Frequency of ABO blood groups in the Eastern region of Saudi Arabia

Layla A. Bashawri, MBBS, FCP, *Abdul Aziz Al-Mulhim,* MBBS, ABOG, *Malik S. Ahmad,* BSc, MS, *Mirghani A. Ahmed,* MD.

ABSTRACT

Objectives: To document the frequency of the ABO and Rhesus blood groups in Saudi male donors, and to compare our results with the results of other studies in the Kingdom and elsewhere.

Methods: This study included a total of 57396 male potential blood donors; 19496 blood donors between the years 1985-1989 (referred to as first period of study) and 37700 blood donors between the years 1995-1999 (2nd period). The blood donors were Saudis, coming to donate blood for various reasons to the Blood Bank Department of King Fahd Hospital of the University, Al-Khobar, Kingdom of Saudi Arabia. ABO and Rhesus blood groups from 200 Saudi females were also determined. The frequency of ABO blood groups and Rhesus status were calculated separately.

Results: Our results revealed the most common blood group was O, (52%) during the first period of study and likewise the most common blood group (51%) during the 2nd period. The lowest blood group frequency was AB (4%) and (4%) during the first and 2nd period. Rhesus positive blood donors comprised 93% and Rhesus-negative donors were 7% during the first period, while they amounted to 91.5% and 8% during the 2nd period. Overall frequency of ABO and Rhesus blood groups during the 2 periods were the following: O-positive 48% and 46%; A-positive 24% and 24.5%; B-positive, 17% and 17%; AB positive 4% and 4%; O negative 4% and 5%; A negative 2% and 2%; B-negative 1% and 2%; and AB negative, 0.23% and 0.32%. Comparison of our results with the other studies from the Kingdom and other nationalities is also presented.

Conclusion: Our results show that the most frequent blood group in Saudis is O-positive. Blood group A is observed at a lower frequency relative to values from Western populations, whereas a significant increase in blood group B combined with a slight increase in blood group AB was recorded. Knowledge of the frequencies of the different blood groups in Saudi Arabia is very important for Blood Banks and transfusion service policies. Knowledge of blood group phenotype distribution is also important for clinical studies (for example disease association), as well as for population studies.

Keywords: Frequency, ABO blood group, Rhesus blood group.

Saudi Med J 2001; Vol. 22 (11): 1008-1012

The history of blood group antigens is characterized by important landmarks. Landsteiner in 1901 named the first 2 blood groups antigens A and B, using the first 2 letters of the alphabet while red blood cells (RBCs) not reacting with anti-A and anti-B were called type C.[1] In 1902, Von Decastello and Sturli described RBCs reacting with both anti-A and anti-B, but did not give these type a name, but continued calling RBCs that did not react with anti-A and Anti-B type C.[1] In 1911, von Dungern and Hirszfeld were the first to use the term O to describe RBCs not reacting with anti-A and anti-B and the term AB for RBCs reacting with both anti-A and anti-B.[1] The ABO blood groups are genetically determined antigens present on the surface of the red cells and most other body cells. Phenotypically there are 4 groups namely, O, A, B and AB determined by 3 allelic genes located near the tip of the long arm of chromosome 9.[2] These alleles at the ABO locus on chromosome 9 code for 2

From the Departments of Pathology, (Bashawri, Ahmed), Obstetrics and Gynecology, (Al-Mulhim), and Blood Banking, (Ahmad), King Fahd Hospital of the University Al-Khobar, Kingdom of Saudi Arabia.

Received 7th April 2001. Accepted for publication in final form 24th June 2001.

