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Research Article

PHENOTYPE FREQUENCIES OF RH AND KELL BLOOD GROUP SYSTEMS IN BLOOD TRANSFUSION DEPARTMENT OF AVICENNA MILITARY HOSPITAL, MARRAKECH, MOROCCO

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ABSTRACT

Introduction

The purpose of our study is presenting new national statistics of phenotypic prevalence Rhesus systems (Rh) and Kell using a new sample of blood donors.

Materials and Methods

This study was conducted in the blood transfusion department of the Avicenna military hospital of Marrakech on a sample of 1286 donors collected between 01/01/2015 and 31/12/2015. This is a military population dominated by men (99%), and composed of young people aged from 18 to 45 years. The samples have been collected in EDTA tubes. The tests were performed on gel-card or on opaline plate at the laboratory temperature. Reagents used are monoclonal antibodies from Society Bio-Rad.

Results

Our results shows a clear predominance of the Rh1 (D) positive (89.81%) compared to Rh-1 (d) negative (10.19%).

CcDee was the most common phenotype (38.95%) followed by ccDee (18.91%) CCDee, ccDEe, ccdee and CcDEe. The ccDEE, CCDEe and ccdEe phenotypes are the minority phenotypes.

For the Kell system, the predominance of Kell-1 subjects was clearly observed at a frequency of 93%.

The Rh D allele was the most prevalent (68.08%) among RH blood type alleles while and the Kell-1 (96.44%) was the frequent among the alleles of Kell blood group system.

Discussion and Conclusion

our results compared to previous national and international studies show that Morocco is in an intermediate situation among the Caucasoid and negroids populations.

KEY WORDS: Phenotype, Rhesus typing, Kell system, Blood Donors, Morocco.

INTRODUCTION

Blood groups systems can be defined as the set of allotypic variations genetically transmitted, detected by antibodies on the surface of on the red blood cell membrane.

The development of the antiglobulin test for the detection of non-agglutinating antibody will lead to the discovery a lot of blood group antigens. The study of these systems for the blood transfusion needs, demonstrates the existence of genetic variation among human populations.

Guidelines for transfusion compatibility and immuno-hematological follow-up during pregnancy are also based on the analysis of these antigens and antibodies. The distribution of the alleles in the world has been studied extensively. The study of these systems demonstrates that the existence of genetic variation among human populations is associated with the evolution of the genetic structure of human populations and natural selection [1;2].

The aim of our study is to present new national statistics of phenotypic prevalence Rhesus (Rh) and Kell blood group systems using a new sample.

Our results were compared with those of previous Moroccan studies and those of other countries.

MATERIALS AND METHODS

This study was performed in the in the blood transfusion department of the Avicenna Military Hospital in Marrakech on samples of 1286 donors collected during 2015.

In our series, blood donors were mostly young with the average age of 30 ranging from 18 years to 45 years. The donors were divided into four age groups; the majority of donors were aged between 20 and 29 years (51.7%, n=665), followed by those aged from 30 to 39 years (35.8%, n=460), those older than 40 (12%, n=154) and those aged less than 20 years (0, 5 %; n=7).The population studied includes both sexes with male predominance (99%).

Samples were collected performed on EDTA tube and were stored at 4 ° C and tested at the latest within 24 hours after collection.

The standard Rh typing was performed on gel-card and plate to the laboratory temperature 22 ° C. The reagents used (Anti-D) was the IgM monoclonal antibody of the Bio-Rad Company (Picture 1 and 2).

Rhesus (CcEe) and Kell phenotyping was performed on gel-card and on opaline plate at the laboratory temperature 22 ° C. The reagents used were Anti-C, anti-c, anti-E, anti-e and anti-K monoclonal antibodies of the Bio-Rad Company: (Picture 3 et 4).

