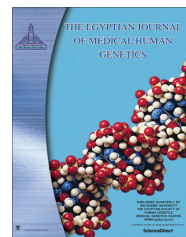




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ORIGINAL ARTICLE

# Distribution of ABO blood groups and rhesus factor in a Large Scale Study of different cities and ethnicities in Khuzestan province, Iran



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## KEYWORDS

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**Abstract** *Background:* The demand for blood and blood products has increased due to advances in medical science, population growth and increased life expectancy. This has increased the need for various blood groups in Khuzestan province because of the higher incidence of thalassemia and other blood transfusion dependent disorders in this province.

*Aim of the study:* Due to the presence of various ethnic groups in Khuzestan province, several types of blood components are required. Knowing the distribution of blood groups in different blood collection centers and tribes is vital for proper object oriented blood collection.

*Subjects and methods:* This was a descriptive cross-sectional study. The study population consisted of 29,922 donors visiting Ahvaz transfusion center, affiliated centers and mobile teams (except for teams established in garrisons) during three months in 2014. Forward and reverse blood grouping was conducted based on hemagglutination and hemolysis reactions. Data analysis was done by Chi-square test using SPSS software.

*Results:* The highest percentage of blood groups in Khuzestan province was related to blood group O (40.21%) with the highest prevalence in Izeh and the lowest in Shadegan. The second most prevalent group was A for which Ramhormoz and Bandar-e Emam Khomeini had the highest percentage, and AB blood group had the lowest percentage and was most frequent in Shadegan. Moreover, blood group B was the most prevalent after group O among different ethnicities except for Bakhtiari.

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**Conclusion:** Our study showed ethnicity-related prevalence. Overall, the blood group O had the highest prevalence and AB the lowest percentage among the ethnicities, indicating a significant difference with studies in other parts of the world.

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## 1. Introduction

The discovery of ABO system in 1900 by Karl Landsteiner is considered as the beginning of modern blood banking and transfusion medicine. Due to the presence of ABO antibodies in all individuals (even without any encounter with human red blood cells), correct grouping of donors and recipients for ABO blood group is the basis of safety in blood transfusion [1]. ABO antigens are largely present on the surface of red blood cells, lymphocytes, platelets, tissue cells, bone marrow and organs such as kidneys. Soluble ABO antigens are found in secretions and all body fluids except for CSF [2–6]. ABO antigens are primarily detected in the first 5–6 weeks of fetal life. The quantity of these antigens is different depending on the age and type of antigen [7,8]. The development of ABO antigens occurs slowly, so that the expression of evolved antigens reaches that of adult level within 2–4 years. The frequency of A and O phenotypes in white populations is 45% and 40%, respectively. Blood groups B and AB are in the next position with respective frequency of 11% and 4% [9]. It is worth noting that the frequency of ABO phenotypes is different in different races and populations.

In the studies conducted in USA, southwest Saudi Arabia, Kenya, Mauritania, Thailand, southwest Nigeria, Al-Azhar University in Gaza and Jordan, the O blood group was the most prevalent and AB the less prevalent blood group. In another study conducted in India, the B and AB blood groups had the highest and lowest frequency, respectively. In a study in Turkey, the A blood group was the most prevalent and AB the less prevalent blood group [10–18].

We got a precise estimation on frequency of each of the blood groups in various ethnic groups in Khuzestan province to save money and time to have ready access to the required blood groups. This study seemed to be necessary, since it was the first study of its kind in this province. Distribution of ABO blood groups and rhesus factor in a Large Scale Study of different cities and ethnicities in Khuzestan province was our aim of study.

