura University ethics committee approved the protocol of this study. All participants in this study gave informed consent according to the declaration of Helsinki. The data for this study were collected from ALnoor Hospital, ALshishah Hospital, the Maternal and Children Hospital and the students of the faculty of medicine, Umm Al-Qura University in Makkah, Saudi Arabia.

Sample collection

The data were collected from all participants without any exclusion.

Methods

A questionnaire was applied to everybody, which include age, sex, marital status, number of children if married, blood group, history of malaria infection, history of dengue fever infection, history of ABO hemolytic disease of the newborn in mothers of blood group O.

Statistical analysis

The statistical analysis of this study was done using SPSS program version 20. Quantitative data were described in the form of mean \pm SD for the normally distributed data. The median and range were used for the data that were not normally distributed. The comparison between groups was performed by using Student t-test for quantitative data and the chi -square test for the qualitative data. The significance level was set at 0.05.

RESULTS:

The results of this study are summarized in tables from 1 to 4

This study included 607 participants. They were 341men and 266 women with male to female ratio of 1.3: 1. Their mean age was 32.07 ± 13.5 years. Their median age was 25 years and it ranged from 14 to 80. Five hundred eighty-three was Saudi, 24 was non-Saudi. Three hundred thirty-seven of them were single and 270 were married. Table 1

Table 1: Clinical data of the participants

	age	nationality		gender		Marital status	
mean±SD	32.07±13.445	Saudi	Non-Saudi	Male	Female	Single	Married
median	25.00						
min-max	14-80						
Number (607)		583	24	341	266	337	270
percentage		96	4	56.1	43.8	55.5	44.5

The frequency of the blood group and Rh of the participants are shown in table2. The highest frequency was group O 49.5% (301) followed by group A with 28.6% (174) then blood group B was 17.9% (109), then the AB blood group was the lowest one with frequency of 3.8%. Regarding the percentage of Rh-positive individuals in our sample was 91.9% (559) while the percentage of Rh negative was 7.9% (48).

Table 2: The frequency of the different blood group and Rh in the whole participant

Blood group and Rh	Number	Percentage
A	174	28.6
AB	23	3.8
B	109	17.9
O	301	49.5
Rh –	48	7.1
Rh +	559	91.9

The comparison between male and female with regards to the ABO and Rh frequency are shown in table3. In male the highest frequency was found in blood group O, 52.5%, then blood group A was 27.3%, followed by blood group B which was 17.6%. The lowest frequency was found in blood group AB, which was 2.6%. In female the highest frequency was found in blood group O, 45.8 %, which was followed by blood group A 30.5% %, then blood group B 18.4% and the last one was blood group AB 5.3%. With regards to the Rh, in male, 92.4% (315) were Rh positive and 7.6 % (26) were Rh negative. In female, 91.7 % (244) were Rh positive and 8.3 % (22) were Rh negative. There were no significant differences in the frequency between male and female with regards to blood group frequency and Rh $p > 0.05$.

Table 3: The comparison between male and female with regards to ABO blood group and Rh.

		A	AB	B	O	Total	Rh -	Rh+	Total
Male	Number	93	9	60	179	341	26	315	341
	%	27.3%	2.6%	17.6%	52.5%	100%	7.6%	92.4%	100%
Female	Number	81	14	49	122	266	22	244	266
	%	30.5 %	5.3%	18.4%	45.8%	100%	8.3%	91.7%	100%
Total	Count total	174	23	109	301	607	48	559	607
	% of Total	28.6 %	3.8%	17.9%	49.5%	100.0%	7.9%	91.9%	100.0%
p & significance		>0.05 NS	>0.05 NS	>0.05 NS	>0.05 NS				

With regards to the association of ABO blood group and different disease. It was found that 11 out of 43 (25.6%) married female with blood group O had babies with ABO hemolytic disease of the newborn. The blood group of the babies were 8 A (3 negative and 5 positive), 2 B and 1 AB. In malaria the highest frequency was observed in AB (8.7%) blood group followed by O (2.7%) then A (2.3%) then B (1.9 %) with no significant difference. In Dengue fever the highest frequency was observed in B blood group (10.1%) followed by O (8%) then AB (4.3%) then A (4%) with no significant difference. Table4.

Table 4: The frequency of malaria and dengue fever in different blood group studied

	A		AB		B		O		Positive Total number	P& significance
	Number	%	Number	%	Number	%	Number	%		
	174		23		109		301			
Malaria Positive	4	2.3	2	8.7	2	1.9	8	2.7	16	0.303 NS
Malaria Negative	170		21		107		293			
Dengue fever Positive	7	4	1	4.3	11	10.1	24	8	43	0.204 NS
Dengue fever Negative	167		22		98		277			

DISCUSSION:

The ABO blood group antigens have an importance because of their different frequencies among different populations, suggesting that a blood group type has a selection advantage against certain disease. (Dean .,2005)

The aim of this study was to determine the frequency of ABO blood group and Rh antigens in the Makkah city, Saudi Arabia and to detect their relations with different disease.

