

# Distribution of ABO blood groups and rhesus factor in Southwest Saudi Arabia

Mohammed A. Sarhan, MSc, PhD, Kamel A. Saleh, MSc, PhD, Saad M. Bin-Dajem, MSc, PhD.

## ABSTRACT

**الأهداف:** تحديد توزيع مجموعات فصائل الدم ABO و Rh في عينات مختارة عشوائياً من الطلاب السعوديين في جامعة الملك خالد، ومقارنة هذه النتائج مع نتائج الدراسات الأخرى التي أجريت في المملكة أو في بلدان أخرى.

**الطريقة:** شملت هذه الدراسة على 944 عينة من الذكور الذين يقطنون منطقة جنوب غرب المملكة العربية السعودية، والمناطق التي تشمل عسير، جازان، نجران. وقد تم تحديد مجموعات الدم ABO و Rh في هذه العينات. ثم تم حساب حالات ABO و Rh كلاً على حدة. أجريت هذه الدراسة في جامعة الملك خالد - أبها - المملكة العربية السعودية، خلال الفترة ما بين يناير 2008م وحتى مارس 2008م، وبعد الحصول على الموافقة الرسمية من قبل لجنة أخلاقيات البحوث في كلية العلوم بجامعة الملك خالد.

**النتائج:** أظهرت الدراسة أن تكرارات مجموعات ABO في العينات، 56.8% للمجموعة O، و 33.4% للمجموعة A، و 6% للمجموعة B، و 3.8% للمجموعة AB. فقط 7.2% منهم كانت نتائجهم سالبة لـ Rh.

**خاتمة:** إن تكرار الشكل المظهري لمجموعة ABO و Rh في مجتمع المنطقة الجنوب غربية من المملكة العربية السعودية يظهر توافقاً وانسجاماً مع النتائج التي قد تم الحصول من دول الخليج العربي الأخرى.

**Objectives:** To document the distribution of the ABO and rhesus (Rh) blood groups in a random sample of Saudi students from the King Khalid University, Abha, Kingdom of Saudi Arabia, and to compare our results from that of other studies in the Kingdom and elsewhere.

**Method:** The subjects included in this study were 944 males from the southwest region of Saudi Arabia including Aseer, Jizan, and Najran regions. The ABO blood groups and Rh factor from 944 Saudi males were determined. The frequency of ABO blood

groups and Rh status were calculated separately. This study was carried out at King Khalid University, Abha, Kingdom of Saudi Arabia, from January to March 2008, and the ethical approval was obtained from the Research Ethical Committee, College of Science, King Khalid University.

**Results:** The frequencies of ABO groups showed 56.8% for group O, 33.4% group A, 6% group B and 3.8% group AB trend. Only 7.2% of them were found to be Rh-negative.

**Conclusion:** The frequencies of ABO and Rh phenotypes in the southwest population of Saudi Arabia are similar to those reported in most areas of the Arabian Gulf region.

*Saudi Med J 2009; Vol. 30 (1): 116-119*

*From the Department of Biological Sciences, Faculty of Science, King Khalid University, Abha, Kingdom of Saudi Arabia.*

*Received 1st November 2008. Accepted 3rd December 2008.*

*Address correspondence and reprint request to: Dr. Mohammed A. A. Sarhan, Department of Biological Sciences, Faculty of Science, King Khalid University, PO Box 9004, Abha 61413, Kingdom of Saudi Arabia. E-mail: mohammed\_sarhan@yahoo.com*

