

# Frequency of ABO and Rhesus blood groups in Saudi healthy blood donors versus non-Saudi in a retrospective study in Makkah City

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## ABSTRACT

**Purpose:** to assess the frequency of ABO and Rh blood groups among Saudi and non-Saudi healthy blood donors and to compare between them.

**Methods:** A retrospective study was conducted; in Makkah City, Saudi Arabia. It included 15,365 participants of 44 nationalities who have attended the blood bank of King Abdul Aziz Hospital. The collected data were age, sex, nationality, ABO, and Rhesus blood groups.

**Results:** 46.8 % of the participants were O, 28.8 % A, 19.5 % B, and 4.9% AB. The nationalities with a higher frequency of blood group O were Saudi, Mauritanian, Yemeni, Thai, Malian, Sudanese, Jordanian, Indian, Moroccan, Somali, Malaysian, Indonesian, Myanmar, Nigerian, Pakistani, Bangladeshi, Algerian, Djibouti, Burkinabe, Eritrean, Ghanaian, Bahraini, Bosnian, Canadian, Gambian, Iraqi, and Sri Lankan. Those with a higher frequency of blood group A were Turkish, Palestinian, Syrian, Lebanese, Egyptian, Afghan, Chadian, French, Tunisian, Cameroonian, Ethiopian, and British. Those with a higher frequency of B were Nigerian, American, Nepalese, and two nationalities with higher AB frequency Filipino and Chinese. 91.6 % of all populations were Rh-positive, and 8.4% were Rh-negative. The Saudi participants were like some nationalities and differed from others.

**Conclusion:** In Makkah city, the higher frequency of ABO blood group in Saudi and non -Saudi people is O followed by A, then B, and AB. The Rh-positive is predominant, and 8.4% of the participants are negative. The ABO and Rh blood groups' identifications are essential for providing suitable blood storage for individuals in need.

**Keyword:** ABO, Rh, blood groups, Saudi, non-Saudi.

## Introduction

The ABO and Rhesus (Rh) blood groups are the most common blood group antigens. The ABO is divided into A, B, O, and AB [1, 2], according to the antigens present on the extra cellular surface of red blood cells (RBC). The O blood group has H antigen on its surface. The A, B, and AB have some oligosaccharides residues added to the H antigen, resulting in groups A, B, and AB [3, 4]. The ABO antigens are also present

On the surface of cells and tissues in most persons [5]. The Rh blood type is the second blood group in its importance in transfusion medicine. It is highly polymorphic as it contains more than 44 different antigens. Rh antigens inheritance is determined by a complex of two closely linked genes: one encodes the D antigen, the other encodes the C or c, and E or e antigens [6].

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The terms Rh positive and Rh negative refer to the presence or absence of D antigen [7, 8]. The frequency of these blood groups varies from one geographic location to another. This reflects human people underlying genetic and ethnic diversity and suggests that a particular blood group showed protection or selective advantage to certain diseases [9-12]. In different parts of the world, the ABO and Rh rate showed variations in blood groups frequency. Some areas with a higher frequency of O, other of A, and others of B, and the Rh-positive is predominant [9, 13-22]. In Saudi Arabia, many studies have been carried out on ABO and Rh frequency, with few in Makkah city which have many residents of different nationalities. Most of these studies were done on the Saudi population and reported that the blood group O is the predominant one, followed by A, B, and AB, and the Rh-positive is dominant except for the Hail province, which showed a group frequency of O>B>A>AB [23-28]. The Aim of the study is to assess ABO and Rh blood groups frequency in Saudi and non-Saudi healthy blood donors in Makkah city and compare the frequency between different populations.

### Methods

A retrospective cross-sectional study was conducted from April 2020 to January 2021 at the Hematology and Immunology Department of the Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia. The data were collected from the blood bank of King Abdul Aziz hospital. The collected data were from January 2014 to August 2019. The biomedical ethics of the faculty of medicine of the Umm Al-Qura University approved the protocol of this study, and the approval number was HAPO-02-K-012-2020-05-385. The followings data were collected:

- 1- Sociodemographic character data, which include age, sex, and nationality.
- 2- The ABO and Rh blood groups. The automated and manual methods were used for determination of ABO and Rh. The automated methods were the microplate or gel card [29-30]. In the microplate, the red cell suspension and monoclonal antibodies were pipetted onto a microwell plate and examined for agglutination. In reverse typing, the cells and patient's plasma were mixed and examined for agglutination. In the gel card (forward), the RBC suspension was added to the column, which contains antisera of ABO/Rh. After centrifugation, the cell pellet was either at the top (positive) or bottom (negative). The manual methods were used to resolve discrepancies or confirm negativity of Rh [31].

