

**ABO and Rhesus blood groups
phenotypes distribution among Saudi
Blood donors at King Abdulaziz
University Hospital, Jeddah, Saudi
Arabia**

**Damanhoury G, Ramadan H Al-Harbi M
and Hindawi S**

Med. J. Cairo Univ, Vol 72, No. 2 (suppl II) June:
103 – 106, 2004.

ABO and Rhesus Blood Groups Phenotypes Distribution Among Saudi Blood Donors at King Abdulaziz University Hospital, Jeddah, KSA

GHAZI DAMANHOURI, M.R.C. Path, F.R.C.P.A., F.R.C.P.I.; HISHAM RAMADANI, F.R.C.O.G.*; MOHAMAD A. AL-HARBI, F.R.C.S.C.** and SALWA I. HINDAWI, M.Sc., M.R.C.Path, C.T.M.

The Departments of Hematology, Obstetrics & Gynaecology and Surgery**, King Abdulaziz University Hospital, Jeddah, Saudi Arabia.*

Abstract

Objectives: It is known that blood groups are genetically determined and show a great deal of polymorphism, this is why there is tremendous population diversity in the percentage of the ABO blood groups throughout the world. This study was conducted to determine the frequency of ABO and Rhesus blood groups in blood donors at King Abdulaziz University Hospital in Jeddah and to relate them to the other reported frequencies within the Kingdom and the outside world.

Materials and methods: Twenty-two thousand one hundred eighteen 22118 Saudi blood donors attending the blood bank at KAUH were included in this study. The blood was drawn by veinipuncture and tested for ABO and Rhesus blood groups using the international known standard tube method. The frequency of the phenotypes O, A, B, AB, Rhesus positive and negative were determined and calculated.

Results: The results of ABO and Rhesus phenotypes were calculated. The highest frequency was that of blood group O Rhesus +ve (43%) and the lowest frequency was that of blood group AB Rhesus -ve (0.5%). The frequency of Rhesus +ve was found to be 92%. The other blood groups were found to have the following frequencies A +ve (29.5%), A -ve (2%), B +ve (15.5%), B -ve (1%), AB +ve (4.5%). The reported number of subjects included in determining the ABO blood groups frequencies from almost all different regions in the kingdom of Saudi Arabia were calculated (95854 subjects) and the results were compared to Caucasians and Blacks.

Discussion: It is important to determine the ABO and Rhesus blood groups phenotype in each country to know the most wanted and needed blood group. Although these results show some differences in comparison with others previously reported studies in the Kingdom, but in general it does agree with all reported studies that blood group O + is the most frequent ABO phenotype and the blood group AB - is the rarest one. The difference in our results from those reported earlier in Saudis may be due the population heterogeneity of the Western region of Saudi Arabia, produced largely by the mixed marriage and population movement from different parts of the country.

Conclusion: When we look at the reported blood group frequencies from the different parts of Saudi Arabia we can observe some differences. We think these differences which have been observed in some areas are negligible, mainly due to the low number of the sample study. At the same time the

cumulative number of the reported blood group frequencies can lead us to conclude that the blood group frequencies in Saudi Arabia have been determined. In this study the ABO blood group phenotype (A, B and O) were found to be comparable to the black race.

Key Words: Blood groups - Blood donors.

Introduction

BLOOD transfusion used to be a risky procedure as it carried a significant rate of mortality and morbidity. The first suggested case of transfusion was rumored to have been given to Pope Innocent VII in July 1492, where three volunteer youths were said to have donated restorative tonic for the pope and were paid one ducat each (whether the pope drank it or it was transfused is dubious). As for the three young donors, they died of blood loss and had the consolation of being considered martyrs [1].

The first truly verified accounts of transfusion occurred in the seventeenth century, the first transfusions were animal to animal by John Wilkins in 1665 and Richard Lower in 1666 [2]. The first human to human transfusion was performed by a French Jean Denys on the 25th of June 1667 [2]. It was in the year 1900 the ABO grouping was discovered by Landsteiner [3]. In 1901, Lansteiner chose a simple experiment. He mixed the serum and red cells from different people and observed the reaction. As a result Lansteiner divided these individuals into three groups called group A, group B and group C. The group C was later changed to group O [4]. Decastello and Sturli identified the fourth group of the ABO system in 1902. This group was called AB [5]. The inheritance of the ABO blood groups was later suggested in 1910. These discoveries allowed the creation of the first transfusion service in the world founded by the British Red Cross in 1926 [5]. And that was fol-

lowed by the introduction of cross-matching which had played significant role in alleviating the fear from blood transfusion. There is no doubt that the discovery of the ABO grouping and later on the Rhesus blood group in 1940 was considered as a breakthrough in the field of blood transfusion [6].