## 2. Subjects and methods

### 2.1. Study type

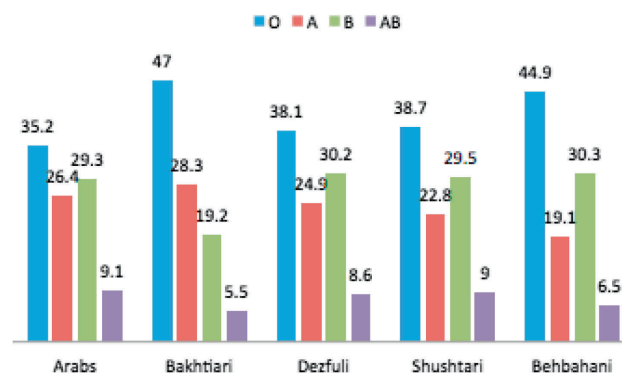
Our study was a descriptive cross-sectional one. The study population included the blood donors visiting Ahvaz transfusion center, affiliated centers in Abadan, Dezful, Behbahan, Masjede Soleyman, Izeh and Shooshtar as well as hospital centers of Ramhormoz, Susangard, Omideiyeh, Aghajari, Khoramshahr, Shadegan, Mahshahr, Bandar-e Emam Khomeyni and donors referring to mobile teams, except for teams established in garrisons. The ethnic group was asked in Ahvaz but not in other counties due to work limitations.

Nonrandom simple sampling method was used. The study was performed for 3 months during 2014 on all the donors. On donor forms, the donor ethnicity (race) was asked from every donor in addition to standard questions, and cellular and serum blood grouping was conducted on samples by hemagglutination and hemolysis reactions.

As the postal address was recorded on donor forms, data collection was done using interview and laboratory tests. The forms and laboratory test results were then analyzed using SPSS software.

## 3. Results

Our results showed that blood group O was the most frequent and the B blood group was the second most frequent blood group among all the ethnic groups in Khuzestan province except for Bakhtiari (Fig. 1). The Bakhtiari and Shushtari had the lowest (6.6%) and highest (10.2%) level of negative Rh antigen, respectively (Table 1).



**Figure 1** Prevalence of different blood groups in Ahvaz residents of county origin.

**Table 1** Percent prevalence of blood groups in donors residing in Ahvaz.

Ethnicity	Number	BG				Rh	
		O	A	B	AB	Pos	Neg
Arabs	5270	35.2	26.4	29.3	9.1	91.4	8.6
Bakhtiari	2687	47	28.3	19.2	5.5	93.4	6.6
Dezfuli*	514	38.1	24.9	30.2	8.6	91.1	9.9
Shushtari*	413	38.7	22.8	29.5	9	89.8	10.2
Behbahani*	89	44.9	19.1	30.3	6.5	92.1	7.9

*Abbreviations:* BG, blood group; Rh, rhesus; Pos, positive; Neg, negative.

\* Behbahani: Those claiming to be original Behbahan residents, Dezfuli: Those claiming to be original Dezful residents, Shushtari: Those claiming to be original Shushtar residents.

**Table 2** Percent prevalence of blood groups in different regions of Khuzestan province.

Region	NO	BG				Rh	
		O	A	B	AB	Pos	Neg
Khuzestan province (total)	29,922	40.21	28.48	24.71	6.6	92.38	7.62
Ramohormoz	129	43.7	31.5	19.6	5.2	93.8	6.2
Susangard	2489	35.2	26.7	31.5	6.7	92.7	7.2
Abadan	4084	40.5	27.2	24.6	7.7	92.9	7.1
Behbahan	4069	41.1	29.3	23.8	5.8	93.9	6.1
Dezful	1286	42.2	27.6	24.1	6.1	93.2	6.8
Masjed Soleyman	1497	48.6	27.7	19.3	4.4	93.9	6.1
Izeh	1146	49.1	26.3	21.1	3.5	91.5	8.5
Shushtar	207	42	29	24	5	94	6
Emam Khomeini port	363	37.7	31.5	23.2	7.6	95.2	4.8
Shush	330	36	27.3	27.3	9.4	87	13
Shadegan	392	32	29	28	11	92	8
Omidiyeh	650	38.8	28.8	26.3	6.1	90	10
Khoramshahr	1338	39.4	27.7	27	5.9	92.6	7.4
Mahshahr	11461	37.2	30.3	25.2	7.3	91.5	8.5
Ahvaz	NO	39.7	27.3	25.7	7.3	91.6	8.4

Abbreviations: BG; blood group, Rh; rhesus, Pos; positive, Neg; negative.

