

## Analysis of ABO and Rh blood groups distribution in East Karadeniz region of Turkey

### *Türkiye'nin Doğu Karadeniz bölgesinde ABO ve Rh kan grupları dağılım analizi*

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#### ABSTRACT

**Objective:** Accurate knowledge on the distribution of blood groups in a region is useful for individuals in need and blood bank processes as well as such knowledge would provide scientific contribution. In this study, our objective is to determine ABO and Rh blood groups distribution in the Rize province.

**Materials and methods:** Retrospective analysis has been conducted on the data of 38,329 individuals applied to Blood Center of Rize Training and Research Hospital for blood group determination. The data collection period covers five years, between January 2005 and December 2010.

**Results:** Our findings indicated that the frequencies of the blood groups were as following: Group O 44.07%, Group A 44.07%, Group B 9.26%, Group AB 2.60%, and Rh(+) 83.70% and Rh(-)16.30%. According to our knowledge, there is no prior study on distribution of blood groups in the Eastern Black Sea region of Turkey. When compared to data throughout Turkey, it has been found out that the rate of blood group O is significantly higher, and the rates of blood groups B and AB are significantly lower.

**Conclusion:** We believe that our results would contribute to database construction on distribution of blood groups.

**Key words:** ABO Blood-Group System, Rize, Turkey

#### ÖZET

**Amaç:** Bir bölgede kan gruplarının dağılımı hakkında doğru bilgiye sahip olmak, bireylerin ihtiyaçları ve kan bankası işlemleri için yararlı olmasının yanında bilimsel katkı da sağlayacaktır. Bu çalışmada, amacımız Rize ilindeki ABO ve Rh kan gruplarının dağılımını belirlemektir.

**Gereç ve yöntem:** Rize Eğitim ve Araştırma Hastanesi, Kan Merkezine kan grubunun belirlenmesi için başvuran 38,329 kişinin verilerinin retrospektif analizi yapılmıştır. Veri toplama dönemi Ocak 2005-Aralık 2010 tarihleri arasındaki beş yılı kapsar.

**Bulgular:** Bizim bulgularımız O, A, B, AB, Rh(+) ve Rh(-) kan grubu sıklıklarının sırasıyla %44.07, %44.07, %9.26, %2.60, %83.70 ve %16.30 olduğunu göstermiştir. Bizim bilgilerimize göre Türkiye'nin Doğu Karadeniz bölgesinde ABO ve Rh kan gruplarının dağılımı üzerine başka bir çalışma yoktur. Türkiye genelindeki verilerle karşılaştırdığımızda, O kan grubu oranı belirgin olarak yüksek ve B ile AB kan grupları oranları belirgin olarak düşük bulunmuştur.

**Sonuç:** Sonuçlarımızın kan gruplarının dağılımı konusunda veri tabanı oluşmasına katkıda bulunacağını düşünüyoruz.

**Anahtar kelimeler:** ABO kan grubu sistemi, Rize, Türkiye

#### INTRODUCTION

Blood group antigens are determined by the proteins, glycoproteins, or glycolipids on the surface of erythrocyte.<sup>1</sup> ABO blood group system was first defined by Karl Landsteiner in 1901.<sup>2</sup> Molecular

principles of ABO blood group system have been enlightened in 1990.<sup>3</sup> ABO blood group is the most significant system in transfusion medicine. A and B antigens on erythrocytes are formed by terminal sugar attached to a carbohydrate chain on membrane

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glycosphingolipids. H antigen is the precursor molecule for the formation of the A and B antigens. A antigen is formed by adding N- acetylgalactosamine to H antigen, and B antigen is formed by adding galactose to H antigen. There exists H antigen in O blood group; however there are no A and B antigens in O blood group. ABO antigens can be detected on the erythrocytes of 6-week-old embryos; however they are entirely developed around 2-4 years of age. Antibody development to A and B antigens may start several months after birth due to environmental effects such as infection. Then, it reaches a peak around 5-10 years of age and decreases as the age increases.<sup>1</sup>

Four main phenotypes determined by antigen and antibody (reverse grouping) method in human beings are A, B, O and AB blood groups.<sup>4</sup>

In transfusion medicine, D antigen is the most important one after A and B antigens. If the D antigen exists it is named Rh (+), if not it is named Rh (-). Rh blood group system includes D, C, c, E, e and other 40 antigens.<sup>1</sup>

Investigation of blood groups distribution rates in a regional basis would obviously contribute to science. Furthermore, in extraordinary cases, such analysis results would be helpful to determine easily from which region or cities blood needed in a certain could be provided. Having accurate information about the rates of blood groups in a region or city would also be useful for individuals in need and blood bank processes.