The gene frequencsies were calculated using statistical method of Landsteiner and Wiener [3]:

d = (Rh) 1/2

D = 1 - (Rh) 1/2

With

d = frequency of the allele corresponding to Rh negative

D = frequency of allele corresponding to Rh positive

Rh = the frequency of Rh-negative phenotype

RESULTS

Phenotypic Frequencies (Table I)

1. Antigens D

We see a predominance of Rh positive (89.81%) compared to Rh negative subjects (10.19%) in our population (Figure 1).

2. Rh Phenotype

The results in the figure2 showed the predominance of the CcDee phenotype (38.95%), followed by CcDee (18.91%),CcDee, CcDee, CcDee, and CcDee. The CcDee , CcDee and CcDee phenotypes were the minority phenotypes

The frequencies of the C, c, E, e antigens are shown in the figure 3 which showed a predominance of the "e» antigen (99.14%) followed by the "c" Antigen (85.07%).

3. Kell system

The results in Figure 4 show the low prevalence of Kell positive subjects (7%) and the predominance of Kell negative donors among Moroccans.

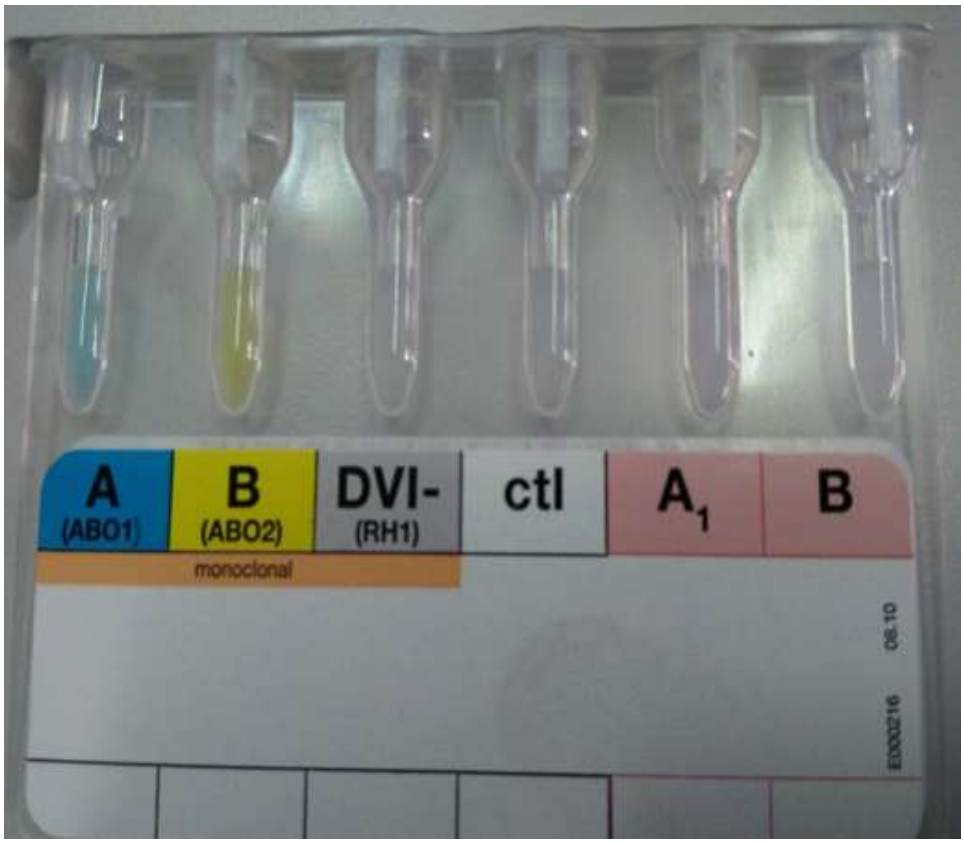
The D gene is dominant; its frequency is 68.08%.