**B**lood group typing is based on the antigenic property of the red blood cells (RBCs). On the surface of the red blood cells, there are approximately 30 different varieties of blood group antigens. The A and B antigens are important complex oligosaccharides antigens on their external surfaces. Antibodies are produced in the blood plasma against these A and B antigens, and continue to be produced throughout a person's life. According to the presence of antigens and agglutinins, individuals are divided into 4 major blood groups A, B, AB, and O.<sup>1</sup> The demand for blood group prevalence studies is versatile, in addition to their importance in blood transfusion, to avoid catastrophes of mismatched transfusion reactions, their relation to disease and

environment is being increasingly required in current medicine. The most important function of blood banks is to offer appropriate blood components, which the patient needs, by preparing certain blood components. Therefore, blood grouping has taken the top place among the routine works of blood centers. The most famous blood group in transfusion medicine is ABO and rhesus (Rh). Therefore, in routine practice, attention is paid to ABO and Rh systems as a compatibility test in any blood bank, or blood transfusion service.<sup>2,3</sup> The Rhesus blood group and the ABO blood group systems are of clinical importance because of their relation to hemolytic disease of the newborn.<sup>4</sup> Human RBCs also contain another antigen, antigen D (Rh). People having this antigen are called Rh positive, and those who do not possess this are Rh negative. It differs from the ABO system in that corresponding antibodies (agglutinins) are not naturally developed, unless sensitized with Rh (+ve) blood transfusion to Rh (-ve) persons.

Knowledge of the ABO and Rh distribution in a certain population is vital as the distribution of this blood group system varies from race to race. The Western Europeans have a higher proportion, up to 46% of group O, whereas, Eastern Europeans have a higher proportion, up to 40% of group B blood.<sup>5</sup> The Americans generally have frequencies of 45% of O blood.<sup>6</sup> In the case of Rh grouping, existing literature indicates that 85% of Caucasians are Rh-positive, and 15% are Rh-negative. Approximately 95% of African-Americans are Rh-positive, whereas indigenous Africans are virtually 100% Rh-positive.<sup>6,7</sup> It is interesting to note that the distribution of ABO and Rh blood group varies from race to race. Among the Western Europeans, 42% belongs to A group, 9% to B group, 3% to AB group, and rest 46% to O group. Again, some of the Western Europeans show higher proportion (up to 40%) of group B. On the other hand, pure American Indians belong almost exclusively to group O. Among the Americans, the frequency of group A is 41%, B is 10%, AB is 4%, and O blood group is 45%.<sup>8</sup> As the distribution of ABO blood groups and Rh factor in the Saudi population in the southwest region is not well documented, thus, the present study was aimed to fill this lack on the genetic map of this region of Saudi Arabia by providing data on ABO-Rh blood group systems.

**Methods.** The study design was approved by the Research Ethical Committee, College of Science, King Khalid University, Abha, Kingdom of Saudi Arabia. All subjects were male, and were informed of the goal of the study, and they agreed to participate. The subjects included in this study were from the southwest region of Saudi Arabia including Aseer (672), Jizan (156), and Najran (116) regions. A total of 944 (18-24 year old

male subjects, were included, and were tested for ABO, and Rh (D) blood groups. Students under the age of 18 or over the age of 24 were excluded from the study. The determination of the blood groups was carried out for 200 randomly selected subjects to confirm the survey results. The blood samples were collected by fingerprick with a sterile lancet. The anti-A, anti-B, and anti-D monoclonal antiserum (Spinreact, Spain) were used for blood group phenotyping by slide method.<sup>9</sup> The manufacturer's procedural instructions were followed. On a labeled slide, a drop of anti-A, anti-B and anti-D was placed, and a drop of test cells was added to each, and was mixed. The results of agglutination were recorded immediately after mixing. The agglutination in blood drop A was considered as group A, and agglutination in blood drop B as group B. The agglutination in both blood drops was considered as group AB, and if both blood drops were not agglutinated, blood group was considered as O. The agglutination in Rh blood drop was considered as Rh positive, and non-agglutination as Rh negative. Based on the distribution of blood groups of other studies and per protocol sampling (PPS) method, a maximum of 800 subjects were found to be enough to detect a 5% difference in the distribution of blood groups with an  $\alpha$  error of 5%, and a power of 80%. The distribution of different blood groups among male were expressed as percentage.