All participants who were fulfilling the national blood transfusion guidelines in Saudi Arabia were included. All persons who were rejected from the blood bank to donate blood were excluded.

### Statistical analysis

This statistical analysis was done using the SPSS program version 20. Quantitative data was described in the form of mean  $\pm$  SD. The numbers and percentage of participants and the blood groups were calculated. The comparison between groups was performed by using the Student t-test.

### Results:

The results were summarized in (Tables 1-4) and (Figure 1). This study included 15,365 persons. They were 15,181 males and 184 females with a ratio of 82.5:1. The mean age was 31.8 $\pm$ 8.9 years, the median was 30 years, and their age ranged from 18 to 62 years. The nationality of the participants, their numbers, their age, and sex were showed in (Table1). There was a significant increase in the age between Saudi and Malian, Myanmar, and Pakistani and a significant decrease between the Egyptian people. The frequency of blood groups in all the populations studied was showed in (Table 2). Of all participants, 46.8 % were O, 28.8 % A, 19.5 % B, and 4.9% AB. 91.6 % were Rh-positive, and 8.4% were Rh-negative. The following nationalities had a higher frequency of blood group O with variations in other blood groups' order. The Mauritanian, Yemeni, Thai, Malian, Sudanese, Saudi, Jordanian, and Indian had a frequency of O>A>B>AB. The Moroccan showed O >A > B=AB. The Somali revealed O >A>AB and the absence of B. The Malaysian showed O >A = AB with the lack of B. The Indonesian, Myanmar, Nigerian, Pakistani, and Bangladeshi showed a frequency of O>B>A>AB. The Algerian and Djibouti showed O >A=B=AB. The Burkinabe and Eritrean displayed O > B>A with AB's absence. The Ghanaian showed a frequency of O>B and a lack of A and AB. The Bahraini, Bosnian, Canadian, Gambian, Iraqi, and Sri Lankan showed 100%frequency of blood group O with the absence of other blood groups. In this study, some had a higher frequency of blood group A. The Turkish, Palestinian, Syrian, Lebanese, Egyptian, and Afghan had a frequency of A >O>B>AB. The Chadian revealed A>O>AB with an absence of B. The French and Tunisian showed 100%frequency of blood group A. The Cameroonian showed A>AB and the lack of B and O. The Ethiopian had A=O> B>AB. The British had A = B with an absence of AB and O. Few populations showed a higher frequency of blood group B with discrepancies in other blood groups'

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arrangement. The Nigerian had B>O>A>AB. The American and Nepalese showed B> O with an absence of A and AB. The Filipino and Chinese populations showed a higher frequency of the AB blood group. The Filipino had AB>O=B>A and the Chinese had AB with the absence of A, B, and O. Comparing the frequency of blood groups in the Saudi population and other societies was shown in (Figure 1). There was a significant decrease in blood group A in the Saudi population compared to Tunisian, Syrian, Palestinian, and Egyptian. Also, there was a significant increase compared to Nigerian, Pakistani, Myanmar, Indonesian, and Bangladeshi. The remaining nationalities showed no significant difference in the frequency of the blood group A. Regarding blood group B; there was a significant decrease in blood group B of the Saudi population compared to Afghan, Bangladeshi, Egyptian, Indian, Myanmar, Nepalese, Nigerian, Nigerian, and Pakistani. In contrast, there was a significant increase to the Yemeni population. The remaining nationalities showed no significant difference in the frequency of blood group B. The comparison between the frequencies of blood group AB in the Saudi population showed a significant decrease compared to Afghan, Bangladeshi, Cameroonien, Chinese, Egyptian, Filipino, Indian, Nigerian, and Pakistani. Comparing the frequency of blood group O in the Saudi population showed a significant increase compared to Afghan, Bangladeshi, Egyptian, Indian, Myanmar, Pakistani, Palestinian, Syrian, and Tunisian. In contrast, there was a significant decrease when compared to Yemeni. The frequency of Rh of the different populations studied was shown in (Table 3). Some populations had Rh-positive only: Algerian, American, Bahraini, Bosnian, British, Canadian, Chadian, Djibouti, Eritrean, Filipino, French, Gambian, Indonesian, Iraqi, Malaysian, Moroccan, Nepalese, Sri Lankan, and Thai. Other populations showed positive and negative Rh with the predominant of the positive Rh. The highest frequency of Rh negativity were found in Tunisian (66.7%), Chinese(50%), Mauritanian(36.1%), Cameroonien(33.3%), Jordanian(16.1%), Sudanese(14.9%), Palestinian(14.7%), Afghan(12.2%), Saudi(8.6%), Nigerian(8.3%), Lebanese(8.3%), Egyptian(8.1%), Yemeni(8.1%), Ethiopian(7.7%), Pakistani(7.7%), Malian(6.8%), Turkish(5.7%), Somali(5.6%), Bangladeshi(5.4%), Nigerian(5.2%), Indian(5%), Burkinabe(4.8%) and Myanmar(3.2%). Comparing the Rh-negative frequency in the different populations to the Saudi population showed a significant increase

