

# Prevalence of Blood Groups at the Blood Transfusion Center at the Military Hospital Avicenna of Marrakech

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**Abstract:** The ABO and RHD systems represent the most immunogenic systems and the most sought after in blood transfusion. The objective of this work was to present new statistics of phenotypic prevalence of ABO and RHD systems in Morocco using a new sample. Our study was a retrospective, descriptive and epidemiological one carried out at the Blood Transfusion Center at the Avicenne Military Hospital in Marrakech on a sample of 10,000 donors collected between the year 2009 and the year 2017. The study of the expression Erythrocyte blood group antigens by the serological phenotyping technique was based on haemagglutination. Double determination was necessary to avoid the risk of grouping errors. This technique was simple and inexpensive, and today remains a gold standard for immunohematology. At the end of this study, the frequency of the antigens of the red blood cell systems ABO and RHD was as follows: ABO system: A (32.7%), B (16.33%), AB (5.26%), O (45.71%). RHD system: RHD positive (92.29%), RHD negative (7.71%). Our results were compared to other previous Moroccan and other foreign countries studies; this allowed us to locate hemotypologically the transfusion center of the Avicenne military hospital of Marrakech in the world. At the end of this study, we have concluded that our results were consistent with previous studies in Morocco. These results were identical to those found in the Mediterranean countries and showed that Morocco was in an intermediate position between the countries of Europe and those of Black Africa.

**Keywords:** Prevalence, Blood Transfusion, ABO, RHD

## 1. Introduction

A blood group is a set of elements that makes it possible to characterize a human being, to individualize him/her or to group him/her within a population according to common characteristics. A blood group is defined as a set of allotypic, genetically induced, determined, and independent antigens expressed on the surface of one or more types of blood elements. Currently there are more than 700 antigens and several blood group systems evaluated at about 339 and distributed in 36 systems including ABO and RH which are erythrocyte systems that are the subject of our study [1]. Knowledge of the molecular basis of polymorphism erythrocyte blood groups have led to new developments in

immuno-hematology.

The identification of the blood group ABO was a major step in the control of transfusion therapy. The ABO blood group system is the main type of blood groups classified into four phenotypes (A, B, O and AB) depending on the presence or absence of specific antigens and antibodies on the red cell membrane or in the plasma [2]. The RH system is the second system of erythrocyte blood groups encountered in the human species. There are several protein antigens in this system, the main one is the D antigen, which is incriminated in immune reactions [3].

The objective of our study was to draw up the phenotypic

profile of blood groups ABO and RHD within a representative military population of the city of Marrakech and its regions recruited over a period of 8 years for whom a biological qualification (among others immunological) was performed according to the standards of transfusion safety in force in our country.

## 2. Patients and Methods

### 2.1. Population

Our Study targeted a military population of Marrakech and its regions (Bengrir, Kasbah Tadla, Ouarzazate...), whose ages range between 18 and 55 years. They were collected according to scheduled collections for intra-hospital internal use (2 to 3 collections per month), which was equivalent to 120-150 donors per month.

The study took 8 years, from October 2009 to October 2017.

### 2.2. Methodologies

The samples were taken at our blood transfusion center at the HMA in Marrakech after a rigorous interrogation eliminating the counter indications of blood donation. The search for antigens on the red cell surface by the Beth-Vincent test and natural antibodies at the plasma level, respectively, by the Simonin-Michon test, both techniques were carried out by two different technicians and were validated by witnesses. To establish an ABO blood group, both tests were mandatory and had to be concordant. The Rh system (or RHD) determines, according to the presence or absence of the D antigen on the red blood cells. It consists of looking for the Ag D (RH1) by direct agglutination technique between the D antigen focused on the red blood cells to be tested and the anti-D test serum.

## 3. Results

### 3.1. Prevalence of the ABO System

In our study blood group O held most of the phenotypes of the entire population studied (almost half) with a prevalence of 45.71% (4571 donors). The second position was occupied by the blood group with a prevalence of 32.7% (3270 donors). 1633 donors were phenotype B or 16.33%. The latter came in 3rd position. And the AB group was the least expressed phenotype in our series with a prevalence of 5.26% (526 donors).

