Genetics and Biodiversity Journal

Journal homepage: http://ojs.univ-tlemcen.dz/index.php/GABJ

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Original Research Paper

Study of the phenotype and allele frequencies of the ABO and Rhesus blood group systems in Algeria.

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Article history; Received: September 7th 2020; Revised: October 22th 2020***;*** Accepted: December 5th 2020

Abstract

The present work aims to study the distribution of blood groups in a simple random sampling and to present new national statistics on the phenotype and allele prevalence of the two ABO and Rhesus blood group systems. The study was carried out on a sample comprising 7549 individuals from the 48 Wilayas (Provinces) of Algeria. For this, a survey was carried out randomly, in hospitals, private laboratories, universities, university halls, Algiers Airport and social networks. The findings allowed stating that group O was found in about half of people with phenotypes (47.52%), group A was twice as high (30.14%) as group B (16.62%), and group AB exhibited the lowest frequency (5.72%). Moreover, a clear predominance of rhesus positive (Rh+) subjects (91.8%) was observed compared to rhesus negative (Rh-) subjects (8.1%) among the Algerian population. However, regarding the allele frequencies, it was found that the O allele was the most frequent, with a prevalence of 68.32%. As for the A allele, it came in the second position, with a frequency of 19.84%, and finally the B allele was the least frequent, with a frequency of 11.84%. The results obtained indicated that the Algerian population is heterogeneous; it is characterized by a high ethnic mix rate due to the migration of populations from all places (introduction of new parents) and to a very high percentage of consanguinity in certain communities due to consanguineous marriages.

Keywords: Group; ABO; Rhesus; Algeria; Frequency; Alleles.

Introduction

All the individuals that make up the human species are genetically very close to each other, but the presence of a large polymorphism in genetic information can create a biodiversity that makes each human being unique, beyond all physiological functions provided by blood in the organism of higher vertebrates and several invertebrates. Blood was used as a genetic marker for the purpose of identifying individuals long before DNA polymorphism was known. Geographically, blood made it possible to follow the migration of populations on earth (Janot, 2002).

The identification of the ABO blood group was an essential step in controlling transfusion therapy (Lefrere and Berche, 2010), by combining it with the rhesus blood group system which is one of the most complex blood groups known in humans so far. Science has thus made it possible to study and understand many phenomena.

The investigation of these systems for transfusion purposes allowed confirming, very early, the existence of genetic variations among human populations. In addition, the distribution of alleles of the ABO blood group system throughout the world has been extensively studied; it is has often been associated, on the one hand, with the evolution of the genetic structures of human populations, and on the other hand, with natural selection (Robert et *al*., 1977). It should be noted that, regarding the genetics of populations, the individuals are not the object of the study but rather the collection of genes they possess and the relationships existing within this set (Hariche, 2002).

The main factors that can influence the evolution of populations can be grouped into two categories. The first one is predominantly biological and / or genetic; it includes mutation, genetic drift and natural selection. The second is primarily cultural and includes the effects of consanguinity, patrimonial assortment, differential fertility of couples and human migrations (Afkir, 2004).

All these phenomena lead to variation in gene frequencies between different populations (Terzian and Biemont, 1988). The present study was conducted within that context and aims mainly to: 1) Study the distribution of blood groups within the ABO system in the Algerian population, 2) Estimate the phenotype and allele frequencies of this system under the Hardy-Weinberg equilibrium hypothesis.

Material and methods

This work started in 2017 and ended in 2019; the realization of this study went through 3 distinct stages, namely sampling, then determination of the phenotype and allele frequencies, and finally application of a balance test.

1. Sampling

This study was carried out on a sample of 7549 individuals from the 48 Wilayas of Algeria (the resident population in Algeria was on July 1, 2019 43.424 million people (ONS, 2020)), by carrying out a search, by distributing, in a random manner, survey sheets requesting the blood grouping and rhesus of the individual as well as those of his parents too, while specifying their origins.

This survey was carried out within several regions and in different structures. It is worth specifying that out of 7549 individuals (100%), 1449 (19.19%) were from hospitals, 524 (6.94%) from private laboratories, 1670 (22.12%) from universities, 1268 (16.79%) %) from universities, 109 (1.44%) from Algiers Airport, and 763 (10.10%) from groups of biologists (Wilayas of Bejaia, Tlemcen, Tiaret, Constantine, Oran, Jijel, Alger, and Blida), and groups of laboratory assistants, on the Social Network Facebook, and 1766 (23.39%) from the street, in addition to family members and friends.