of the Rh negativity in Mauritanian, Sudanese, Syrian, and Tunisian  $p<0.05$ . Moreover, the Saudi population showed a significant increase of Rh negativity than Myanmar and Nigerian  $p<0.05$ . The remaining populations showed no significant difference compared to the Saudi population  $p>0.05$ , (Table 3). The distributions of both the ABO and Rh in all populations studied were showed in (Table4).

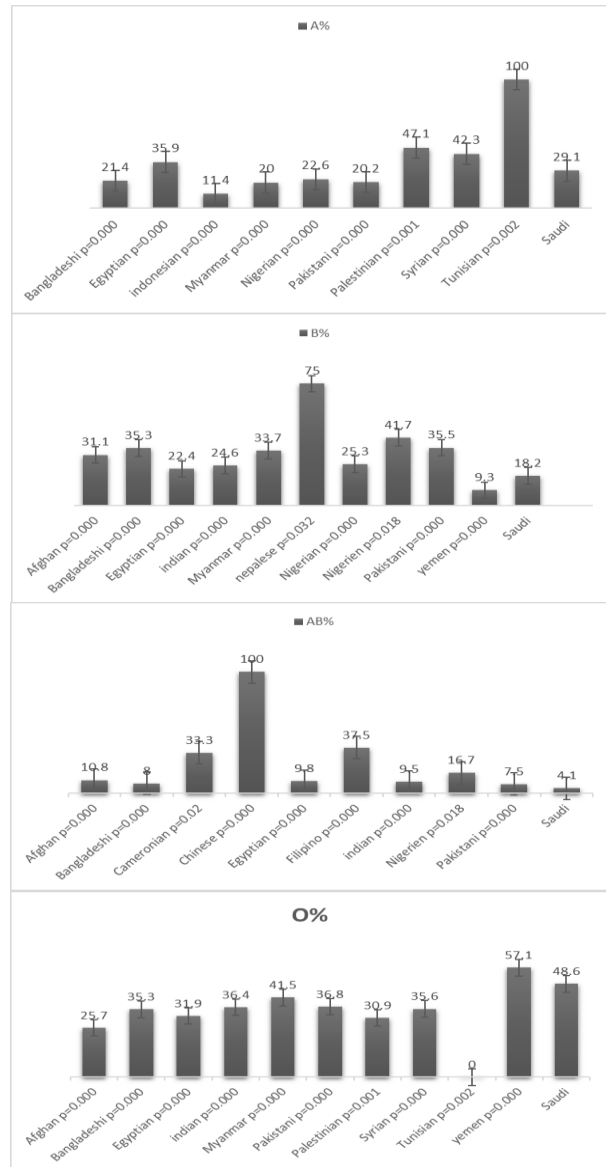


Figure 1: Comparison of the blood group A, B, AB and O between Saudi population and other populations. N.B. Nationality with significant difference were shown.

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**Table 1:** Sociodemographic characteristics of the participants.