Address correspondence and reprint request to: Dr. L. A. Bashawri, Consultant Hematopathologist, PO Box 1334, Saudi ARAMCO, Dhahran 31311, Kingdom of Saudi Arabia. Fax. +966 (3) 8468565.

glycosyltransferase enzymes, that transfer a terminal sugar unit to the precursor H chain giving either A or B antigenic properties to cell membranes. Although the Mendelian inheritance of the 2 glycosyltranferases is simple, the genetic control of A and B antigen expression is more complex,[2] due to differential tissue expression and secretor gene control of A and B antigens of different tissues. After the discovery of the Rhesus (Rh) system in 1940, the nomenclature problem became acute again, due to 2 different terminologies, the CcDdEe terms of Fisher and Race, and Race and Sanger and the Rh/Hr terms used by Wiener and his followers.[1,3] At the present time the Rh blood group system is composed of over 50 different specificities. The expression of the Rh factor is controlled by 2 closely linked genes; one gene codes for D and the other gene for CcEe.[3,4] The D-antigen, after the A and B is the most important in transfusion medicine. Anti-D formation usually results from exposure through either pregnancy or transfusion of red cells processing the D-antigen to persons who lack this antigen. Both ABO and Rh blood groups exhibit extensive polymorphism and frequency in different populations. The aim of this study is to determine the frequency of ABO and Rh blood groups in Saudi blood donors in a University Hospital set-up, since data concerning the prevalence of the common blood group antigens in the Eastern Province of Saudi Arabia is still lacking.

Methods. All ABO and Rh serological results obtained in the Blood Bank Department of King Fahd Hospital of the University (KFHU), between 1985 and 1989 (first study period) and 1995 to 1999 (2nd study period) were retrospectively reviewed and analyzed. During these periods a total of 57196 potentially healthy Saudi male donors (donating blood for various reasons), living in the Eastern region were evaluated for the ABO and Rh factor. For comparison we managed to determine and analyze the ABO and Rh blood groups from 200 Saudi female volunteers, during the year 2000. ABO blood grouping was carried out by the tube method using commercially prepared antisera: anti-A, anti-B, and anti-AB for the direct grouping, and reagent cells: A cells and B cells for the indirect or reverse grouping (Orthodiagnostic systems Incorporated United States of America (USA). Agglutination in any tube or hemolysis constitutes positive results. Presence of the D Rh antigen is determined by testing the red cells with reagent anti-D by tube method. Most red cells carrying D antigen are directly agglutinated by anti-D reagent. Red blood cells weakly agglutinated or not directly agglutinated with anti-D reagent as seen macroscopically after centrifugation, are tested for weakly expressed D antigen (D_u). The weak expression of D antigen is tested for by the indirect antiglobulin test after incubating the RBCs with anti-D, according to standard procedures. The ABO and Rh blood groups in each potential blood donor was carried out by a preliminary finger prick, repeated again from blood donor unit segment and a serum sample obtained at the time of donation. Statistical package for Social Sciences (SPSS)-PC[5] software was used for data analysis.

Results. There was a total of 57196 Saudi male blood donors, during the specified periods. The results revealed the most common blood group was O (52%) and (51%) during the 2 study periods, then blood group A (26%) and (26.5%), followed by group B (18%). Blood group AB was the rarest of the blood groups (4%). The frequency of Rh positive and Rh negative were as follows: Rh positive blood donors were 93%, while Rh negative blood donors were 7% during the first period, while they were 91.5% and 8% during the 2nd period. The distribution of blood groups for the 200 Saudi females revealed blood group O positive 92 (46%), A positive 49 (24.5%), B positive 37 (18.5%), AB positive 5 (2.5%), O negative 8 (4%), A negative 6 (3%), B negative 3 (1.5%), AB negative none. Table 1 summarizes the blood group distribution of the Saudi potential donors, during the periods 1985 – 1989 and 1995 – 1999. Table 2 compares the results of our study with results of other studies from the Kingdom. Table 3 compares our results in this region with results reported from other countries and nationalities.

