

Study of the Prevalence of Blood Groups ABO, Rh and Kell in the Region of Méknes-Morocco: About 18168 Donations of Blood

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Abstract

Original Research Article

Introduction: The ABO, Rhesus and Kell systems are the most immunogenic systems in blood transfusion. Today, there are more than 29 blood group systems in humans, which confirm human polymorphism. The objective of our work is to present the phenotypic prevalence of ABO, Rhesus and Kell systems at the HMMI of Meknes, using a sample of blood donors composed of healthy soldiers; and also to allow a better estimation of the frequencies of the antigens (C, c, E and e). **Materials and methods:** This is a retrospective study spread over 9 years (2010-2018), involving 18,168, active and healthy, and military volunteer blood donors. The data was collected and used from the records of the transfusion service of the Moulay Ismail Military Hospital in Meknes (HMIM). Samples are taken at military establishments. The ABO, Rhesus and Kell grouping is performed by agglutination tests using Bio-rad® reagents on plate and gel cards. **Results:** 96% of blood donors are male, aged between 18 and 54 years old. The calculation of phenotypic prevalence for the ABO system showed that group O is present in almost half of the people (48.50%), followed in descending order by group A (34.08%), group B (14.18%), then the AB group (3.24%). With regard to the Rh system, the positive RH phenotype is predominant with 90.04%. For the extended RH system antigens, the results are as follows: C (67.30%), c (83.15%), E (21.29%) and e (92.44%). The prevalence of the K positive phenotype is 9.15%. **Discussion and conclusion:** The analysis of these results in relation to the review of the national and international literature shows that Morocco is in an intermediate position between the countries of the European and African continents.

Key words: Blood donation; erythrocyte groups; ABO, RH and KELL systems.

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INTRODUCTION

Karl Landsteiner was the first to discover the blood group system ABO which allows classifying the blood groups, then comes the rhesus system, which is a very polymorphic system and that includes a large number of antigens, the most important of which are D, C, c, E and e. The third system, the Kell system discovered in 1946, has 2 main antigens: K (Kell) and k (Kell or Cellano).

The aim of our work is to evaluate the phenotypic prevalence of the ABO, Rhesus and Kell blood groups, in a population of 18,168 military volunteers of blood donors, at the HMMI of Meknes; as well as to compare our results with previous studies made in Morocco and foreign countries.

MATERIALS AND METHODS

This is a retrospective study spread over nine years (2010-2018) and involving 18,168 blood donors, military volunteers in good health. The data was collected and exploited from the records of the transfusion service of the Moulay Ismail Military Hospital in Meknes. The ABO, Rhesus and Kell grouping is performed by agglutination tests according to the two complementary tests: Beth Vincent and Simonin.

The samples are taken at military establishments after an interview and a compulsory medical examination to exclude people who are not eligible for donation. This phase is important for transfusion safety.

The samples are stored at +4°C in 5 ml EDTA tubes under vacuum with removal of tubes showing

signs of hemolysis; and blood grouping is carried out at the latest within 24 hours after collection.

The ABO Rhesus and Kellest grouping was carried out by agglutination tests according to the two complementary tests Beth Vincent and Simonin, by two manipulators: the first performs the tests on plate using the Bio-rad® reagents and the second one on the gel cards.

Phenotypic frequencies are calculated using Excel 2007 software and gene frequencies according to the Bernstein formula for the ABO system; and the Landsteiner and Wiener method for the Rhesus and Kell systems.

RESULTS

The age group was 18 to 54 years old with a male predominance (96% male). The average of blood donations collected was 162 per month.

The phenotypic prevalence of the ABO system are presented in the following descending order: O group (48.5%), followed by a group (34.08%), B group (14.18%) and finally AB group (3.24%) (Figure1).

For the Rh system, we note that the positive RH phenotype is predominant with 90.04% (Figure 2). The prevalence of antigens in the extended Rh system are as follows: positive antigens C (67.30%), c (83.15%), E (21.29%) and e (92.44%). Finally, the prevalence of the positive K phenotype is only 09.15% (Figure 3).

