Blood groups in Saudi obstetrics patients

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ABSTRACT

Objective: Blood groups are genetically determined and exhibit polymorphism, where different population groups have significant difference in the frequency of each blood group. This study was conducted to determine the frequency of the ABO and Rhesus blood groups in pregnant Saudi females.

Materials and methods: This group included 859 Saudi females attending the outpatient section of the Obstetric and Gynecology clinic at King Khalid University Hospital for routine check up. The blood was drawn by venepuncture and used for the estimation of ABO and rhesus blood group. The frequency of the phenotypes A, B, AB and O, rhesus positive and rhesus negative were calculated separately.

Results: The frequency of ABO and Rhesus phenotypes was calculated. The highest frequency was that of blood group O (53.20%) and the lowest of blood group AB (3.49%). Among the rhesus phenotypes, majority (91.5%) were rhesus positive. The prevalence of coexisting ABO/Rhesus phenotypes were calculated and the highest frequency was that of O* (48.54%) followed by A* (21.65%) and B* (18.277%). The blood groups A, B, O, and AB and AB* occurred at lower frequency of 1.51%, 1.862%, 4.656% and 3.026%, respectively. Comparison of our results with studies reported in Saudis in 1982 shows that a significant increase has occurred in blood group O and a significant decrease in blood group A. This difference is more significant in the Rhesus positive group.

Discussion: These results show significant differences in the frequency of the blood groups in Saudis compared to other populations, and point to the greater need for blood group O for the purpose of transfusion particularly for the obstetric patients. The difference in our results from those reported earlier in Saudis may be either due to a real shift in genetic frequencies in the Saudi population, produced largely by population movement from different areas of the country or could be related to the improvement in the laboratory techniques.

Conclusion: It is necessary to determine blood groups in different areas of Saudi Arabia in order to identify if any difference exist in the frequencies.

Keywords: Blood groups, Rhesus, Saudi Arabia.


The ABO blood groups were first discovered by Landsteiner in 1900. Later several other blood groups, notably the Rhesus (Rh) blood group was identified in 1940. The ABO blood groups are genetically determined antigens present on the surface of the red blood cells and most other body cells. These are determined by reaction of an individuals red cells with specific anti-A and anti-B antibodies. Phenotypically there are four groups i.e. O, A, B and AB determined by three allelic genes located near the tip of the long arm of chromosome 9. These give rise to six possible genotypes OO, AA, BB, AO, BO and AB. The A&B are inherited as codominant traits, while O is recessive to both, thus
AA, AO are both expressed as A and similarly BB and BO as B, while AB are expressed as AB.1

The ABO alleles determine the activity of specific transferases, in which the A allele adds N-acetyl-
galactosamine to the precursor glycoprotein known as H-substance, while the B allele adds D-galactose.
In presence of the O-allele the H substance remains unchanged.2

The second type of blood groups are the Rhesus blood group system.3 There are only two rhesus
phenotypes and these are rhesus-positive and rhesus negative depending on whether the Rh antigen is
present on the red cells or not. These antigens are determined by the reaction of an individuals red cells
with anti-Rh antibody. The Rhesus blood groups are also genetically determined and the Rhesus gene
complex is located on chromosome 1 with two alleles at each of three closely linked loci. These are C, c, E,
e, and D or not D. The Rhesus positive persons are heterozygous or homozygous for the D allele, while
all others are Rhesus negative.2

Interestingly, both ABO and Rhesus blood groups exhibit extensive polymorphism in different
populations and the frequency at which each of the blood group exists shows considerable variations in
different populations.4,5

This study was carried out with the specific aim to determine the frequency of ABO and Rhesus
phenotypes in Saudi pregnant females and to compare the results with the results in other populations and
with a study reported earlier in Saudis.

Materials and methods. The study group included a total of 859 Saudi females attending the
obstetric and gynaecology clinic at King Khalid

Table 1 - Prevalence of the phenotypes of the ABO and Rh alleles in
Saudi females*

<table>
<thead>
<tr>
<th>Phenotype</th>
<th>No.</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I) ABO Phenotypes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>199</td>
<td>23.166</td>
</tr>
<tr>
<td>B</td>
<td>173</td>
<td>20.139</td>
</tr>
<tr>
<td>AB</td>
<td>30</td>
<td>3.49</td>
</tr>
<tr>
<td>O</td>
<td>457</td>
<td>53.200</td>
</tr>
<tr>
<td>(II) Rh Phenotypes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhesus positive</td>
<td>786</td>
<td>91.5</td>
</tr>
<tr>
<td>Rhesus negative</td>
<td>73</td>
<td>8.5</td>
</tr>
</tbody>
</table>

*Total No. investigated = 859

University Hospital, Riyadh, for routine check-up. Essential information about the females, i.e. age and
nationality, were filled on the files and blood sample was extracted for estimation of the blood group. Only
Saudi nationals were included in this study.

The ABO blood groups were estimated by monoclonal method, using NovacloneTM kits from
Dominion Biologicals Ltd. (Canada).