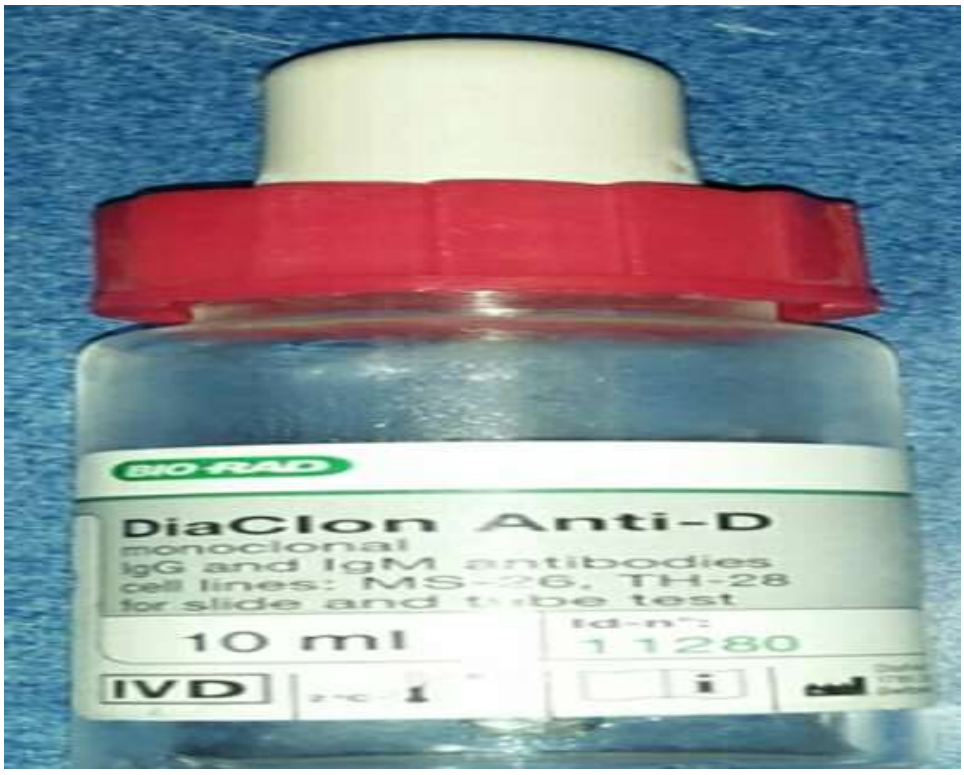
2. System Kell

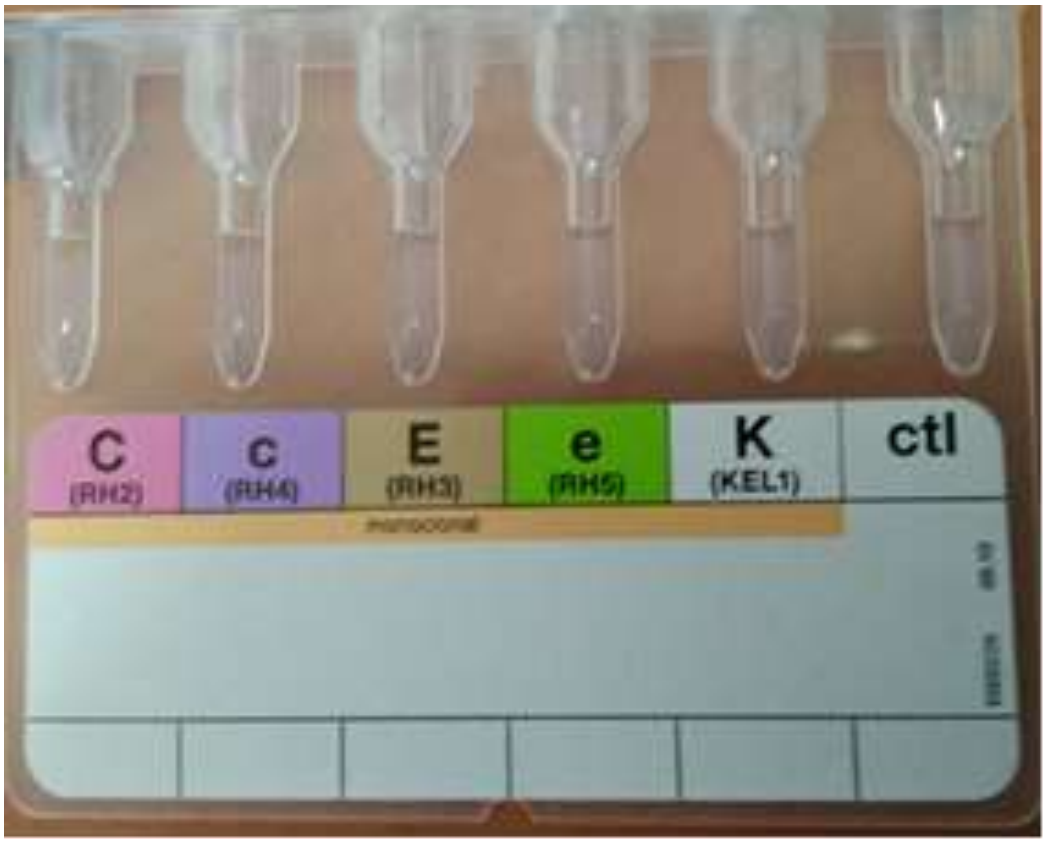
Allelic frequencies of the Kell system were derived from the formula of Landsteiner and Wiener. The fig6 showed the minority of K allele (3.56%).

Genotypic frequencies

1. Allele D






C
(RH2)
c
(RH4)
E
(RH3)
e
(RH5)
K
(KEL1)
ctl


Anti-C
10600
Anti-c
10610
DiaClon Anti-E
10 ml
10620
DiaClon Anti-e
10 ml
10630
DiaClon Anti-K
10 ml
IVD

Table 1: Results of Rh and Kell phenotype

Phenotype	Number	Phenotype (%)	Genotype (5%)
D (Rh1)	1155	89,81%	68,08
d (Rh-1)	131	10,19%	31,92
C	806	69,67%	-
c	1094	85,07%	-
E	221	17,18%	-
e	1275	99,14%	-
CcDee	501	38,95%	-
ccDee	243	18,91%	-
CCDee	191	14,85%	-
ccDEe	115	8,94%	-
ccdee	110	8,55%	-
CcDEe	93	7,23%	-
Ccdee	20	1,56%	-
ccDEE	11	0,85%	-
ccdEe	1	0,08%	-
CCDEe	1	0,08%	-
KELL1	90	7,00%	3,56
KELL-1	1196	93,00%	96,44