Nationality	no.	Age Mean± SD	sex		Nationality	no.	Age Mean± SD	sex	
			Male	female				Male	female
Afghan	74	28.8 ±7.0	73	1	Iraqi	1	34	1	0
Algerian	6	34.2±14.1	6	0	Jordanian	62	30.1 ±11.7	61	1
American	3	32.3±13.2	3	0	Lebanese	12	35.8±14.6	12	0
Bahraini	2	45.0±9.9	2	0	Malaysian	7	29.3 ±4.6	7	0
Bangladeshi	224	31.4±7.0	224	0	Malian	176	29.9 ±7.0*HS	176	0
Bosnian	1	30	1	0	Mauritanian	36	28.2 ±10.5	33	3
British	2	37.5±14.8	2	0	Moroccan	15	28.1 ±14.8	15	0
Burkinabe	21	28.0 ±7.5	21	0	Myanmar	439	28.7 ±6.3 *HS	439	0
Cameroonian	3	34.7±10.8	3	0	Nepalese	4	25.5 ±1.3	4	0
Canadian	1	28	1	0	Nigerian	439	24.1±13.5 *HS	438	1
Chadian	9	29.3 ±5.5	9	0	Nigerien	12	33.0±6.5	12	0
Chinese	2	28.5 ±5.0	2	0	Pakistani	853	29.6 ±7.1 *HS	350	3
Djibouti	5	25.2 ±3.7	5	0	Palestinian	68	27.4±12.5	68	0
Egyptian	1130	33.5±8.3* HS	1128	2	Saudi	8554	31.9±9.5* S	8400	154
Eritrean	10	28.3 ±9.8	10	0	Somali	18	27.7 ±11.5	18	0
Ethiopian	39	29.4 ±10.3	39	0	Sudanese	451	30.6±12.8	451	0
Filipino	8	34.6 ±7.3	6	2	Sri Lankan	5	25.4±15.8	5	0
French	1	33	1	0	Syrian	430	33.1 ±12.5	425	5
Gambian	6	42.2±1.2	6	0	Thai	68	27.0 ±14.0	68	0
Ghanaian	9	25.3 ±1.4	9	0	Tunisian	6	26.5 ±11.1	2	4
Indian	220	28.8 ±12.3	219	1	Turkish	35	28.0 ±19.0	35	0
Indonesian	44	29.5 ±13.9	41	3	Yemeni	1854	29.9 ±11.1	1850	4
Total						15365	31.8±8.9	15181	184

HS= highly significant; s=significant

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**Table 2:** The distributions of the ABO blood group in different nationalities studied.

<b>Nationality</b>	<b>A%</b>	<b>B%</b>	<b>AB%</b>	<b>O%</b>	<b>Nationality</b>	<b>A%</b>	<b>B%</b>	<b>AB%</b>	<b>O%</b>
Turkish	48.6	11.4	2.9	37.1	Malaysian	14.3	0	14.3	71.4
Palestinian	47.1	13.2	8.8	30.9	Indonesian	11.4	27.3	9.1	52.3
Syrian	42.3	17	5.1	35.6	Myanmar	20	33.7	4.8	41.5
Lebanese	41.7	25	8.3	25	Nigerian	22.6	25.3	3.9	48.3
Egyptian	35.9	22.4	9.8	31.9	Pakistani	20.2	35.5	7.5	36.8
Afghan	32.4	31.1	10.8	25.7	Bangladeshi	21.4	35.3	8	35.3
Chadian	44.4	0	22.2	33.3	Algerian	16.7	16.7	16.7	50
French	100	0	0	0	Djibouti	20	20	20	40
Tunisian	100	0	0	0	Burkinabe	14.3	38.1	0	47.6
Cameroonian	66.7	0	33.3	0	Eritrean	20	40	0	40
Ethiopian	35.9	23.1	5.1	35.9	Ghanaian	0	11.1	0	88.9
British	50	50	0	0	Bahraini	0	0	0	100
Mauritanian	16.7	11.1	2.8	69.4	Bosnian	0	0	0	100
Yemeni	30.4	9.3	3.2	57.1	Canadian	0	0	0	100
Thai	26.5	14.7	5.9	52.9	Gambian	0	0	0	100
Malian	25.6	22.7	2.3	49.4	Iraqi	0	0	0	100
Sudanese	25.7	20.4	4.7	49.2	Sri Lankan	0	0	0	100
Saudi	29.1	18.2	4.1	48.6	Nigerien	16.7	41.7	16.7	25
Jordanian	32.3	22.6	1.6	43.5	American	0	66.7	0	33.3
Indian	27.7	24.6	9.5	36.4	Nepalese	0	75	0	25
Moroccan	26.7	6.7	6.7	60	Filipino	12.5	25	37.5	25
Somali	27.8	0	11.1	61.1	Chinese	0	0	100	0