To compare the results of pregnant Saudi females with those reported in other populations and in earlier
studies on Saudis chi square analysis using 2x2 contingency tables were used. p value < 0.05 was
considered as statistically significant.

Results. Each sample was labelled according to its
ABO phenotype and rhesus positive or negative. The
prevalence of the phenotypes A, B, AB and O was
 calculated in the Saudi females and the results are
presented in Table 1. The most common blood group
in the pregnant females was blood group O, followed
by blood group A and blood AB occurred at the
lowest prevalence.

The prevalence of Rhesus positive and Rhesus
negative phenotype was calculated and is present in
Table 2. Majority (91.5%) of the females were
Rhesus positive (Rh+).

The prevalence of the ABO phenotypes linked to
the Rhesus phenotype was calculated and the
prevalence is presented in Table 2. The most frequent
phenotype in the Saudi females was O+ where almost
48.54% of the females had this phenotype. This was
followed by A+ in 21.65% and B+ in 18.277%. The
lowest prevalence was that AB- (0.456%).

Discussion. This study has determined the
distribution frequency of ABO and Rhesus blood
groups in the Saudi females. Only a limited number
of studies are available for comparison in Saudi
Arabia. One report on demographic data in Saudi
Table 3 - Prevalence of ABO blood groups in different populations**

<table>
<thead>
<tr>
<th>Country</th>
<th>Total No. investigated</th>
<th>O</th>
<th>A</th>
<th>B</th>
<th>AB</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>30810</td>
<td>12844*</td>
<td>13955*</td>
<td>2808*</td>
<td>1203</td>
<td>7</td>
</tr>
<tr>
<td>Germany</td>
<td>597</td>
<td>233*</td>
<td>274*</td>
<td>65*</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>West Germany</td>
<td>4017</td>
<td>1686*</td>
<td>738*</td>
<td>412*</td>
<td>181</td>
<td>9</td>
</tr>
<tr>
<td>East Germany</td>
<td>7500</td>
<td>2743*</td>
<td>3188*</td>
<td>1089*</td>
<td>480*</td>
<td>10</td>
</tr>
<tr>
<td>Greece</td>
<td>44106</td>
<td>19251*</td>
<td>17025*</td>
<td>5737*</td>
<td>2093</td>
<td>11</td>
</tr>
<tr>
<td>Hungry</td>
<td>1603</td>
<td>529*</td>
<td>633*</td>
<td>295*</td>
<td>146*</td>
<td>12</td>
</tr>
<tr>
<td>Italy</td>
<td>1967</td>
<td>901*</td>
<td>763*</td>
<td>221*</td>
<td>82</td>
<td>13</td>
</tr>
<tr>
<td>England</td>
<td>44094</td>
<td>19752*</td>
<td>19422*</td>
<td>3580*</td>
<td>1340</td>
<td>14</td>
</tr>
<tr>
<td>Turkey</td>
<td>8430</td>
<td>2733*</td>
<td>3681*</td>
<td>1390*</td>
<td>626*</td>
<td>15</td>
</tr>
<tr>
<td>Iran</td>
<td>16368</td>
<td>6750*</td>
<td>4652*</td>
<td>3872*</td>
<td>1094*</td>
<td>16</td>
</tr>
<tr>
<td>Kuwait</td>
<td>2632</td>
<td>1244*</td>
<td>638</td>
<td>635*</td>
<td>115</td>
<td>17</td>
</tr>
<tr>
<td>Lebanon</td>
<td>5445</td>
<td>1966*</td>
<td>2573*</td>
<td>627*</td>
<td>279*</td>
<td>18</td>
</tr>
<tr>
<td>India</td>
<td>200</td>
<td>76*</td>
<td>81*</td>
<td>38</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>Dehli</td>
<td>606</td>
<td>237*</td>
<td>142</td>
<td>190*</td>
<td>37*</td>
<td>20</td>
</tr>
<tr>
<td>Pakistan</td>
<td>201</td>
<td>68*</td>
<td>43</td>
<td>76*</td>
<td>14*</td>
<td>21</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>1000</td>
<td>338*</td>
<td>254</td>
<td>311*</td>
<td>97*</td>
<td>22</td>
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<tr>
<td>Algeria</td>
<td>145</td>
<td>87</td>
<td>36</td>
<td>17*</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>Libya</td>
<td>1100</td>
<td>448*</td>
<td>421*</td>
<td>182*</td>
<td>49</td>
<td>24</td>
</tr>
<tr>
<td>Egypt (Cairo)</td>
<td>601</td>
<td>219*</td>
<td>204*</td>
<td>126</td>
<td>52*</td>
<td>25</td>
</tr>
</tbody>
</table>

* Difference in comparison with the results of this study is statistically significant (p<0.005) [Uncorrected; Mantel-Haenszel and Yates corrected].