**Results.** The distribution of ABO and Rh blood groups was recorded in 944 male Saudi students. The percentage of A, B, AB, and O blood group among the studied male subjects is shown in Table 1. Of the 944 male students, the most common blood group was O, followed by blood group A and B. The lowest blood group frequency was AB. The Rh-positive blood groups comprised 92.8% and Rh-negative were 7.2% (Table 3). With respect to both ABO and Rh system, the prevalence of ABO and Rh blood groups are shown in Figure 1.

**Discussion.** The ABO blood group antigens are of major clinical significance for 2 reasons: they are naturally

**Table 1** - Distribution of different ABO blood groups among male students.

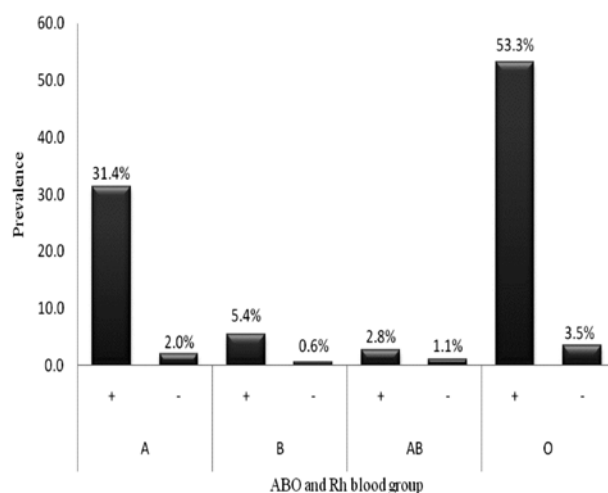
Blood group	n	(%)
A	315	(33.4)
B	57	(6)
AB	36	(3.8)
O	536	(56.8)
<b>Total</b>	<b>944</b>	<b>(100)</b>

occurring and are found universally, and they are highly reactive. The ABO and Rh blood group systems are the most commonly utilized grouping systems in blood transfusion. In transfusion medicine, they are the most immunogenic of all the blood group antigens. The most common cause of death from a blood transfusion is when an incompatible type of ABO blood is transfused. However, despite their obvious clinical importance, the physiological functions of ABO blood group antigens remain a mystery. No disease is known to result from the lack of expression of ABO blood group antigens, but the susceptibility to a number of diseases has been linked with a person's ABO phenotype. Such correlations remain controversial and include the observation that gastric cancer appears to be more common in group A individuals, whereas gastric and duodenal ulcers occur more often in group O individuals.<sup>10</sup> The present study records data on ABO and Rh blood groups of the Saudi population in the southwest region of Saudi Arabia. For this purpose, the blood groups of 944 males from the different faculties of the King Khalid University were

studied. The results of the present study showed the distribution of A, B, AB and O blood groups among population aged from 18-24 years (Table 1). The relative frequency of the various blood groups does not seem to deviate from those, which have been recorded for studies on various regions of the Saudi population.<sup>11-13</sup> While current literature indicates that over 99% of Asians are Rh-positive, our students were Rh-positive, and Rh-negative (Table 2). These results draw attention to the shortage of negative blood types in the population, which is very important to blood banks, and voluntary blood donation movement. It has been observed that percentages of blood group distribution in different parts

**Table 2** - Distribution of different rhesus (Rh) blood groups among male students.

Blood group	n	(%)
Rh positive	876	(92.8)
Rh negative	68	(7.2)
<b>Total</b>	<b>944</b>	<b>(100)</b>



**Figure 1** - Prevalence of ABO and rhesus (Rh) blood groups among male students.

**Table 3** - Comparison of distribution of different ABO and rhesus (Rh) blood groups in the present study and other countries.