2. Determination of phenotype and allele frequencies

The survey data were analyzed using the Excel version 2007 software.

2.1. Phenotype frequencies

The data collected in the field were used to calculate the phenotype frequencies of each blood group (A, B, O, and AB) in all the 48 Wilayas of Algeria by applying the following formula:

Phenotypic frequency = Number of individuals of each blood group / Total number of individuals

2.2. Allele frequencies

To calculate the allele frequencies we used the formula of Bernstein (1930) (Hiernaux and Tissier, 1972):

$p' = 1-\{F(B) + F(O)\}^{1/2}$

$q' = 1-\{F(B) + F(O)\}^{1/2}$

$r' = F(O)^{1/2}$

Then if $p'+q'+r' \neq 1$ correction by deviation D; $D = 1-(p'+q'+r')$.

$p = p' (1+D/2)$

$q = q' (1+D/2)$

$r = (r' + D/2)(1+D/2)$

With: p: Frequency of the allele A.

q: Frequency of the allele B.

r: Frequency of the allele O.

F(O), F(A) and F(B) are the frequencies of the corresponding phenotypes.

3. *Application of the balance test*

The hypothesis of equality between the observed distribution and the theoretical distribution (hypothesis H_o) was tested using the χ^2 statistical test; then, the observed numbers and the expected ones in all the 48 Wilayas of Algeria were compared by applying the formula:

$\chi^2 = \Sigma$ [(Observed numbers-theoritical numbers)^2/observed numbers]

The sum was carried out on all the genotypes and the χ 2 value was compared with a threshold value that was read in a table of χ^2, according to 2 parameters. The first one is the risk (α) that is generally fixed at 5% (0.05) and chosen by the user, and the second is the degree of freedom (dof). In this study, the threshold value χ^2 was 7.81 for a degree of freedom dof = 1 and a risk α = 5%.

- If calculated χ^2 is less than the threshold value, then the hypothesis H_o is acceptable, which means that there is no significant difference between the observed distribution and the theoretical distribution; it can therefore be concluded that the population follows the Hardy-Weinberg law and is therefore balanced.
- If calculated χ^2 is greater than the threshold value, then the hypothesis H_o is rejected and it can then be concluded that the population does not follow the Hardy-Weinberg law, with a risk α = 5%.

Results and discussion

1. ABO system

The phenotype frequencies and the allele frequencies of the A, B and O genes in a sample of the Algerian population were determined and analyzed. Table 1 shows the number of individuals taken from each Wilaya of Algeria, with their blood groups.

1.1. Phenotype frequencies

Figure 1 summarizes the results of the phenotype frequencies of the ABO blood groups.

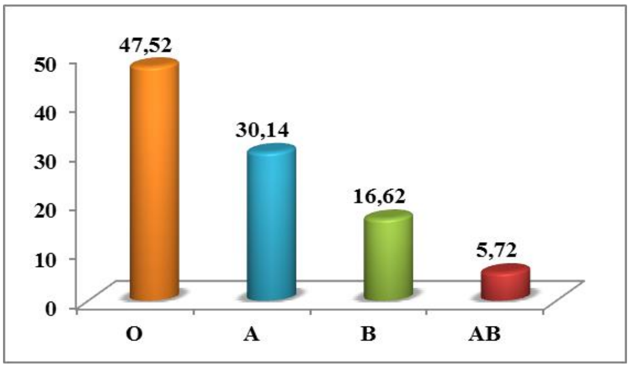


Figure 1. Distribution of the sampled population according to blood groups.

Table 1. Number of individuals taken from each Wilaya with their ABO blood systems.