In all the centers, the highest prevalence of blood groups was related to O and the lowest prevalence to the AB blood group (Table 2).

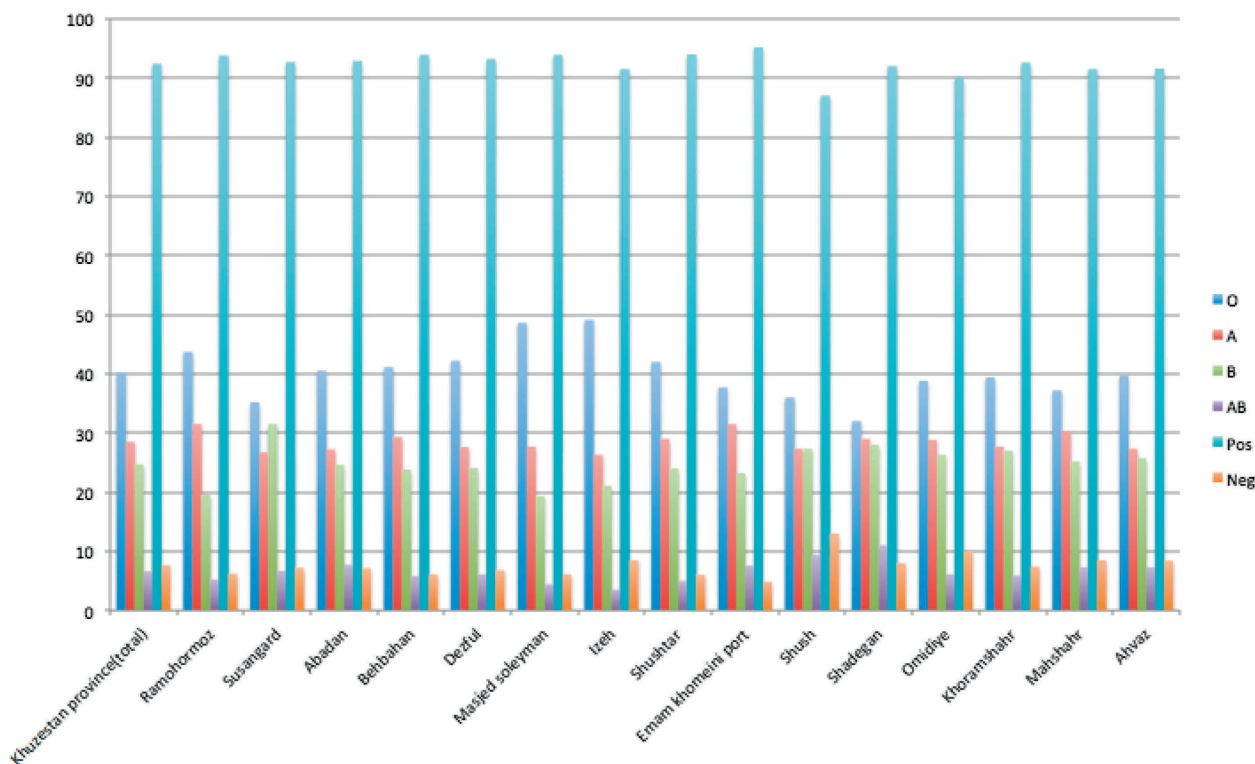
In all centers, the prevalence of blood group A was higher than B except for Susangard and Shush (Fig. 2).

In Susangard center, the frequency of B blood group was higher than A, and in Shush the frequency of these two blood groups was the same. A and B blood group prevalence showed the highest difference in Ramhormoz center and the lowest in Khoramshahr center (Fig. 2).

The prevalence of Rh-negative groups was the highest in Shush center and the lowest in Bandar-e Emam Khomeini center (Fig. 2).