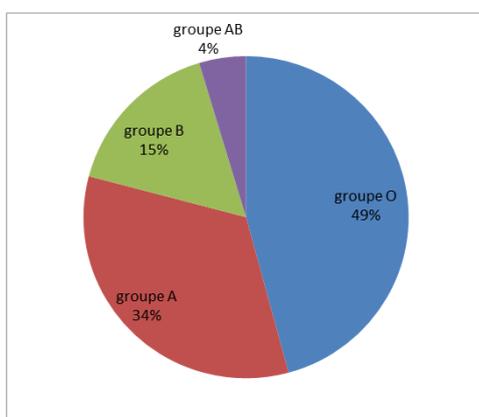


Fig-1: The phenotypic prevalence of the ABO system in our study

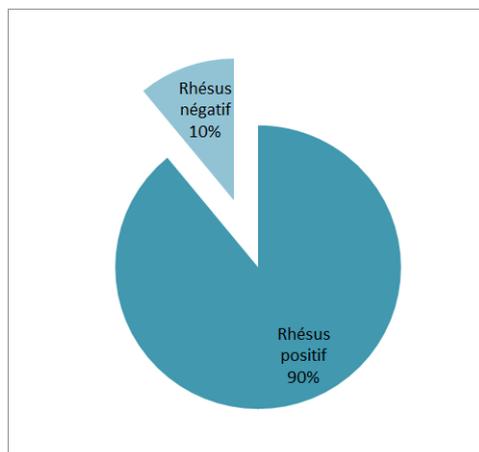


Fig-2: The prevalence of the Rhesus D phenotype in our study

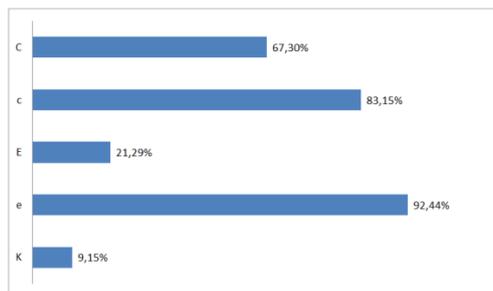


Fig-3: The phenotypic prevalence of the Rhesus-Kell system in our study

DISCUSSION

The erythrocyte blood groups are a set of genetically determined antigens, independent from each other and expressed on the surface of red blood cells [8].

Today, there are more than 29 blood group systems in humans, which confirm the human polymorphism [1]. Studies of ABO, Rhesus and Kell systems are of great interest, especially in blood transfusion and organ transplantation.

The prevalence of ABO-Rhesus and Kell blood groups differs from one population to another [7].

Table-1: Comparison of the prevalence of ABO groups in our study with previous Moroccan studies [2, 12, 10]

Year of study	Group O	Group A	Group B	Group AB
Our study (2019)	48,50%	34,08%	14,18%	3,24%
2018 [2]	52%	29,69%	14,85%	3,46%
2011 [12]	47,13%	32,20%	15,79%	4,70%
2002 [10]	47,41%	31,67%	15,64%	5,35%

We note that the blood groups of the ABO system predominate in the following descending order:

Our work was performed in the transfusion service of the Military Hospital of Meknes, where we compared the results of the phenotypic prevalence of the ABO systems of our donors to previous Moroccan and international studies.

Indeed, several Moroccan studies published between 2002 and 2018 concerning the different representative regions of the Kingdom show the following average phenotypic frequencies: O between 47% and 52%; A between 29% and 32%; B between 14% and 16%; and AB between 3% and 5%. Our results confirm these previously found frequencies (Table 1).

O, A, B, and AB. Concerning the international studies, the results are close to ours (Table 2).