Wilaya	O	A	B	AB	Total
Adrar	28	12	12	1	53
Chlef	31	16	16	3	66
Laghouat	29	8	5	-	42
Oum El Bouaghi	13	7	6	3	29
Batna	53	45	17	14	129
Bejaia	147	86	51	16	300
Biskra	34	14	8	3	59
Bechar	409	173	79	11	672
Blida	473	298	236	63	1070
Bouira	47	21	8	3	79
Tamanrasset	6	3	3	-	12
Tébessa	32	23	9	4	68
Tlemcen	75	36	22	8	141
Tiaret	21	17	4	2	44
Tizi Ouzou	111	55	43	14	223
Alger	396	269	120	46	831
Djelfa	66	31	16	8	121
Jijel	32	31	6	2	71
Sétif	162	84	45	16	307
Saida	9	10	-	-	19
Skikda	56	30	17	11	114
Sidi Bel Abbas	34	11	10	8	63
Annaba	74	57	16	12	159
Guelma	20	15	7	3	45
Constantine	83	35	22	13	153
Médéa	72	86	31	18	207
Mostganem	32	14	11	1	58
M’Sila	18	16	6	1	41
Mascara	24	8	8	4	44
Ouargla	66	26	24	7	123
Oran	79	41	36	5	161
El Baidh	16	3	2	1	22
Illizi	2	3	-	-	5
Bourdj Bou Arreridj	27	30	9	3	69
Boumerdès	30	30	13	6	79
El Taref	12	2	-	1	15
Tindouf	23	11	3	5	42
Tissemsilt	8	5	4	-	17
EL Oued	16	8	1	2	27
Khenchla	32	18	10	3	63
Souk Ahras	31	12	7	3	53
Tipaza	552	481	258	97	1388
Mila	10	11	9	-	30
Ain Defla	42	32	12	6	92
Naama	16	8	5	1	30
Ain Timouchent	11	13	7	2	33
Ghardaia	6	9	7	-	22
Rélizane	21	18	9	2	50

The average frequencies of phenotypes A, B, AB and O in our population fall within the ranges varying from 13.33% to 30.14% for the phenotype A, from 3.7% to 16.62% for the phenotype B, from 0.33% to 5.72% for the phenotype AB and from 27.27% to 49.52% for the phenotype O, while the distribution of blood groups is spread in accordance with the order of O > A > B > AB, among the entire Algerian population. In addition, it was found that about half of phenotyped individuals (47.52%) belong to group O. It should also be noted that group A was twice as high (30.14%) as group B (16. 62%), and group AB presented the lowest frequency (5.72%).

These results were compared with those reported in previously conducted studies, on the same themes, and on various segments of the population of Algeria and throughout the world. It is worth citing the study conducted by Boulkadid (2016) on the phenotype and allele frequencies of the ABO, Rhesus and Kell blood group systems in eastern Algeria. The results indicated that approximately 43.13% of phenotyped people belong to group O. Furthermore, a similar study conducted in Great Britain reported the following phenotype frequencies, namely 46.7% for group O, 41.7% for group A, 8.6% for group B, and 3.0% for group AB. It was observed that the distribution was in the order O > A > B > AB. However, for India, this distribution turned out to be in the order O > B > A > AB and the phenotype frequencies were 38.75% for group O, 18.85% for group A, 32.50% for group B, and 9.90% for group AB (Khattak, 2008).

The study, which aimed to determine the phenotype frequency of blood groups of blood donors and patients in the Khyber Pakhtunkhwa Province, in the North-Western region of Pakistan, indicated that group B was found the most predominant (32.40%), followed by group O (29.10%), group A (27.92%) and finally group AB (10.58%). This distribution was found in the order B > O > A > AB (Khattak, 2008).

In the year 2010, 219 287 blood donors were gathered for the purpose of studying the ABO blood group system across Morocco. The overall phenotype frequencies of the ABO system, in all the regions concerned, were 32.86% for group A, 15.80% for group B, 4.53% for group AB and 46.80% for group O (Benahadi, 2013).

With regard to the European countries, it was found that 42% belong to blood group A, 9% to blood group B, 3% to blood group AB and 46% to blood group O. However, some Western Europeans exhibited a fairly higher proportion (up to 40%) for blood group B. American Indians who are viewed as belonging to a pure race are almost exclusively in group O. With regard to white Americans, the frequency was 41% for group A, 10% for group B, 4% for group AB, and 45% for group O. It should be noted that group O is the most widespread throughout the world with around 63%; its highest frequency was found among indigenous populations in Central and South America where it is close to 100%. The highest frequency for group A was found within the interval (45% - 43%) in France, (43% - 33.30%) in Turkey and (43% - 41%) in Germany. Similarly, the highest frequency for group B was recorded in Eastern Europe, Central Asia, northern India, Central Africa and Egypt (Lyiola et *al.*, 2012).

1.2. Allele frequencies

Figure 2 displays the frequencies of the alleles A, B, O, represented by p (allele frequencies of A), q (allele frequencies of B), r (allele frequencies of O) in the sampled population which included 7549 individuals from 48 Wilayas in Algeria.