Discussion. In this study we were able to determine the frequency of ABO and Rh blood groups in Saudi male donors. There are few studies from the Kingdom describing the frequency and distribution of ABO, and Rh blood groups. In the study by Talib et al in 1998,[6] obstetric patients were studied, and the frequency of blood group O was found the highest (53%), followed by blood group A (23%), blood group B (20%) and lowest frequency was blood group AB (3.5%). Their results are almost similar to our study. The 2 different study periods in our study for example 1985 – 1989 and 1995 – 1999, did not show any remarkable change in the frequencies of blood groups as was observed in the cited study,[6,7] where they observed a significant increase in blood group O and a decrease in blood group A during 2 different study periods. This observation was attributed to population drifts and travel, however that study was carried out on a population of obstetric patients in Riyadh, Saudi Arabia.[7] Another study, again on obstetric patients, but carried out in the Eastern province of Saudi Arabia[8] showed a slight difference of 6% in blood group O and higher incidence in blood group AB

Table 1 - Blood groups of Saudi male blood-donors (KFHU - 1995-1999).

First Study period 1995 - 1999			2nd Study period 1995 - 1999		
Blood Group	**N**	**%**	**Blood Group**	**N**	**%**
O+ve	9390	48	O+ve	17378	46
A+ve	4770	24	A+ve	9267	24.5
B+ve	3278	17	B+ve	6429	17
AB+ve	720	4	AB+ve	1446	4
O-ve	710	4	O-ve	1733	5
A-ve	331	2	A-ve	744	2
B-ve	252	1	B-ve	584	1.5
AB-ve	45	0.23	AB-ve	119	0.32
Total	19496	-	Total	37700	-

KFHU - King Fahd Hospital of the University; +ve - positive; -ve - negative; N - number.

Table 2 - Comparison of our results from Al-Khobar KFHU, Eastern Province, and other studies from the Kingdom.

Place of Study	**Sample Size**	**ABO Blood group and Rh (D) Status (and / or)**					
		O	**A**	**B**	**AB**	**Rh D Positive**	**Rh D Negative**
		N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**
Present Study (10 year period)	57396 (Males +200 Females)	29311 (51)	15167 (26)	10583 (18)	2335 (4)	52861 (92)	4535 (8)
Saudi (Gurayat)	1349 Neonates	637 (47)	271 (20)	384 (29)	57 (4)	1262 (93.5)	- -
Saudi (Riyadh)	859 Obstetric patients	457 (53)	199 (23)	173 (20)	30 (3.5)	786 (91.5)	73 (8.5)
Saudi (Riyadh)	1235 (803 Males, 432 Females)	- (49)	- (27)	- (20)	- (4)	- -	- -
Saudi (Abha)	760 (Males and Females)	- (57)	- (30)	- (9)	- (4)	- (93)	- (7)
Saudi (Dammam)	7093 Males	- -	- -	- -	- -	- (91)	- (9)
Saudi (Eastern Province)	576 Obstetric patients	- (45)	- (27)	- (21)	- (7)	- -	- -
Saudi (Riyadh)	978 Obstetric patients	- (48)	- (30)	- (19)	- (4)	- (92)	- (8)
Saudi (Riyadh)	New borns 3324 (1660 Males and 1664 Females)	- (50)	- (26)	- (20)	- (4)	- (92)	- (8)
Tabuk and Madina Al-Munawaara Regions	166 Obstetric patients	88 (53)	50 (30)	20 (12)	8 (5)	153 (90)	13 (10)

KFHU- King Fahd Hospital of the University; N - Number; Rh - Rhesus

Table 3 - Prevalence of ABO and Rh blood groups in some different Nationalities for comparison.