Figure 1: the frequency of Rh phenotype (D) in our study

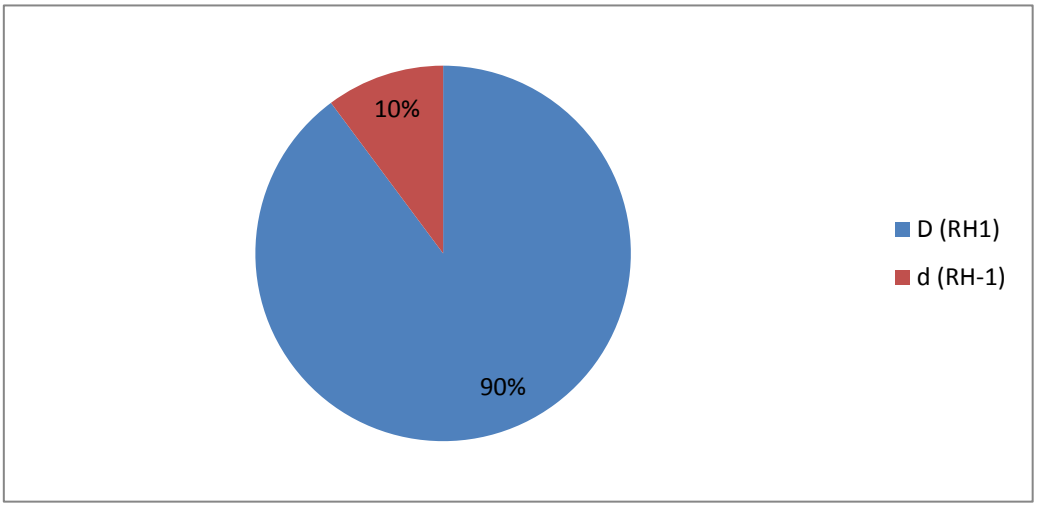


Figure 2: the distribution of different Rh phenotypes in the population studied

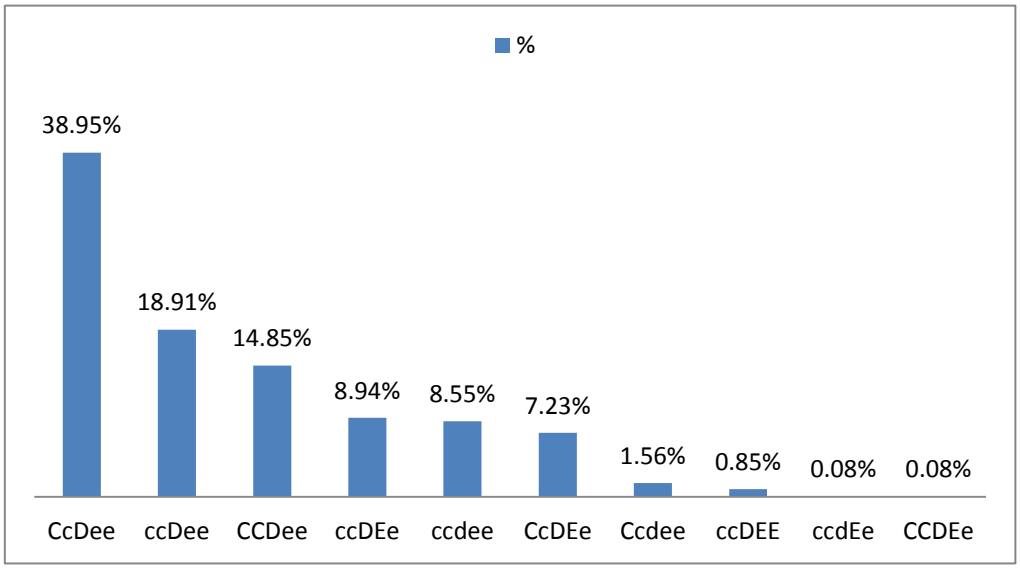


Figure 3: "C", "c", "E" and "e" Phenotypes in the population studied

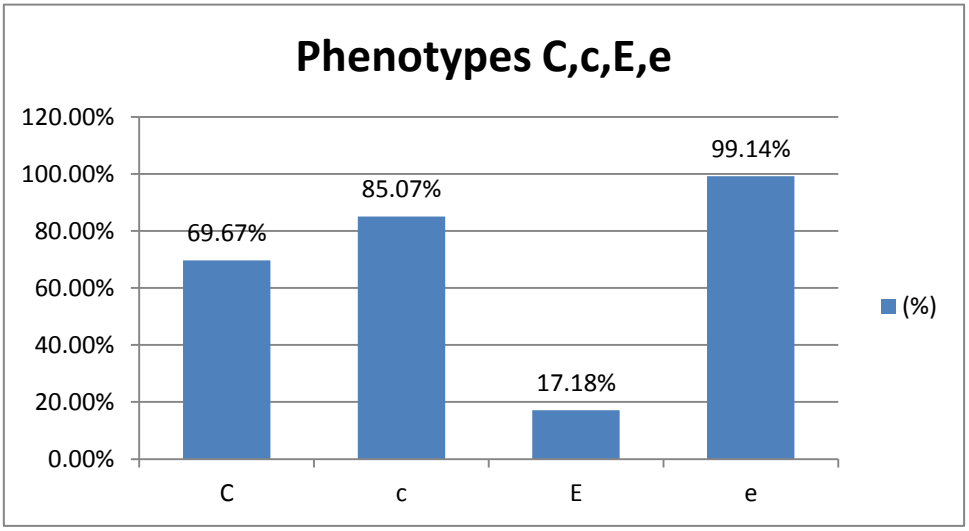


Figure 4: Kell phenotypes frequency in the population studied

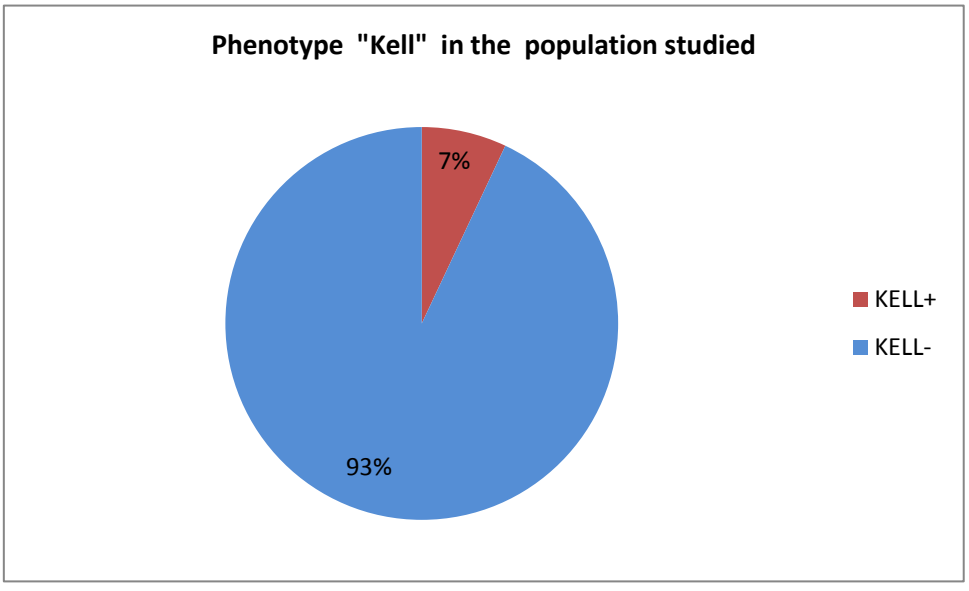