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**Table 3:** The comparison of the frequency of Rh in different populations versus Saudi populations.

Nationality	No.	Positive		Negative		Nationality	No.	Positive		Negative	
		N	%	N	%			N	%	N	%
Afghan	74	65	87.8	9	12.2	Iraqi	1	1	100	0	0
Algerian	6	6	100	0	0	Jordanian	62	52	83.9	10	16.1*S
American	3	3	100	0	0	Lebanese	12	11	91.7	1	8.3
Bahraini	2	2	100	0	0	Malaysian	7	7	100	0	0
Bangladeshi	224	212	94.6	12	5.4	Malian	176	164	93.2	12	6.8
Bosnian	1	1	100	0	0	Mauritanian	36	23	63.9	13	36.1* HS
British	2	2	100	0	0	Moroccan	15	15	100	0	0
Burkinabe	21	20	95.2	1	4.8	Myanmar	439	425	96.8	14	3.2 *HS
Cameroonian	3	2	66.7	1	33.3	Nepalese	4	4	100	0	0
Canadian	1	1	100	0	0	Nigerian	439	416	94.8	23	5.2 * S
Chadian	9	9	100	0	0	Nigerien	12	11	91.7	1	8.3
Chinese	2	1	50	1	50	Pakistani	853	787	92.3	66	7.7
Djibouti	5	5	100	0	0	Palestinian	68	58	85.3	10	14.7
Egyptian	1130	1039	91.9	91	8.1	Saudi	8554	7817	91.4	737	8.6
Eritrean	10	10	100	0	0	Somali	18	17	94.4	1	5.6
Ethiopian	39	36	92.3	3	7.7	Soudanese	451	384	85.14	67	14.86*HS
Filipino	8	8	100	0	0	Sri Lankan	5	5	100	0	0
French	1	1	100	0	0	Syrian	430	378	87.9	52	12.1* S
Gambian	6	6	100	0	0	Thai	68	68	100	0	0
Ghanaian	9	9	100	0	0	Tunisian	6	2	33.3	4	66.7* HS
Indian	220	209	95	11	5	Turkish	35	33	94.3	2	5.7
Indonesian	44	44	100	0	0 *S	Yemeni	1854	1704	91.9	150	8.1

HS=highly significant; S=significant

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**Table 4:** The distributions of the ABO and Rh blood group in different nationality studied.