Nationality	Sample Size	O Blood Group		A Blood Group		B Blood Group		AB Blood Group		Rh (D) +ve		Rh (D) -ve	
		N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Present Study	57396	29311	(51)	15167	(26)	10583	(18)	2335	(4)	52861	(92)	4535	(8)
France	30810	12844	(42)	13955	(45)	2808	(9)	1203	(4)	-	-	-	-
West Germany	4017	1686	(42)	738	(43)	412	(10)	181	(4.5)	-	-	-	-
Greece	44106	19251	(44)	17025	(39)	5737	(13)	2093	(5)	-	-	-	-
England	44094	19752	(45)	19422	(44)	3580	(8)	1340	(3)	-	-	-	-
Iran	16368	6750	(41)	4652	(28)	3872	(24)	1094	(7)	-	-	-	-
United Kingdom	-	-	(47)	-	(42)	-	(8)	-	(3)	-	-	-	-
Chinese	-	-	(44)	-	(26)	-	(25)	-	(5)	-	(99)	-	(.06)
South American Indians	-	-	(100)	-	(0)	-	(0)	-	(0)	-	-	-	-
West Africans	-	-	(52)	-	(24)	-	(21)	-	(3)	-	-	-	-
Bengali	-	-	(22)	-	(24)	-	(38)	-	(16)	-	-	-	-
Europeans	-	-	(50)	-	(40)	-	(8)	-	(2)	-	(85)	-	-
Asians	-	-	(44)	-	(21)	-	(28)	-	(7)	-	(98)	-	-
Pakistans	1039	377	(36)	256	(25)	316	(30)	90	(9)	995	(96)	44	(4)
American Blacks	-	-	(49)	-	(27)	-	(20)	-	(4)	-	-	-	-

+ve - positive; -ve - negative; N - Number; Rh- Rhesus

(Table 2), but the number studied was smaller, 576 subjects. These studies together with ours, show the high prevalence of blood group O in Saudi Arabia, and appear to demonstrate that it is not unique to any part or province in the country. A study by Gader et al,[9] also revealed almost similar findings to ours, where a high frequency of blood group O, was observed (Table 2). A study of 3924 subjects from the Western Region, Jeddah showed: O, 54%; A, 27%; B, 16%; and AB, 3.5%.[10] The results are similar to ours. However, another study showed a decrease in the frequency of blood group A, and a significant increase in blood group B,[11] that study was carried out in Gurayat, Saudi Arabia. A further study revealed a higher frequency of blood group A and a decrease in group B which differs from all the other studies[12] and this study is from Abha, south part of the Kingdom. These differences are difficult to explain, but may be due to population travel at different times, or may reflect a difference in population genetics. A further study showed similar results to our study.[13] It seems that the distribution of the ABO and Rh blood groups in Saudi Arabians differs from that in Europeans and Caucasians. It should be noted that whereas group O and AB approximately show the same frequency in Saudi Arabian and Caucasians, the distributions for groups A and B differ considerably. In the present study 26% of the population studied were group A, and approximately 17% group B, whereas in Europeans and USA Caucasian populations approximately 40% are group A and 8 – 11% are group B.[14-16]

It is also quite clear from all studies in the Kingdom, including a study on a large group of Saudi male donors,[17] that the incidence of Rh negativity is approximately 8 – 9%, which is much less compared to the Western countries.[7,14-16] Thus the number of cases of hemolytic disease of the newborn (HDN) are expected to be much lower. A study from a referral center in the Kingdom reported that hemolytic disease of the newborn runs a moderate to severe course.[18] The frequency of RhD negativity, is also less in Africans, Asians (especially Chinese) and American blacks compared to Caucasians.[14-16,19] However it has been reported that ABO HDN may be a concern among the offspring of group O mothers if the father is not group O.[20]

The prevalence of blood groups in different nationalities is interesting. If we stress on analysis of the data given in Table 3, it is noticed that blood group O is common and frequent in almost all nationalities except the Bengali nationality. Blood group AB is the rarest again in all nationalities. However, blood group A is just as frequent in some

nationalities as group O, and that is clearly observed in Caucasians in Europe and the USA. It also appears that the high incidence of blood groups O and B are unique or characteristic to certain nationalities such as Iranians, Arabs, Chinese, Africans, Asians, Bengalis and Pakistanis[14,15,21] (Table 3). Furthermore, Saudi Arabs manifest ABO phenotype distribution similar to that seen in black Africans.