Study	A	B	AB	O	Rh positive	Rh negative
Present	33.4	6.0	3.8	56.8	92.8	7.2
Saudi Arabia <sup>13</sup>	26.0	18.0	4.0	51.0	92.0	8.0
Kuwait <sup>16</sup>	26.7	24.1	4.6	44.6	ND	ND
Bahrain <sup>17</sup>	21.5	24.4	4.5	49.6	94.5	4.5
Oman <sup>18</sup>	27.5	17.5	3.5	51.5	ND	ND
Yemen (Hadhramout) <sup>19</sup>	29.6	16.5	2.3	51.5	92.9	7.1
Iran <sup>20</sup>	33.1	23.3	8.9	34.7	88.7	11.3
Palestine <sup>21</sup>	40.0	22	6.0	32.0	97.3	2.7
Jordan <sup>22</sup>	38.5	18.1	6.9	36.6	ND	ND
Turkey <sup>23</sup>	43.8	16.2	9.2	30.8	86.0	14.0
Pakistan <sup>24</sup>	23.8	38.0	10	28.2	89.1	10.9
India(Punjab) <sup>25</sup>	21.9	37.6	9.3	31.2	97.3	2.7

ND - not determined

of the world are different depending upon geographical variations, external environment, and genetic factors involved.<sup>14,15</sup> For this reason, in comparison with the data from the neighboring countries, this study showed that the distribution pattern in Saudi Arabia does not look much different from that of other countries. The frequency of blood group O, is the highest among ABO blood groups in Saudi Arabia,<sup>11-13</sup> Kuwait,<sup>16</sup> Bahrain,<sup>17</sup> Oman,<sup>18</sup> Yemen,<sup>19</sup> and Iran,<sup>20</sup> while in other populations, Palestine,<sup>21</sup> Jordan,<sup>22</sup> and Turkey,<sup>23</sup> the blood group A is the highest (Table 3). The blood group O is said to be the characteristic of Arabia as it occurs at high frequency, and this is confirmed in our study, which is related to the neighboring countries' study. The higher percentage of people having O+ blood group depends on the frequency of the alleles in the population in the first place, then allelic dilution would not occur very much through interbreeding with A and B group people. The limitation of our study is that our data set comprised a relatively small number of individuals from Jizan and Najran regions. However, the distribution of blood groups in our pool was similar to that found in the population of the Eastern region of Saudi Arabia.

In conclusion, our results show that the most frequent blood group in the Saudi population in the southwest region is O-positive, while blood group AB is observed at a lower frequency. Understanding the frequencies of various blood groups in Saudi Arabia is essential for blood banks and blood donations in emergencies. The knowledge of blood group phenotype distribution is also important for clinical studies (for example, disease association), as well as, for population studies.