There are four main blood groups O, A, B and AB. These blood groups are determined by three allelic genes which are located on the long arm of chromosome 9 (9q 34.1) [7].

Accordingly six possible genotypes are well known OO, AA, BB, AO, BO and AB. The recessive inheritance of O antigen and the dominant inheritance of A or B antigen expressed AA and AO as blood group A and in a similar way BB and BO as blood group B, while AB are expressed as blood group AB (Table 1).

Table (1): ABO blood group genetic outcomes.

| Blood type of parents | Possible blood types among children |
|-----------------------|-------------------------------------|
| A and A | A and O |
| A and B | A, B, AB, O |
| A and AB | A, B and AB |
| A and O | A and O |
| B and B | B and O |
| B and AB | A, B and AB |
| B and O | B and O |
| AB and AB | A, B and AB |
| AB and O | A and B |
| O and O | O |

For the purposes of Rh (Rhesus) incompatibility the Rh blood group system operates as a one gene-two allele system. The gene product is identified as the RhD antigen or D antigen.

Material and Methods

Ten mls of blood were collected from 22118 Saudi blood donors (volunteers and patient's relatives) attending the blood bank of King Abdulaziz University Hospital during the period January 1997-January 2001. The cells are washed properly at least three times with a normal saline and a cell suspension (3-5%) is prepared. One drop antisera and one drop of cell suspension are mixed in the test tube. These tests were performed by an experienced medical blood bank technologist. ABO phenotype was determined on all samples by the forward and reverse groups using monoclonal antisera (anti-A, anti-B, anti-A, B) and standard red cells (A1, B and O) obtained from Gamma-Diagnostics. Controls were run with each batch. The Rhesus (D) blood grouping was performed on all samples.

Results

The number and the frequency distribution of ABO and Rhesus blood group phenotypes in Saudi blood donors who attended the blood bank at KAUH in Jeddah are shown in (Fig. 1).

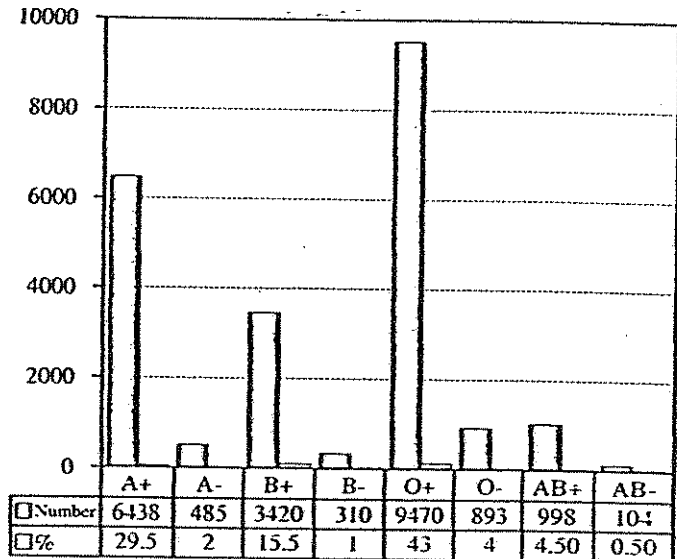


Fig. (1): ABO and Rh blood group frequency in Saudi donors at KAUH in Jeddah.

It is important to determine the frequency of ABO blood groups in every country. There are several studies from different parts of Saudi Arabia. We compared our reported frequencies with those previously reported from KKNHG from Jeddah and the other reports from the eastern and central provinces. When we look at the frequency of ABO phenotypes in these different reports we can see the great similarity of these studies (Table 2).

Table (2): Frequencies of ABO blood group in different parts in Saudi Arabia.

| | KAUH, Jeddah | KKNHG, Jeddah | Eastern province | Central |
|----|--------------|---------------|------------------|---------|
| A | 31.5 | 27 | 26 | 26 |
| B | 16.5 | 15.9 | 18 | 20 |
| O | 47 | 54 | 51 | 50 |
| AB | 5 | 3.5 | 5 | 4 |

In this table we can appreciate the similarity in ABO blood group in the main inhabited regions within the kingdom, although there are some frequent differences especially blood group A at KAUH (31.5%) in comparison to other reports from eastern central and also KKNHG in Jeddah. As there are many reported ABO blood group

frequency figures from almost all regions from Saudi Arabia and many of these reports consisted of small samples, we calculated the number included in all reports and we think that the cumulative ABO blood group frequencies will be more informative and may represent the real Saudi ABO blood group frequencies. The sum of the most reported samples including ours were found to be 95854 Saudi blood donors (Jeddah, Al Khobar, Riyadh, Dammam, Abha, Tabuk).