ABO, Rh Nationality	A%		B%		AB%		O%		ABO, Rh Nationality	A%		B%		AB%		O%	
	+ve	-ve	+ve	-ve	+ve	-ve	+	-ve		+ve	-ve	+	-ve	+	-ve	+ve	-ve
Afghan	27	5.4	27	4.1	10.8	0	23	2.7	Pakistani	18	1.5	32	2.6	6.9	0	34.2	2.6
Egyptian	33.2	2.7	20.6	1.8	8.9	0.9	29.2	2.7	Burkinabe	14	0.3	38	0.1	0	0	42.9	4.8
Lebanese	33	8.3	21	3.8	8.3	0	25	0	Eritrean	20	0	40	0	0	0	40	0
Palestinian	44	2.9	11	1.8	5.9	2.9	23	7.4	Ghanaian	0	0	11	0.1	0	0	88.9	0
Syrian	39	2.5	13	3.5	4.7	0.5	30	5.3	Algerian	16	0.7	16	0.7	16	0.7	50	0
Turkish	45	2.7	8.6	2.9	2.9	0	37	0.1	Djibouti	20	0	20	0	20	0	40	0
Chadian	44	0.4	0	0	22.2	0	33	0.3	Ethiopian	35	0.9	20	2.5	2.6	2.6	33.3	2.6
Indian	24	3.5	23	0.9	9.5	0	35	0.9	Bahraini	0	0	0	0	0	0	10	0
Jordanian	21	11.3	19	3.4	1.6	0	41	1.9	Canadian	0	0	0	0	0	0	10	0
Malian	23	1.9	20	2.5	2.3	0	46	2.8	Bosnian	0	0	0	0	0	0	10	0
Mauritanian	13	2.9	11	0.1	2.8	0	36	3.3	Sri Lankan	0	0	0	0	0	0	10	0
Saudi	26	2.8	16	1.7	3.6	0.5	44	4.3	Iraqi	0	0	0	0	0	0	10	0
Sudaneese	22	3.2	18	1.8	4.2	0.4	40	9.1	Gambian	0	0	0	0	0	0	10	0
Thai	26	0.5	14	0.7	5.9	0	52	0.9	French	10	0	0	0	0	0	0	0
Yemeni	27	2.8	8.7	0.6	2.9	0.3	52	4.6	Tunisian	33	66.3	0	0	0	0	0	0
Moroccan	26	0.7	6.7	0	6.7	0	60	0	Nigerien	16	0.7	41	0.7	16	0.7	16.7	8.3
Somali	27	0.8	0	0	11.1	0	55	5.6	American	0	0	66	0.7	0	0	33.3	0
Malaysian	14	0.3	0	0	14.3	0	71	0.4	Nepalese	0	0	75	0	0	0	25	0
Bangladeshi	20	0.5	31	3.7	8	0	34	0.4	British	50	0	50	0	0	0	0	0
Indonesian	11	0.4	27	0.3	9.1	0	52	0.3	Cameronian	33	33.4	0	0.3	33	0.3	0	0
Myanmar	18	1.7	32	0.9	4.6	0.2	40	0.8	Filipino	12	0.5	25	0.5	37	0.5	25	0
Nigerian	21	0.6	23	1.7	3.9	0	44	2.9	Chinese	0	0	0	0	50	50	0	0

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### Discussion

This retrospective study was done in Makkah city on healthy blood donors (Saudi and non-Saudi). 98.8 % were male, and 1.2% were female. This is because there is no good awareness in females about blood donation or they are not accepted as blood donors because of anemia [32]. The blood donors' age ranged from 18 to 62 years, which is accepted for blood donation [33]. The significant difference in the age between Saudi and non-Saudi is of no importance as all matching the accepted age for donations. The Saudi population showed a frequency of O>A>B>AB. This agrees with previous studies [23-27]. The Mauritanian, Yemeni, Thai, Malian, Sudanese, Jordanian, Indian, and Moroccan had the same incidence of ABO as the Saudi population. This is in accordance with previous studies with few discrepancies [14, 18-19, 22, 34-40]. In India, certain regions had a higher frequency of O and others of B or A [18, 22, 41]. In Thailand, the frequency was O>B>A>AB and not O>A>B>AB [38, 39]. In Mali, some authors reported O>A>B>AB, and others O>B>A>AB [36, 42]. The Malaysian (n=7) and Somali (n=18) had the frequency of O>A>AB with an absence of B blood group. In Malaysia, the frequency was either O>B>A>AB or O>A>B>AB [43, 44]. In Somalia, the frequency was O>A>B>AB [45]. The absence of blood group B may be due to their small number. The Indonesian (n=44), Myanmar (n=439), and Nigerian (n=439) had the frequency of O>B>A>AB, which agrees [46-48], and disagrees [49, 50], with their countries results. In Indonesia, the frequency was B>O>AB>A [49], and in Nigeria, it was O>A>B>AB [50]. This may be explained by that these countries have different ethnic's origins. In Pakistan, the frequency was either B>O>A>AB or A>O>B>AB [51, 52], and both are in contrast to our results, which was O>B>A>AB (n=853). This because some people have higher blood group incidence than others. The Bangladeshi (n=224) showed O=B>A>AB. This is similar to the results done in Bangladesh [17], which reported a higher frequency of either O or B. The Algerian (n=6) and Djibouti (n=5) had the frequency of O>A=B=AB. It agrees with previous studies in Algeria, but no studies were found for Djibouti. In Algeria, the frequency was either O>A>B>AB, or A>O>B>AB [53, 54]. The equal frequency of other blood groups in our work may be due to the small number of participants. The Burkinabe (n=21) had O>B>A with the absence of AB. This agrees with a study done in Burkina Faso [55], in the higher incidence of O. The AB blood group is the least proportion of the ABO blood group. The Eritrean (n=10) had O=B>A with the AB's absence. There were no previous references about the ABO in Eritrea. However, it agrees with most African people,