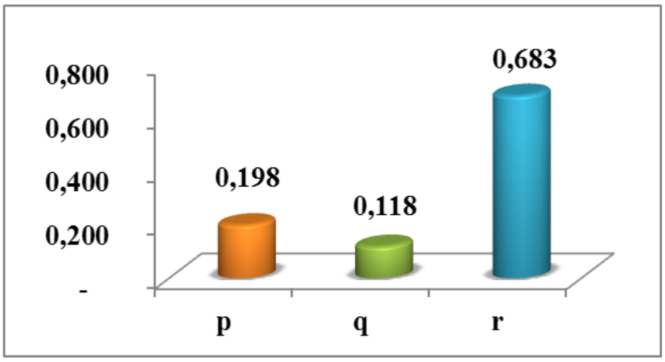


Figure 2. Frequencies of alleles A, B, and O in the sampled population.

Regarding gene frequencies, it turned out that the allele O (68.322%) was globally the most predominant in the Algerian population. It was followed by the allele A (19.840%) and then the allele B (11.84%).

Table II shows a comparison of the allele frequencies of the ABO blood group system in Algeria, with those found in other parts of the world (Lyiola et *al.*, 2012; Vona et *al.*, 1994; Benahadi, 2013; Hmida et *al.*, 1994; Hamed et *al.*, 2011; Houmeida, 2011; Sabir et *al.*, 2004).

Table II. Comparison of the allele frequencies of the ABO blood group system in Algeria with the frequencies reported in other populations of the world.

Population	p(A)	q(B)	r(O)
Algérie	0.198	0.118	0.683
Mauritanie	0,177	0,120	0,702
Maroc	0,253	0,117	0,626
Lybie	0,214	0,094	0,699
Soudan	0,148	0,112	0,739
Nigéria	0,13	0,11	0,76
Guinée	0,147	0,154	0,698
Espagne	0,244	0,41	0,715
France	0,280	0,062	0,662
Grèce	0,260	0,112	0,620
Turquie	0,298	0,125	0,576
Allemagne	0,279	0,081	0,640
Arabie Saoudite	0,169	0,122	0,714
Irak	0,166	0,238	0,595
Inde	0,202	0,262	0,535
Bangladesh	0,20	0,18	0,63
Egypte	0,260	0,147	0,593
Tunisie	0,193	0,118	0,688
Japon	0,266	0,190	0,540

Allele A: Very high frequency in Europe; non-negligible frequency in Africa and North America; frequency almost absent in South America.

Allele B: Frequency almost absent throughout the American continent and in Australia; high frequency in the Middle East and Asia; low frequency in Europe.

Allele O: Maximum frequency in South and North America; very low frequency in Asia.

A comparison with data from Morocco, Tunisia, Mauritania and Libya, countries bordering Algeria, shows that our results suggest a low allele frequency A compared to those of the Moroccan population, i.e., 0.194 - 0.253 (Benahadi, 2013), and the Libyan population, i.e. 0.094 - 0.214 (Vona et *al.*, 1994).

However, it is higher for the allele B (0.073 - 0.117) and the allele O, respectively, in the Moroccan and Libyan populations. On the other hand, it is close to those of the Tunisian (Hmida et *al.*, 1994) and Mauritanian (Hamed et *al.*, 2011) populations.

2. Rhesus system

2.1. The rhesus system (rhesus positive and rhesus negative) in the population under study

The distribution of the rhesus positive and negative for each blood group, relative to the Algerian population and to the ABO blood group, is shown in Figures 3 and 4.

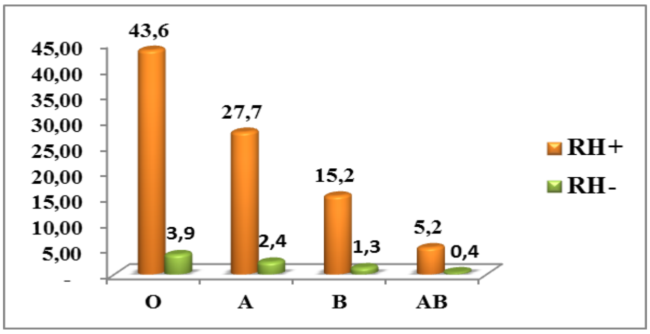


Figure 3. Distribution of rhesus positive and rhesus negative in the Algerian population.