Our study has been performed with the aim of determining ABO and Rh blood groups distribution in the Eastern Black Sea region of Turkey, in particular the Rize province.

## MATERIALS AND METHODS

In present results of 38.329 individuals applied to Rize Training and Research Hospital, Blood Center for blood group determination between January 2005 and December 2010 were retrospectively analyzed.

ABO and Rh blood groups have been determined by either tube agglutination method using Dia-Gast (BP-9-59374 100S France) kit or gel centrifugation method using DiaMed (1785) GmbH, Cressier FR Switzerland kit.

Number and percent of all blood groups were determined using descriptive statistics.

## RESULTS

Our findings indicated that; among the blood groups of 38.329 individuals applied to the blood center, 83.7% (32.084) of them is Rh (+) and 16.3% (6.245) of them is Rh (-). As shown in Table 1, the frequencies of the blood groups A, B, O and AB are 44.07% (16.893), 9.26% (3.547), 44.07% (16.892) and 2,60% (997) respectively. In addition, the ratios of Rh(+) in the blood groups A, B, O and AB are measured as 84.01%, 85.87%, 82.98% and 83.04% respectively (Table 1, 2).

**Table 1.** Distribution of ABO and Rh blood groups

| ABO and Rh groups | Frequency (%) | Total frequency (%) |
|-------------------|---------------|---------------------|
| Group A           |               |                     |
| Rh (+)            | 37.03         | 44.07               |
| Rh (-)            | 7.04          |                     |
| Group O           |               |                     |
| Rh (+)            | 36.57         | 44.07               |
| Rh (-)            | 7.50          |                     |
| Group B           |               |                     |
| Rh (+)            | 7.96          | 9.26                |
| Rh (-)            | 1.30          |                     |
| Group AB          |               |                     |
| Rh (+)            | 2.16          | 2.60                |
| Rh (-)            | 0.44          |                     |

## DISCUSSION

Genes coding ABO and Rh blood groups are located on chromosome 9 and chromosome 1 respectively. ABO and Rh blood groups are transferred hereditary in accordance with Mendel's laws.<sup>1</sup>

Several studies have been conducted in this subject, after the milestone work of Hirszfeld in 1919 which shows that blood groups frequencies are different between communities.<sup>5</sup>

To the best of our knowledge, this is the first study on distribution of blood groups in the Eastern Black Sea region of Turkey. We also perform comparative analysis and discussion of our results as follows.

In Table 2, we give the distribution of ABO and Rh blood groups in the entire Turkey, in our study as well as in different regions of Turkey.<sup>6-17</sup> Figure 1 and Figure 2 also show the regions and cities of Turkey on the map respectively. When compared to data throughout Turkey, it has been found out that the rate of blood group O is significantly higher, and the rates of blood groups AB and B are significantly lower in Rize. By several studies conducted in our country, the ratio for blood group O is reported as

between 30.8% and 41.3%, and also 32.7% in Turkey in general.<sup>6,10,14</sup> In Rize, blood group O is found to be a quite high ratio as 44.07%. While the ratios of B and AB blood groups in Turkey are 16.5% and 8.0% respectively, they are found to be fairly low as 9.3% and 2.6% in Rize.<sup>6</sup> As shown in Table 2, according to the ratios of O, B and AB blood groups, Malatya is the closest to Rize with reported ratios of 41.3%, 13.46% and 6.0% respectively.<sup>10</sup>