which have a higher incidence of O blood group [48, 50, 55]. The Ghanaian (n=9) had O>B with the absence of the A and AB. They were like their country in the higher frequency of O [20, 21]. The lack of other blood groups is due to their small number. The Bahraini (n=2), Canadian (n=1), Boasian (n=1), Sri – Lanka (n=5), Iraqi (n=1), and Gambian (n=6), all had frequency of O blood group only. This because they do not represent the whole population of their nationalities. They had a similar frequency as in their countries with some exception [56-62]. In Bosnia, some districts had a higher frequency of O, and others had of A [59]. In the American (n=3) and Nepalese (n=4), the frequency was B>O with the absence of other blood groups. These results contrasted with previous results and which showed a higher frequency of O [9, 50, 53, 54, 63]. The discrepancy is because they do not represent the whole population. In the Nigerien (n=12), the frequency was B>O>A=AB, but no previous results were found. In Chinese, participants (n=2) had an AB blood group with the absence of other blood groups. This is in contrast to a previous work, which was either A>O>B>AB or O>A>B>AB [64]. The discrepancy is due to our participants' small number. In Filipino (n=8), they had AB>B=O>A, which contrasts with previous work that reported O>A>B>AB. The discrepancy is because they do not represent the whole population [65]. The Turkish (n=35), Palestinian (n=68), Syrian (n=430), Lebanese (n=12), Egyptian (n=1130), and Afghan (n=74) showed frequency of A > O > B > AB. In Turkish, Syrian, and Egyptian, our results agree with previous studies [13, 66-69]. In Palestinian and Lebanese previous works, the frequency was O>A>B>AB in some regions and A>O>B>AB in other regions [70-72]. Our results disagree with previous results in the Afghan, which was of O or B or O=B but not of A [73]. This may because they do not represent the whole population. In Ethiopian participants, both A and O had equal frequency. This agrees with previous results, which found some areas with a higher frequency of A and other of O [15, 74]. The Chadian(n=9), French (n=1), Tunisian (n=6), Cameroonian (n=3), and British (n=2) all had a higher frequency of blood group A which was followed by O or AB or equal to B or absent of other blood groups. This agrees with France and contrasts with Cameron, Tunisia, and England, which reported O>A>B>AB [16, 75-77]. The discrepancy because they do not represent the whole population. In the Chadian, no previous works were found. Of all populations studied, 46.8 % were O, 28.8 % A, 19.5 % B, and 4.9% AB. This is in agreement with previous results, which stated that the O allele is (63%), A (21%), and B (16%) [78]. The blood group A, B, AB, and O of the Saudi population had a significant or no significant



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difference when compared to other people, (Figures1). The presence or absence of significance is due to the variations in the blood group's higher frequency. The variations are due to genetic and environmental factors. Also, the ABO blood group frequency may play a role in human disease [79]. The Rh-positive was predominant, and the Rh-negative ranged from 3.2% to 66.7%. The absence of Rh-negative in Indonesian, Malaysian, Thai, and Filipino agree with studies, which reported <1% of Rh-negative [38, 44, 49, 80-82]. The higher negativity in Tunisian, Chinese, and Cameroonian is due to their small number. All over the world, 5–11% are Rh-negative except Britain and the USA, 15 and 17%, respectively [83].

### Limitation of the study

Some of the nationalities in our work had few numbers of participants, which need further studies to confirm our results.

### Conclusion:

In Makkah city, the higher frequency of ABO blood group in Saudi and non -Saudi people is O followed by A, then B, and AB. The Rh-positive is predominant, and 8.4% of the participants are negative. The encouragement of blood donation is essential for providing suitable blood storage for individuals in need. We recommendations further studies are needed to be performed on the ABO and Rh genes frequencies and their alleles in Makkah city.

### Conflict of Interest

None

### Funding

None

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