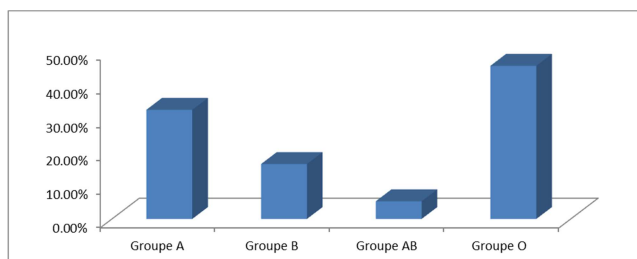


Figure 1. Prevalence of ABO blood groups in our study population.

### 3.2. Prevalence of the RHD System

In our series, RHD positive subjects were predominant with a percentage of 92.29%, while RHD negative subjects were only 771 (7.71%) of the study population.

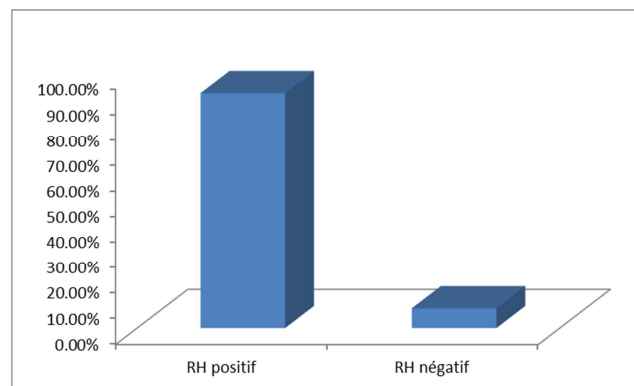


Figure 2. Prevalence of D antigen in our study population.

### 3.3. Prevalence of the RHD System Combined with the ABO System

Blood group O RH + was the dominant group with a phenotypic frequency of 42.15% (4215 donors), followed by the blood group A RH + In our series, 3 000 donors (30%), the phenotype B RHD + took the 3rd position with 1543 donors either (15.43%) after blood group O and A, 471 donors were of the AB RHD + phenotype either (4.71%). Concerning the negative RHD system combined with the ABO system, our series showed that among the 10,000 donors 357 were of the phenotype O RH- with a prevalence of 3,57%, 270 donors were of the group A RH- is (2,70%) of the study population, followed by the blood group B RH- was found in 90 donors or (0.9%), and lastly our survey had shown that just 54 donors were from group AB RH- with a prevalence of 0, 54%.

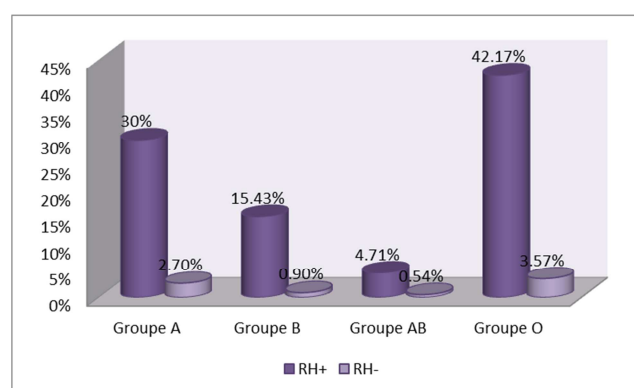


Figure 3. Prevalence of the RHD phenotype associated with the ABO system.

## 4. Discussion

The two groups O and A had the highest prevalences while the AB group was present with a lower prevalence.

At national scale, concerning the blood group O in our

series the prevalence was 45.71%, a value close to that found in the study conducted by Khaloufi [4] in Meknes in 2016, Eddoum. K [5] made in Rabat, and that of Benhadi [6] with 219,287 donors from different regions of Morocco. Higher than that found in Erfoud during the Mechali. D investigation [7], but this survey had weak sample. The prevalence of the lowest blood group A was found in the Mechali. D study [7] in the Tinghir region 25%. The study by Bennaka. L [6] showed a prevalence of 33.89%, a value higher than that found in our study 32.7%. In the El Akermi. I series [8], 32.69% of the donors were blood group A, a value very similar to that found in our study. The study of Khaloufi [4], and that of Eddoum [5] found successively 15.92% and 16.25% of donors of the blood group B, value close to that found in our study (16.33%).