Figure 5: Prevalence of "D" and "d" alleles in the population studied

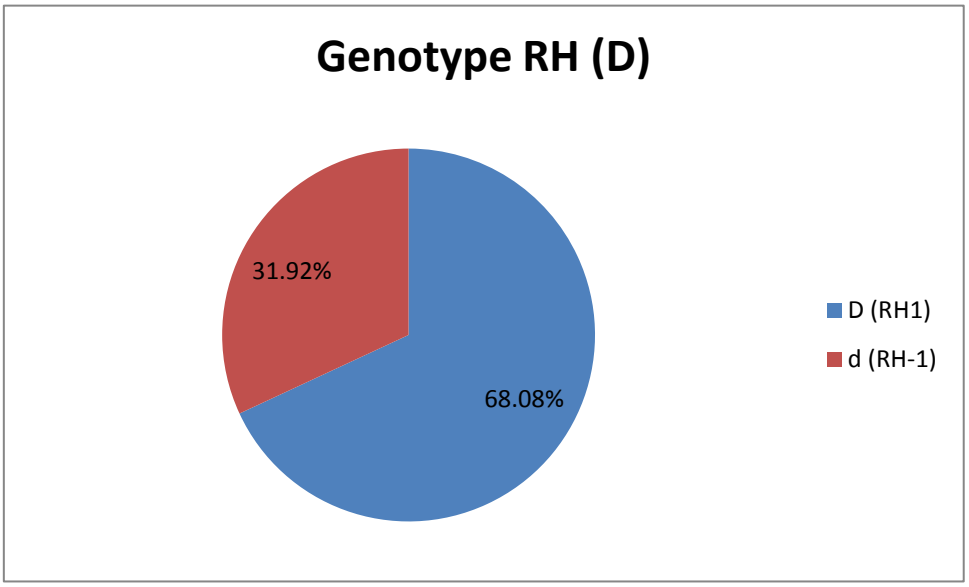


Figure 6: Prevalence of the «Kell" alleles in the population studied

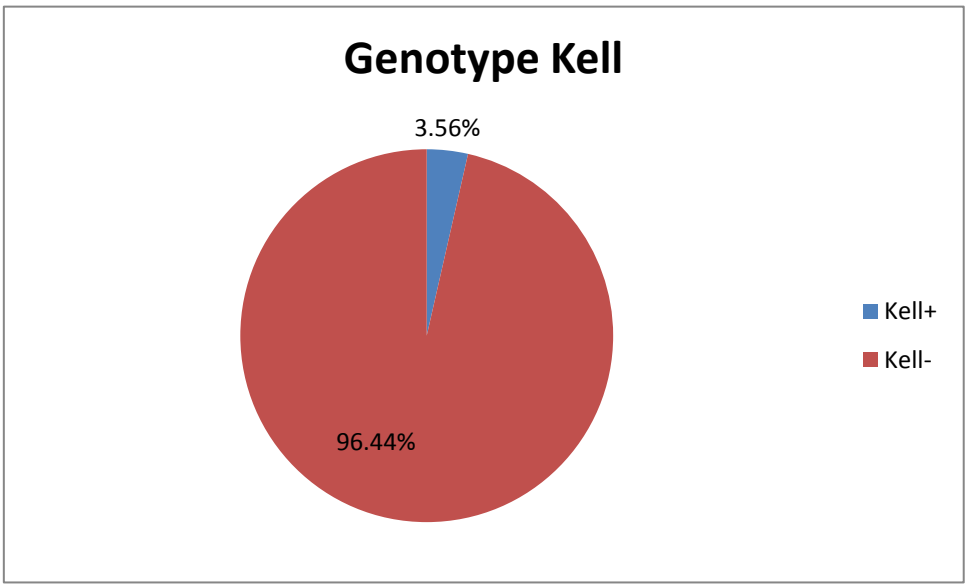


Table 2: Rh phenotype prevalence in the population studied compared to the other countries.

	D (RH1)	d (RH-1)	C	c	E	e
our study	89,81%	10,19%	69,67%	85,07%	17,18%	99,14%
Morocco 2002[3]	91%	9%	62%	84,53%	18%	82%
Morocco 2016[4]	90,50%	9,50%	-	-	-	-
Algeria[5]	91,53	8,47	-	-	-	-
Mauritania [6]	94,23%	5,77%	-	-	-	-
Ivory Coast[7]	92,93%	7,70%	21,97%	99,85%	13,82%	99,85%
Cameroon [8]	95%	6%	95%	97,50%	92,50%	95,00%

African [9]	92%	8%	27%	96%	22%	98%
Iran [10]	90,20%	9,80%	75,90%	97,90%	29,50%	75,90%
Pakistan [11]	97%	3%	87%	57%	19%	99%
Asian [9]	99%	1%	93%	47%	39%	96%
Caucasian [9]	85%	15%	68%	80%	29%	98%

Table 3: Comparison of the frequency of the system "Rh" in the population studied with other studies.