Table (3): ABO blood group frequency in Saudi Arabia, Caucasians and Black.

| | Saudi Arabia | Caucasians | Blacks |
|----|--------------|------------|--------|
| A | 27 | 44 | 27 |
| B | 18 | 8.59 | 19 |
| O | 50 | 43.54 | 49 |
| AB | 5 | 3.17 | 5 |

In table (3) the sum of the available reports regarding the ABO frequency from all areas of the kingdom has been calculated as the number of samples almost reached one hundred thousands which is really a very good representative figure which comes from almost all parts of this large country.

Discussion

The frequencies of the ABO blood system vary significantly in various population and ethnic groups around the world [8,9]. There have been several reasons given for this phenomenon such as population migration and diseases where certain blood groups were thought to provide a selective advantage or disadvantage. In the case of migration, ethnic communities that experienced little migration due to their location being remote maintain high degree of genetic similarity and relatively low ABO group polymorphism. An example of this situation is the Aboriginal population of Queensland, Australia which has approximately 75% of the population being O positive [10]. Although the ABO blood groups frequencies have been studied and reported in this country on several occasions but most of these reports consisted of relatively small numbers of Saudi blood donor samples. The largest study population size came from the eastern province (57396 samples) and the smallest one from the north west region (166 samples) [11-15]. The Kingdom of Saudi Arabia is one of the largest countries in the middle east, its size is approximately 2/3rd of Europe and it is situated in the western part of Asia. It is inhabited by 20 millions and six millions are expatriates. In this study the frequencies of ABO groups in Saudi population

attending the blood bank at KAUH in Jeddah as stated before were found to have the following frequencies O +ve (43%), O -ve (4%), A +ve (29.5%), A -ve (2%), B +ve (15.5%), B -ve (1%), AB +ve (4.5%), AB -ve (0.5%).

They are more or less similar to the previously reported figures done in the different parts of the country. When we compare our findings to the one reported in the eastern province [16] we can see the great deal of similarity between these two far away provinces (the distance is around 2000 km). The A + population (29.5%) in Jeddah is 1.2 more than Alkhobar and although the number of AB - is the least frequent blood group in both, but it is in Jeddah is nearly 1.9 twice frequent than in Alkhobar. Abdul Aal group from the National guard hospital in Jeddah studied the frequencies of ABO blood groups phenotype in the Arab tribes and concluded that Saudi Arab tribes share similar A and B phenotype distributions with Blacks but differ from Caucasians who manifest at least 1.6 times more group A [17]. In our study we included all the Saudi nationals and their A and B blood group phenotypes percent frequency were found to be similar to Saudi Arab tribes, but blood group O was found to be less frequent (0.87). This data base information will be useful in studying the relation between ABO blood groups and disease [18-24] in our population also we should start from now to have our own bank for the rare blood group phenotypes (Table 2). By looking at the different ABO blood groups reports from different parts all over the world [25] and also in general the black and white races (Table 3), we can conclude the following.

- 1- The most frequent blood group phenotypes are O, A, B and at last AB.
- 2- ABO blood group in Saudi population is similar to Blacks.
- 3- B blood group phenotype in Saudi population is more frequent than Caucasians.
- 4- There are no much differences of the frequency of blood groups phenotype among Saudi Nationals and Saudi tribes.

References

- 1- GOTTLIEB A.M.: History of the first blood transfusion but a fable agreed upon: The transfusion of blood to a Pope. *Transfusion Medicine Reviews*, Vol. 5 (3): 228-235, 1991.
- 2- MYHRE B.A.: The first recorded blood transfusions: 1656 to 1668. *Transfusion*, 30 (4): 358-362, 1990.
- 3- The Noble Foundation: Biography of Karl Landsteiner-Biomedicine 1939-.