**Results of males and females
obstetric patients showed the frequency of blood groups O, A, B and AB as 47.6%, 29.7%, 18.6% and 4.1% respectively where 91.7% were Rhesus positive and 8.3% were Rhesus negative. Our study shows differences in the frequency of O (53.2%), A (23.17%), B (20.14%) and AB (3.49%) blood group, where the blood group O has increased significantly ($\chi^2=5.06; p<0.05$), while blood group A has significantly decreased ($\chi^2=9.9; p<0.01$) over the 14 years period. On the other hand, prevalence of blood group B and AB has not altered significantly ($p>0.05$). Differences are also observed when the combination of the two blood groups types are compared. In the study by Cochran and Faqeeera, O+, A+, B+ and AB+ were encountered in 43.8%, 27.2%, 17.1% and 3.6% females, respectively, while in our study the frequency was 48.54%, 21.65%, 18.277%, 3.02%, respectively. The frequency of O-, A-, B- and AB- in Cochran and Faqeeera study were 3.8%, 2.5%, 1.5% and 0.5% compared to our results of 4.656%, 1.51%, 1.86% and 0.465%, respectively. Thus the increase in blood group O is mainly due to increase in O+, while the decrease in blood group A is mainly due to A+. On the other hand, the proportion of O- and A- have not altered significantly. These results suggest that differences in the frequency of blood groups are taking place over period of time, where over 14 years period the frequency of blood group O has increased, while that of blood group A has decreased, while blood groups B and AB have not changed significantly. However, the Rhesus blood groups alone do not show any change in the pattern of Rhesus positive and negative, though O+ has increased, A+ has decreased while O- and A- have not changed. These differences may be due to a real shift in genetic frequencies, caused largely by population drift in Riyadh. Riyadh is the capital of Saudi Arabia with tremendous opportunities for education and work and hence population flow from different areas of the country is quite significant. In addition, differences may be caused by the significant improvement in the blood group determination technology, where a higher degree of sensitivity and specificity has been introduced.

Table 2 lists the frequency of ABO blood groups in other populations. It must be pointed out that the reports in all populations group the males and females together. This is due to the fact that blood groups are autosomal and the frequencies are not different in the two sexes. Comparison of the Saudi results with those from the other populations show significant differences in the frequency of blood group. The frequency of blood groups O, A, B and AB in these populations range from 32.4 to 60.0%, 10.89 to 47.5%, 8.12 to 37.81% and 2.5 to 9.7%, respectively.

In the Saudi females, the blood group O occurs at a significantly higher frequency compared to all the reports (except Algeria) in different populations presented in Table 3. This difference may be, due to some extent, on the difference in the laboratory technique used for estimation of blood group. Most of the reports compiled in Table 3 are during or prior to 1970's, while definite technical advancements have improved both the sensitivity and specificity of the NovacineTM kit used during our study. A re-evaluation of the blood groups in these populations using the new techniques may reveal similar differences. Populations show differences in the phenotypic distribution of the blood group phenotypes. In Greece, Italy, Iran, Kuwait, India, Bangladesh, Algeria, Libya and Egypt, like in Saudi females, the frequency of blood group O is significantly higher, while in some of the other populations the frequency of blood group A is highest (France, W. Germany, E. Germany, Hungary, Turkey, Lebanon and overall Indian population) (Table 3). An interesting difference between our results and those reported for U.K. populations is in the frequency of Rhesus negative, where in the U.K. population almost 17% are Rhesus negative compared to 8.5% in the Saudis. This suggests that the number of cases of Rhesus isoimmunization would be lower than that encountered in the U.K. population prior to anti-D-IgG immunoglobulin availability.

The blood group O is said to be a characteristic of Arabians as it occurs at a high frequency in indigenous desert populations. The Arabs of Saudi Arabia are regarded as the main nuclear populations and the blood groups are stated to resemble those of the mountain and island people of Europe and Northern Africa with a high frequency of group O. This statement is confirmed by our findings in this study. When we compare the results of the countries with similar frequencies with the two major European countries, with a large number of investigsted individuals (i.e. France 30810 and England 44094) it is observed that the frequency of blood group O is either similar or lower in most of these countries except Algeria, Libya, Kuwait, Italy and Saudi Arabia. Thus the results in Saudi Arabia are related to these countries and are higher than the others listed in Table 3.

This study has several significant implications. Firstly, it provides information to the blood banks regarding the higher need of blood group O for transfusion purpose particularly for obstetrics patients. Secondary, it points to a significant health implication. Studies concerning possible association between ABO blood groups and cardiovascular diseases have confirmed systematically that the relative frequency of group O is lower in persons affected by coronary heart disease, ischaemic heart disease, venous thromboembolism, atherosclerosis etc. and these individuals also have a higher in vitro
heparin anticoagulant effect. Several studies have reported an association between blood groups and certain disease states and it is possible that higher frequency of blood group O has a protective effect against some diseases in Saudi females. This correlation aspect should be the theme of a future study. Thirdly, this study shows variations in the frequency of blood groups with time either due to genetic or technical causes. Thus, most countries should re-evaluate the blood group frequencies in order to identify differences, if any. Finally, if we consider that the changes in blood groups in Saudis which has taken place over the last 14 years is due to population movement to Riyadh from other areas of Saudi Arabia, then we also suggest indirectly that blood group frequencies may be different in different areas of Saudi Arabia. Thus it is necessary to conduct similar studies in order to determine the blood group frequencies in different regions of Saudi Arabia.

References