	our study	**Morocco 2016[4]**	**Morocco 2002[3]**	**France[12]**	**Germany [13]**	**Pakistan [11]**
CcDee	38,95%	38,85%	39,11%	36,6%	42,86%	34%
ccDee	18,91%	19,66%	19,12%	2,4%	2,01%	3%
CCDee	14,85%	15,90%	14,96%	20%	23,67%	41%
ccDEe	8,94%	7,48%	9,12%	12,6%	15,81%	8%
ccdee	8,55%	8,77%	8,64%	15%	13,62%	1%
CcDEe	7,23%	7,32%	7,29%	12,2%	15,17%	10%
Ccdee	1,56%	0,60%	0,72%	-	0,83%	-
ccDEE	0,85%	1,05%	0,53%	-	2,45%	1%
ccdEe	0,08%	0,18%	-	-	0,43%	-
CCDEe	0,08%	0,16%	-	0%	0,18%	-
ccdEE	0,00%	0,01%	-	-	-	-

Table 4: Comparison of the prevalence of the Kell phenotype in the population studied with other countries

	KELL1
our study	7%
Morocco 2002[3]	7,38%
Ivory Coast [7]	0,77%
France [12]	9%
Pakistan [11]	0%
India [14]	5,56%
Iran [10]	8%

DISCUSSION

Rh System

The discovery of the Rh system was the result of monitoring a woman who gave birth to a child with neonatal hemolytic disease by Levine and Stetson in 1939.

The Rhesus system is a complex system with multiple antigens (50 antigens) worn only by red blood cells, polymorph, and play major role in blood transfusion. On the red cells of Rh positive subjects is located an D antigen or RH1 which is not present in Rh negative subjects or Rh-1.

On red blood cells also are found:

C Antigen or Rh 2, and /or c antigen or Rh 4;

E Antigen or Rh3 and/or e antigen or RH5.

These antigens are transmitted genetically or haplotypes into blocks. The three most haplotypes are DCe, DCE and dce. The C and c antigens on the one hand and, E and e antigens on the other hand are antithetical. This means that if one is absent the other is necessarily present. The presence or absence of these four antigens was analyzed in the context of Rh-KEL1 phenotypig which further comprises the search for KEL1 antigen of KELL system [1][2].

Table II demonstrates that the frequency of the D antigen, of our study was comparable to that of the Maghreb countries (Algeria), closer to that of Sub-Saharan Africa and higher than that of the countries of the Western Europe. In the Asian countries, the prevalence of the D antigen is greater than that of Morocco. Morocco is nearer to the black race than white race concerning D antigen. e antigen or RH5 is the most common in the countries followed by c antigen or Rh3, C antigen or Rh2 and E antigen or Rh4.

The most common phenotype among Moroccans and Europeans (France, south West Germany) is the CcDee. The most common phenotype among Pakistani is CCDee [Table III].

Kell System

Coombs discovered in 1946, a new antibody in a subject whose name was given to the system: KEL (K, Kell). Three years later Levine describes the antithetical antibodies: KEL2 (k Cellano). Among the immunogenic antigens of blood groups, the KEL antigens are ranked second behind RH1 antigen. The KEL system is not only important in transfusion and in obstetrics because the KEL1 antigen is developed very early in fetal erythroid cells and a maternal-fetal incompatibility by anti-KEL1 alloimmunization can lead to neonatal disease hemolytic with death in utero. Twenty-five antigens have been identified. The two principal and antithetical antigens are KEL1 and KEL 2[1][2].

In our study ,the rate of Kell positive subjects is 7% (Table IV), this rate is comparable to that of the previous Moroccan study (2002) which is 7,38% and higher than that of Asian countries (Pakistan and Indian), less than that of France and Iran.

CONCLUSION

We determined the phenotypic and genotypic frequencies in Rh1 and Kell Antigens in the Moroccan population; we also estimated the prevalence of antigens and phenotypes of the Rh system (CcEe).

Our results were compared with previous Moroccan and others countries reports. These results imply the character mostly Caucasoid of the Moroccan population associated with a significant Negroid character.

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