In our study, the highest frequency was found in blood group O 49.5% followed by group A with 28.6% followed by blood group B which was 17.9% and the minority was in blood group AB 3.8%. Our findings are consistent with other studies done in the Makkah region and in the south west area of Saudi Arabia. They demonstrated that the majority of blood group are O followed by A, B and AB (Bashwari et al.,2001;Sarhan et al.,2009;Dahlawi et al.,2005). In comparison, with Arab countries our results are in agreement with Kuwait (Al-Bustan et al.,2002), Oman (Moftah .,1993) and Bahrain (Al-Arrayed et al., 2001). Whereas, they are in contrast with studies done in Palestine (Skaik and El-Zyan .,2006) and Jordan (Hanania et al.,2007) who reported that the majority of blood group are A blood group. In comparison, with international studies our results are in accordance with some studies done in India (Latoo et al.,2006; Das et al., 2001) and in contrast with other studies done in other parts of India (Sidhu .,2003) and Pakistan (Hammed et al.,2002) who found that the blood group B has the highest frequency. With regards to the ABO frequency in male and female in our study, they follow the distribution of the whole population with no significant difference between them. This is in agreement with previous national and international studies (Elsayid et al.,2015; Chandra and Gupta 2012; Butt et al.,2016). Regarding the Rh frequency, 91.9% was Rh positive and 7.9% was Rh negative.

our findings are near to the result of other areas of Saudi Arabia (Bashwari et al.,2001;Sarhan et al.,2009;Dahlawi et al.,2005) and similar to neighboring countries and other countries worldwide. (Al-Bustan et al.,2002; Moftah .,1993; Al-Arrayed et al., 2001)

The ABO blood group system is part of the innate immune system and it has been shown that individuals with different ABO blood groups differ in their susceptibility or resistance to viral and bacterial infections and diseases. In people with blood group A there are antibodies to antigen B and vice versa in people with group B. Human blood AB group does not contain antibodies to erythrocyte antigens of other blood groups. Blood group O erythrocytes do not possess A or B antigens, but they have antibodies to A and B antigens. This determines the natural resistance of people to many infectious diseases whose agents have antigens on the surface of their cells that are similar to antigens of one or another group of blood.

Regarding the frequency of malaria in different blood group, our study reported that the highest frequency was observed in AB blood group (8.7%) followed by O (2.7%) then A (2.3%) then B (1.9%). This may explain by the fact that AB persons have no antibodies in their serum and have the lowest natural resistance against diseases. In addition, in earlier studies, it was reported that blood group O protect against falciparum malaria (Rowe et al., 2007), and individuals with blood group AB, A, and B are more susceptible to plasmodium falciparum malaria than those with O blood group (Tewodros et al.,2011). In Saudi Arabia, plasmodium falciparum constitutes 99% of malaria cases followed by 1% of plasmodium vivax (WHO.,2016). Blood group O has protective effect through the mechanism of reducing and preventing rosetting, Rosetting is a process whereby uninfected red blood cells adhere to red blood cells that have been infected with malarial parasites,

forming clusters, or rosettes. Once they are formed, the immune system cannot destroy the malarial infected cells because they are surrounded by uninfected cells. Moreover, the rosettes can obstruct the blood flow in small blood vessels with subsequent tissue damage and severe malaria disease and this is more severe in non-O blood group. Recently (Goel *et al.*,2015), a group of researchers found that malaria parasites secrete polypeptide proteins called RIFINs (repetitive interspersed family of proteins) which move towards the surface of infected red blood cells, causing them to become more sticky and adhere to each other. They reported that, it is more common in blood group A. With regards to the relation of malaria infection to the blood group, there are no similar studies done in Saudi Arabia but in comparison with international works. Our results are against studies done in Nigeria, (Abah *et al.*,2016), China (Xuan *et al.*,2017) and India (Gupta and Chowdhuri.,1980) who observed that the highest frequency of blood group in relation to malaria was O ,O and B respectively and the least frequency was in AB blood group.

In our work, the infection of Dengue fever was highest in blood group B (10.1%) followed by O (8%) then AB (4.3%) then A (4%). We suggest that dengue virus have structure that not neutralized by anti A and Anti B antibodies as the highest frequency was found in B persons who have anti A followed by O persons who have anti A and anti B in their plasma. This may be due to a cross reaction between dengue virus and red blood cells as both are glycosylated (Khode *et al.*,2013). No previous literatures are found in Saudi Arabia with regards to ABO blood group and dengue fever infection. In different international studies, a group of workers reported that the high frequency of dengue fever was in blood group O ((Khode *et al.*,2013). Other authors do not rely on the highest frequency of the blood group in relation to dengue fever infection, but they stress on the complication of dengue fever in relation to ABO blood group. They reported that, Patients with blood group AB had higher risk of developing dengue hemorrhagic fever and those with blood group O had the lowest risk. (Murugananthan *et al.*,2018; Kalayanaroj *et al.*,2007). More studies are needed to determine whether dengue fever and ABO are related and whether some blood groups are associated with a specific high risk of dengue virus. In our work, 25.6% of babies who born to mothers with blood group O had ABO hemolytic disease of the newborn. This is consistent with previous national and international studies (Irshad *et al.*,2011; Alkhotani *et al.*, 2014)

CONCLUSION:

The frequencies of blood group in the Makkah city are O followed by A then B and lastly AB. Blood group AB and B are more liable to malaria and dengue fever infection respectively. They are followed by O blood group in both conditions. More studies are needed to confirm the relation of ABO blood group to malaria and dengue fever infection.

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Disclosure of interest: the authors report no conflict of interest

Ethics approval The Umm AlQura University ethics committee approved the protocol of this study.

Additional information

Competing financial interests: The authors declare no competing financial interests.

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