Our study confirmed the results of those carried out previously at the level of the various Moroccan hospitals by demonstrating almost the same phenotypic frequencies A, B, AB and O within the population coming from the different

regions of Morocco. At the end of our study we concluded that the groups of the ABO system predominated in descending order of group O, group A, group B and group AB.

At the international scale, the prevalences found in our study were similar to those of the Mediterranean rim showed the study done by Said et al [9] in Tunisia and Bennaka. I [10] in southern Italy, for the blood group O the prevalence was lower than that of sub-Saharan Africa [11] and higher than that recorded in Europe as evidenced by the German [12] and French [13] study; in contrast to the blood group A, European studies showed higher values; 44.4%, 43.26% and 40.82% [12-14] (Table 1).

Compared with Asian countries (northern India), Morocco showed higher frequencies, especially blood groups A and O (Table 1).

We concluded that the prevalence of ABO phenotypes in Morocco was intermediate between that of sub-Saharan Africa and that of Europe.

**Table 1.** Prevalence of ABO phenotypes at the international level.

| authors           | countries      | O%    | A%    | B%    | AB%   |
|-------------------|----------------|-------|-------|-------|-------|
| Deba. T [15]      | Algeria        | 50.4  | 29.3  | 13.2  | 6.9   |
| Said et al [9]    | Tunisia        | 46.18 | 30.94 | 17.83 | 5.00  |
| Bukasa et al [11] | Congo          | 60.50 | 21.60 | 15.40 | 2.50  |
| DULAT et al [16]  | Ivory Coast    | 48.10 | 23.7  | 23.6  | 4.6   |
| Alia et al [11]   | Iraq           | 49.90 | 28.7  | 13.8  | 7.6   |
| Parul et al [18]  | North India    | 28.7  | 28.7  | 32.07 | 10.53 |
| Adrián et al [19] | Mexico         | 61.82 | 27.44 | 8.93  | 1.81  |
| Henri et al [14]  | France         | 42.5  | 44.4  | 9.2   | 3.7   |
| Willy. A [13]     | Germany        | 41.21 | 43.26 | 10.71 | 4.82  |
| Tlamçani. Z [20]  | Australia      | 49.00 | 38.00 | 10.00 | 3.00  |
| Irem et al [12]   | Turkey         | 34.72 | 40.82 | 17.98 | 6.48  |
| Bennaka. L [10]   | Thailand       | 42.60 | 20.20 | 30.80 | 6.40  |
| Loua et al [21]   | Guinea         | 48.88 | 22.54 | 23.86 | 4.72  |
| Traoré. O [22]    | Mali           | 45.7  | 24    | 24.5  | 5.8   |
| Ivanov et al [23] | Ukraine        | 34.04 | 37.7  | 19.3  | 8.96  |
| Lemu et al [24]   | Ethiopia       | 41.20 | 34.96 | 20.48 | 3.34  |
| Bennaka. I [10]   | Southern Italy | 49.97 | 33.65 | 15.27 | 4     |
| Our study         | Morocco        | 45.71 | 32.7  | 16.33 | 5.26  |

In our study, Rh positive subjects were predominant with a prevalence of 92.29%, while Rh negative subjects were only 7.71% of the study population.

Our results were superimposable on the results of previous studies in Morocco where the D antigen predominated [6, 20, 25].

On the international level our study shows that the prevalence of D antigen (92.29%) was comparable to that revealed by the Dembele study. AS [26] (92.80%) in Mali and close to that found by Deba. T [27] in Algeria. In the countries of Asia, two studies had shown a higher prevalence of Ag D than that of our study. The first study was conducted by Liu. J [28] in China, of which 99.71% had the D antigen. The second study was done in Bangladesh by Talukder. S [29] and revealed a prevalence of 97.4%. In Europe (Germany [13]), as well as in North America (Canada [20]), the frequency of the RH- phenotype was respectively 17.3% and 15%. These values were higher than that found in Morocco (7.71%). In these parts of the world, there was a greater number of universal RH donors.

## 5. Conclusion

The phenotypic frequency of blood groups ABO and RHD is not the same in the world; there are variations between countries, as well as between continents. This pushes each country to carry out regular studies in order to know the phenotypic profile of the country and situate it in the world.

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