Table-2: Comparison of the prevalence of ABO groups in our study with international studies

Country	O (%)	A (%)	B (%)	AB (%)
Greece [5]	38,77	39,95	16,03	5,25
South-West Germany [13]	41,21	43,26	10,71	4,82
Algeria [9]	44,04	39,29	12,83	3,89
Tunisia [9]	46,7	30,80	18	4,5
Our study	48,50	34,08	14,18	3,08
Guinea [6]	48,88	22,54	23,86	4,72
Cameroun [11]	51,3	24,2	18,8	5,7
Congo [3]	52,31	23,18	21,05	3,50
Mauritania [4]	49,10	28,28	18,56	4,05

In Fact, in 2007, an Algerian study found a predominance of group O (44.04%) followed by group A (39.29%), then group B (12.83%) and finally the AB group with 3.84% in a sample of 2,759 donors, which is congruent with the results of our study; Similarly for a Tunisian study dating from 2003 that treated a sample of 63,375 people, the prevalence of group O was predominant (46.7%), followed by group A (30.8%) then B (18%), group AB being the minority (4.5%) [9].

With regard to sub-Saharan Africa, a Congolese study found a 21% prevalence of group B, slightly higher than the one found in our work; otherwise the results are very close [3]. Group A is dominant in European countries, unlike our studied population where group O predominates [12, 13].

Table-3: Comparison of the frequencies of the antigen D of our study with those of the other countries [10, 2]

Country	Rh positive (%)
Our study	90.04
Algeria	91.53
Tunisia	90.81
Germany	82.71
Canada	85.00
Turkey	89.61
South Italy	82.71
India	94.53
Bangladesh	97.44

These results made it possible to situate the Moroccan population in an intermediate position between that of sub-Saharan Africa and of Europe.

Concerning the standard Rhesus system D, we notice that in our study and in Moroccans in general a clear predominance of the antigen D (90.04%) compared to the phenotype d (9.96%). In general, it is the positive Rhesus phenotype that predominate worldwide (Table 3).

However, we notice a clear difference between our study and that of Asian countries whose frequency is high compared to ours. However, the prevalence of positive RH phenotype is reduced in Europe. (Table 3)

Regarding the association of RH phenotyping with the ABO system, we notice the predominance of the O Rh+ phenotype with 7,125 people, then A Rh+ with 5,445 subjects, then in descending order: B Rh+ with 2,669 subjects, O Rh- with 1095 subjects, AB Rh+ with 922 people, A Rh- with 528 subjects, 302 subjects for the B Rh- phenotype and 82 subjects for the AB Rh- phenotype.

The frequency of the positive RH phenotype is similar to that of the Maghreb countries, and close to that of sub-Saharan Africa [9].

The prevalence of the antigens of the extended Rh system C, c, E and e in our study, show that the "c" antigen (83.15%) is more frequent than the "C" antigen (67.30%), and that the "e" antigen is present at (92.44%) relative to the "E" antigen (21.29%).

The results thus confirm the predominance of the Cc Dee haplotype with a percentage twice as high as the one found in Europe, the other phenotypes being a minority [12].

For the Kell system, the results indicate that the prevalence of the K antigen is low (09.15%). Our results are comparable to other previous Moroccan studies. Table 4 shows that our values are higher than the values of Bangladesh and lower than the Syrian values.

Table-4: Comparison of the frequency of the K antigen in our study with that of other countries [2]

Country	Prevalence of the antigen K (%)
Our study	9.15
France	9.00
Norway	8.28
Syria	17.80

CONCLUSION

The erythrocyte antigens of the ABO, Rhesus and Kell systems have a great interest in the prevention of transfusional accidents, hence the interest of our work, despite the extreme polymorphism of blood group systems.

The data of our study are in perfect agreement with previous Moroccan studies, noting the predominance of the O group and the Rh positive phenotype.

The CcDeeK phenotype is the most common. These results are identical to those found in the Mediterranean countries and show that Morocco is in an intermediate position between the countries of Europe and those of sub-Saharan Africa.

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