This report highlights the incidence of blood groups from different areas of Saudi Arabia. Such findings may help in formulating a national figure for future reference. Knowledge of blood group antigens and their distribution is very useful for transfusion services; clinical studies for example disease association and studies of population genetics.

References

1. Garratty G, Dzik W, Issitt PD, Lublin DM, Reid ME, Zelinski T. Terminology for blood group antigens and genes – historical origins and guideline in the new millennium. Transfusion 2000; 40: 477-489.
2. Eastlund T. The histo-blood group ABO system and tissue transplantation. Transfusion 1998; 38: 975-988.
3. Mollison PL. The genetic basis of the Rh blood group system. Transfusion 1994; 34: 539-541.
4. Issitt PD. The Rh blood group system: from clumps to clones. Transfusion 1994; 34: 462-463.
5. Statistical Package for Social Sciences – Personal Computers (SPSS-PC). Version 6. Illinois: Chicago SPSS Co; 1996.
6. Talib ZMA, Al-Nuaim LA, El-Hazmi MAF, Warsy AS. Blood groups in Saudi obstetrics patients. Saudi Med J 1998; 19: 260-264.
7. Cochran TE, Faqeera F. Demographic data: Saudi Obstetric patients. Saudi Med J 1982; 3: 25-30.
8. Al-Saeed AH. The distribution of ABO and Rh blood groups in a sample of pregnant women in the Eastern Province of Saudi Arabia. Arab Gulf J Scient Res 1998; 16: 259-265.
9. Gader AGMA, Bahakim HM, Malaika SS. Normal reference levels of hemostatic variables in healthy Saudis. Saudi Med J 1990; 11: 478-483.
10. Albaz N. Distribution of some blood group antigens, Western Region, Saudi Arabia [Abstract]. Update in Hematology and Transfusion Medicine Symposium. 2001 January 23-24; Jeddah, Kingdom of Saudi Arabia.
11. Harunur Rashid AKM. Blood groups and Rh status in Saudi newborns [letter]. Saudi Med J 1993; 14: 168-169.
12. Khan MU, Amir SED, Aggerwal S. Hemoglobin levels and blood groups in persons living at high altitude. Annals of Saudi Medicine 1989; 9: 458-462.
13. Niazi GA. Hematological profile of Saudi newborns. Saudi Med J 1994; 15: 243-249.
14. Kay LA, Huehns ER. The blood groups. In: Clinical Blood Transfusion. 1st ed. United Kingdom: Pitman Publishing Limited; 1985. p. 4-26.
15. Sukkar MY, El-Munshid HA, Ardawl MSM. Blood. In: Concise Human Physiology. Oxford, United Kingdom: Blackwell Scientific Publications; 1993.
16. Vengelen-Tyler V. ABO, H and Le blood groups. In: American Association of Blood Banks Technical Manual. 12th ed. Maryland USA: Bethesda MD; 1996. p. 229-254.
17. Al-Sheikh IH, Zaidi SZA, Islam SIAM, Quadri MI, Al-Jama A. Frequency of various Rh antigens in Dammam Eastern Province, Saudi Arabia. Saudi Med J 1998; 19: 265-268.
18. Ohlsson A, Badawi B. Moderate to severe HDNB in a referral center in Saudi Arabia. Annals of Saudi Medicine 1985; 5: 207-211.
19. Lin-Chu M, Broadberry RE, Chang FJ. The distribution of blood group antigens and alloantibodies among Chinese in Taiwan. Transfusion 1988; 28: 350-352.
20. Ozsoylu S, Alhejaily M. The distribution of ABO and Rh blood groups in the Tabuk regions and Madinah Munnawwara, Saudi Arabia. Turk J Pediatr 1987; 29: 239-241.
21. Khaskheli DK, Qureshi AH, Akhund AA. Distribution of ABO and Rh blood groups in the Residents of Sindh. Pakistan J Health 1994; 31: 45-50.