#### 4. Discussion

Although transfusion therapy has saved millions of lives throughout the world, lack of blood supply in cases such as pregnancy, trauma and some other diseases poses risks for patients. In Khuzestan province, supply of required blood groups is of utmost importance due to location of the province on thalassemia and hemoglobinopathy zone, high frequency of road accidents as well as specialist and subspecialist surgeries. In this study, prevalence of different blood groups in Khuzestan province was assessed for three months during 2014. The results of evaluating 29,922 blood donors showed that the blood group O was the most frequent blood group (40.21%) with the highest percentage in Masjede Soleyman and the lowest in Shadegan. The second most prevalent group was A (28.48%), which was most frequent in Bandar-e Emam Khomeini and Ramhormoz and the least frequent in Izeh. Blood group AB had the lowest prevalence (6.6%), which was the most frequent blood group in Shadegan and the least frequent in Izeh. In addition, 92.38% of the donors in Khuzestan province were Rh positive and 7.62% were Rh negative,



**Figure 2** Prevalence of different blood groups in individuals of county origin in Khuzestan province.

**Table 3** ABO distribution among different world regions in comparison with our study.

		Saudi	Kenya	Indian	Punjab	Ghaza	Nairobi	Thai	Jordan
A	0.45	0.26	0.262	0.3269	0.21	0.393	0.23	0.305	0.3836
B	0.11	0.18	0.22	0.188	0.3616	0.213	0.27	0.205	0.1804
AB	0.04	0.27	0.034	0.527	0.09	0.065	0.04	0.085	0.0698
O	0.4	0.52	0.477	0.3875	0.3414	0.329	0.45	0.405	0.3662
References	Our study	[19]	[10]	[20]	[22]	[13]	[23]	[11]	[21]

with the majority of Rh-positive donors in Bandar-e Emam Khomeyni and their minority in Shush.

The difference in percentage of blood groups in ethnic Arabs of Khuzestan province was very low in Ahvaz and Susangard (which is an ethnic Arab town) probably due to proximity of the two cities, lack of active blood transfusion center in Shushtar as well as massive migration of Susangard people to Ahvaz. We can say that most Arab residents of Ahvaz are from Susangard. In contrast, the residents of Shadegan (an Arab town) rarely visit Ahvaz to donate blood because of distance, presence of a relatively active center and proximity with Abadan center. Therefore, the difference in percentage of blood groups in this city is higher than Susangard and Ahvaz.

The percentage of blood groups was very similar in Bakhtiari in Ahvaz, Izeh and Masjed Soleyman (two Bakhtiari cities of Khuzestan), which can be due to migration of Masjed Soleyman and Izeh people to Ahvaz, genetic relationship between Masjed Soleyman and Izeh people and low genetic mixing of them with other residents in Ahvaz. The difference in blood group percentage in Dezfuli, Behbahani and Shoosh-tari minority in Ahvaz and their own cities can be due to genetic mixing of these people.

There was not much difference between A and B blood groups between Khoramshahr and Abadan likely due to migration to these cities.

High percentage of Rh negative blood groups in Shush despite low number may be due to random sampling in this city.

In a comparison between the percentage of blood groups in ethnic Arabs of Ahvaz in Khuzestan province and the study of Bashwari et al. in Saudi Arabia, there was no close similarity between the results. Therefore, we can conclude that there is low genetic relationship between Arabs in Khuzestan province and those in Saudi Arabia [19]. Also, distribution of ABO blood group in Khuzestan based on Chi-square test ( $\chi^2$ ;  $df = 3$ ) was statically different ( $P < 0.05$ ) with some other countries that was compared (Table 3).

This was the first basic and applied research on blood groups in Khuzestan province and its results can be used for other studies and surveys.

Lack of a specific reliable system to detect various ethnic groups living in Khuzestan province was a limitation of our study.

## 5. Conclusion

Overall, our study indicated the ethnicity-related prevalence but O and AB blood groups had the highest and lowest prevalence in all the ethnic groups, respectively. Although our study was generally and apparently consistent with studies in other

regions except for Punjab, India, Gaza, Ankara and white population, it showed statistically significant correlation with other studies.

## Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this article.

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