- 4- GREENWALT T.J.: A short history of transfusion medicine. *Transfusion*, 37 (5): 550-563, 1997.
- 5- MOLLISON P.L., ENGELFRIET C.P. and CONTRERAS M.: *Blood transfusion in clinical medicine*. Tenth Edition. Blackwell Science Ltd, p. 61.
- 6- UNLENBRUCK G. and PROKOP O.: *HUMAN blood and serum groups*. McLaren and Sons. London, 1969.
- 7- DANIELS G.: *Human blood groups blackwell groups*. Blackwell Science Ltd Chapter 2, 1995.
- 8- WARRY J.: *Warefare in the classical world*. University of Oklahoma Press. Norman, 1995.
- 9- STRICKLAND M.: *Anglo norman warefare*. The Boydell Press, 1994.
- 10- Australian Red Cross Blood Service: *About Blood Types*. August, 2003.
- 11- AL-SAEED A.H.: The distribution of ABO and Rh blood groups in a sample of pregnant women in the Eastern Province of Saudi Arabia. *Arab Gulf J. Science Res.*, 16: 259-265, 1998.
- 12- HARUNUR RASHID A.K.M.: Blood groups and Rh status in Saudi newborns (letter). *Saudi Med. J.*, 14: 168-169, 1993.
- 13- NIAZI G.A.: Hematological profile of Saudi newborns. *Saudi Med. J.*, 15: 458-462, 1994.
- 14- OZSOYLU S. and ALHEJAILY M.: The distribution of ABO and Rh blood groups in the Tabuk region and Almadina. Saudi Arabia. *Turk. J. Pediatr.*, 29: 239-24, 1987.
- 15- ZIENAB M.A. TALIB: Blood groups in Saudi obstetrics patients. *Saudi Med. J.*, 19 (3): 260-264, 1998.
- 16- COCHRAN T.E. and FAQEERA F.: Demographic data. Saudi obstetric patients. *Saudi Med. J.*, 3: 25-30, 1982.
- 17- LAYLA A. BASHAWRI, et al.: Frequency of ABO blood groups in the Eastern region of Saudi Arabia. *Saudi Med. J.*, 22 (11): 1008-1012, 2001.
- 18- M.A. ABDULAAL: Blood group phenotype distribution in Saudi Arabs. *Afr. J. Med. Sci.*, 28: 133-135, 1999.
- 19- BRACHTEL R., WALTER H., BECK W. and HILLING M.: Association between atopic disease and polymorphic systems ABO, Kidd, Inv and red cell acid phosphatase. *Hum. Genet.*, 49: 337-348, 1979.
- 20- WOOLF B.: On estimating the relation between blood group and disease. *Ann. Hum. Genet.*, 19: 251-253, 1955.
- 21- ALLAN T.M.: ABO blood groups age groups in surgical venous thrombo embolism. *Atherosclerosis*, 23: 141-142, 1967.
- 22- BROUTE-STEWART B., BOTHA M.C. and KURT L.H.: ABO blood groups in relation to ischemic heart disease. *Br. Med. J.*, 1: 1646-1650, 1962.
- 23- KINGSBURY K.J.: Relation of ABO blood-groups to atherosclerosis. *Lancet*, 1: 199-203, 1971.
- 24- WEINER A.S.: Blood group and disease. *Am. J. Hum. Genet.*, 22: 276-483, 1970.
- 25- VOGEL F.: ABO blood groups and disease. *Am. J. Hum. Genet.*, 22: 464-475, 1970.
- 26- MOURANT A.E., KOPIC A.C. and DOMAINIEWSKA-SOBE CZAK K.: *The distributions of the human blood groups and other polymorphisms*. 2nd ed. Oxford University Press, 1976.
- 27- HIRSZFELD L. and HIRSZFELD H.: Serological differences between blood of different races. The results of research on the Macedonian front. *Lancet*, ii: 675-679, 1919.
- 28- ZERVOPOULOS G., TSANA K. and MIHAILIDIS G.: Relation of metal disease to blood groups (in Greek). *Neuropsychiat Chron.*, 6: 32-47, 1967.
- 29- KOPEC, ADA C.: *The distribution of the blood groups in the United Kingdom*. London, New York (etc.). Oxford University Press. x: 146, 1970.
- 30- MIZAN N. TURAN and ALPTEKIN, AYTAN: The frequencies of ABO blood groups and their distribution according to the geographical regions in Turkey. *Ankara. The Turkish Red Crescent Sco.*, 16, 1967.
- 31- SWADESH A.: ABO blood group in relation to eosinophilia. *Anthropologist*, 8: 33-39, 1961.