## References

1. Watkins WM. The ABO blood group system: historical background. *Transfus Med* 2001; 11: 243-265.
2. Calhoun L, Petz LD. Erythrocyte antigens and antibodies. Beutler E, Lichtman MA, Coller BS, Kipps TJ, Seligsohn U, editors. In: Williams Hematology. 6th ed. New York (NY): McGraw-Hill; 2001. p. 1843-1858.
3. McCullough J. Blood Procurement and Screening. Beutler E, Lichtman MA, Coller BS, Kipps TJ, Seligsohn U, editors. In: Williams Hematology. 6th ed. New York (NY): McGraw-Hill; 2001. p. 1871-1877.
4. Cariani L, Romano EL, Martinez N, Montano R, Suarez G, Ruiz I, et al. ABO-haemolytic disease of the newborn (ABO-HDN): factors influencing its severity and incidence in Venezuela. *J Trop Pediatr* 1995; 41: 14-21.
5. Keel CA, Neil E, Joels N. Blood groups. In: Samson Wright's applied physiology. 13th ed. Oxford (UK): Oxford University Press; 1996. p. 46.
6. Ganong WF. Circulation. Review of Medical Physiology. San Francisco (LA): Mc Graw Hill, International; 2005. p. 537.
7. Guyton AC, Hall JE. Blood Cells, Immunity, and Blood Clotting: blood groups. In: Text book of Medical Physiology. 11th ed. Philadelphia (PA): WB Saunders Company; 2005. p. 458-459.
8. Wilkinson S. The ABO and H blood group systems. In: Rudman S, editor. Textbook of blood banking and transfusion medicine. Philadelphia (PA): WB Saunders Co.; 1995. p. 66-81.
9. Walker RH, Hoppe PA, Judd WJ. Technical Manual. Arlington (VA): American Association of Blood Banks; 1993.
10. Stayboldt C, Rearden A, Lane T. B antigen acquired by normal A1 red cells exposed to a patient's serum. *Transfusion* 1987; 27: 41-44.
11. Abdelaal MA, Anyaegbu CC, al Sobhi EM, al Baz NM, Hodan K. Blood group phenotype distribution in Saudi Arabs. *Afr J Med Med Sci* 1999; 28: 133-135.
12. Ozsoylu S, Alhejaily M. The distribution of ABO and Rh blood groups in the Tabuk region and Medina Munewera, Saudi Arabia. *Turk J Pediatr* 1987; 29: 239-241.
13. Bashwari LA, Al-Mulhim AA, Ahmad MS, Ahmed MA. Frequency of ABO blood groups in the Eastern region of Saudi Arabia. *Saudi Med J* 2001; 22: 1008-1012.
14. Khaliq MA, Khan JA, Shah H, Khan SP. Frequency of ABO and Rh (D) blood groups in Hazara division (Abbottabad). *Pak J Med Res* 1984; 23: 102-103.
15. Onde S, Kensee A. Geographic variations analysis of the ABO and Rh system in Turkey. *Gene Geogr* 1995; 9: 211-220.
16. Al-Bustan S, El-Zawahri M, Al-Azmi D, Al-Bashir AA. Allele frequencies and molecular genotyping of the ABO blood group system in a Kuwaiti population. *Int J Hematol* 2002; 75: 147-153.
17. Al-Arrayed S, Shome DK, Hafadh N, Amin S, Al Mukhareq H, Al Mulla M, et al. ABO Blood Group and RhD Phenotypes in Bahrain: Results of Screening School Children and Blood Donors. *Bahrain Med Bull* 2001; 23: 112-115.
18. Moftah FM. ABO, Rh Blood Group Configuration in Oman. Oman: Oman Newsletter; 1993. p. 25-26.
19. Bahaj AA. ABO and Rhesus Blood Groups Distribution In Hadhramout Population. *Hadhramout for Studies & Researches* 2003; 4: 52-58.
20. Boskabady MH, Shademan A, Ghamami G, Mazloom R. Distribution of Blood Groups Among Population in the city of Mashhad (North East of Iran). *Pak J Med Sci* 2005; 21: 194-198.
21. Skaik YA, El-Zyan N. Spectrum of ABO AND Rh (D) Blood Groups amongst the Palestinians Students at Al-Azhar University - Gaza. *Pak J Med Sci* 2006; 22: 333-335.
22. Hanania S, Hassawi D, Irshaid N. Allele Frequency and Molecular Genotypes of ABO blood group System in a Jordanian Population. *J Med Sci* 2007; 7: 51-58.
23. Dilek I, Demir C, Bay A, Akdeniz H, Oner AF. ABO and Rh Blood Groups Frequency in Men and Women Living in Eastern Turkey. *International Journal of Hematology and Oncology* 2006; 16: 23-26.
24. Hamed A, Hussain W, Ahmed J, Rabbi F, Qureshi JA. Prevalence of Phenotypes and Genes of ABO and Rhesus (Rh) Blood Groups in Faisalabad, Pakistan. *Pak J Biol Sci* 2002; 5: 722-724.
25. Sidhu S. Distribution of the ABO Blood Groups and Rh(D) Factor Among the Scheduled Caste Population of Punjab. *Anthropologist* 2003; 5: 203-204.