**Table 2.** Distribution of ABO and Rh blood groups in Turkey and various cities

| Region            | Ref. number | Group A (%) | Group O (%) | Group B (%) | Group AB (%) | Rh (+) (%) | Rh (-) (%) |
|-------------------|-------------|-------------|-------------|-------------|--------------|------------|------------|
| Turkey in general | 6           | 42.84       | 32.67       | 16.46       | 8.03         | 88.54      | 11.46      |
| Rize              | Our Study   | 44.07       | 44.07       | 9.26        | 2.60         | 83.70      | 16.30      |
| Denizli           | 7           | 42.60       | 33.30       | 16.80       | 7.40         | 89.90      | 10.10      |
| Van               | 8           | 43.80       | 30.80       | 16.20       | 9.20         | 86.80      | 13.20      |
| Diyarbakır        | 9           | 40.81       | 33.66       | 18.53       | 6.98         | 89.17      | 10.82      |
| Malatya           | 10          | 39.32       | 41.28       | 13.36       | 6.04         | 89.00      | 11.00      |
| Gaziantep         | 11          | 40.01       | 35.09       | 18.10       | 6.80         | 90.83      | 9.17       |
| Konya             | 12          | 45.06       | 32.21       | 15.63       | 7.12         | 87.40      | 12.60      |
| Ankara            | 13          | 44.62       | 32.24       | 15.45       | 7.69         | 88.13      | 11.87      |
| İstanbul          | 14          | 44.80       | 30.80       | 15.90       | 8.10         | 87.20      | 12.80      |
| Eskişehir         | 15          | 43.52       | 31.10       | 16.84       | 8.50         | 86.65      | 13.35      |
| Edirne            | 16          | 46.55       | 30.93       | 15.99       | 6.53         | 87.79      | 12.21      |
| Kırklareli        | 16          | 44.99       | 33.05       | 15.04       | 6.92         | 87.61      | 12.39      |
| Tekirdağ          | 16          | 44.85       | 31.73       | 15.49       | 7.93         | 87.83      | 12.17      |
| Şanlıurfa         | 17          | 36.38       | 34.69       | 21.25       | 7.68         | 90.79      | 9.21       |



**Figure 1.** Geographic regions of Turkey

Approximately 85% of the white race is Rh (+) and 15% is Rh (-). Although there exist 95% Rh (+) in American blacks, almost 100% of African blacks are Rh (+).<sup>18</sup>

In our study, ratios of Rh (+) and Rh (-) individuals are found to be 83.70% and 16.30% respec-

tively. As shown in Table 2, in Eskişehir, that is the closest city to Rize according to these results, ratios of Rh (+) and Rh (-) are reported as 86.7% and 13.4% respectively.<sup>15</sup> Besides, in the entire Turkey, 88.5% Rh (+) and 11.5% Rh (-) are determined.<sup>6</sup>

**Table 3.** ABO blood group distributions in the world and various countries

| Region         | Reference number | Group A (%) | Group O (%) | Group B (%) | Group AB (%) |
|----------------|------------------|-------------|-------------|-------------|--------------|
| World-wide     | 18               | 41          | 47          | 9           | 3            |
| UK*            | 15               | 41.78       | 46.63       | 8.56        | 3.04         |
| USA**          | 19               | 37.10       | 46.70       | 12.10       | 4.10         |
| Greece         | 15               | 48.19       | 34.21       | 12.04       | 5.56         |
| Bulgaria       | 15               | 39.96       | 35.80       | 16.84       | 7.60         |
| Cyprus (North) | 20               | 44.22       | 32.45       | 13.80       | 9.53         |
| Cyprus (South) | 20               | 46.36       | 35.36       | 12.25       | 6.03         |

\* United Kingdom, \*\* United States of America

Table 3 gives ABO blood group distributions world-wide as well as in various countries.<sup>15,18-20</sup> Note that, when the results of our study are compared to the results world-wide, surprising similarity is remarkable.

In conclusion, ABO and Rh blood group distributions in Rize have shown significant differences in comparison to distribution results for the other regions of Turkey. These differences could be due to the fact that Rize is in a region that is prone to emigration rather than immigration. In fact, as future work, it would be very useful and complementary to conduct large scale studies for the entire Eastern Black Sea region.

We believe that our results would contribute to database construction on distribution of blood groups.

**Conflict of interest:** Authors declare no conflict of interest.

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