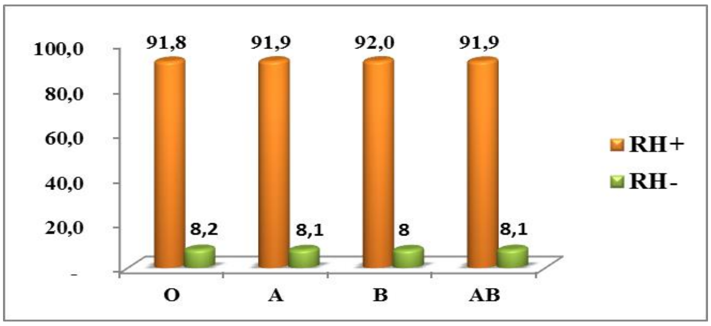


Figure 4. Distribution of rhesus positive and rhesus negative for the ABO blood group.

The results show that 91.8% of individuals are rhesus positive (Rh+) and 8.1% are rhesus negative (Rh-), which indicates that rhesus positive is more predominant than rhesus negative. In addition, the analysis of the histograms illustrated in Figure 5 suggests that the positive rhesus is higher in women than in men. A simple comparison shows that the results obtained in this study are close to those reported in Morocco. According to Benahadi's work (2013), the rhesus system in Morocco is 91% for Rh+ and 9% for Rh-.

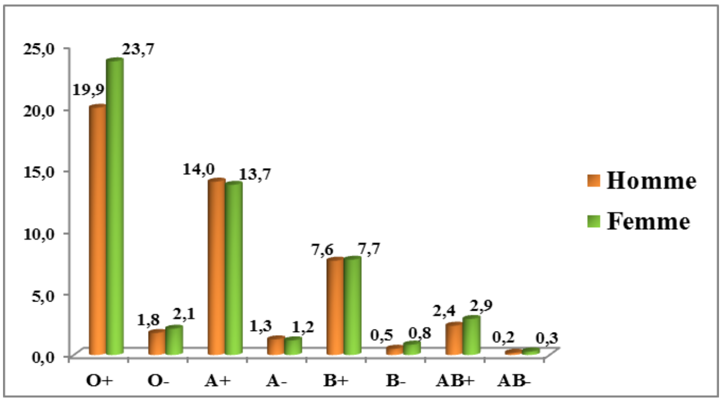
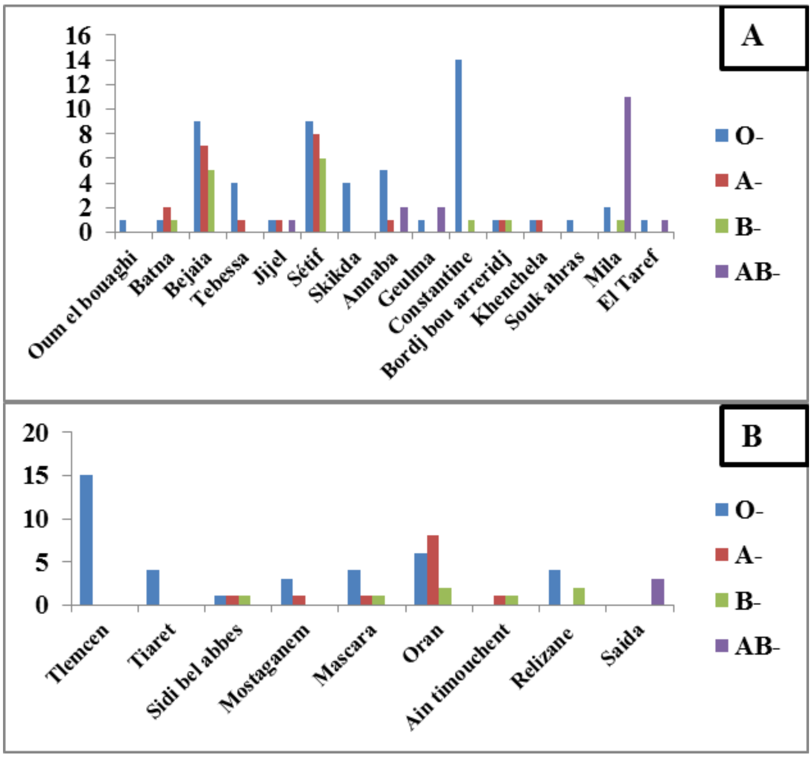


Figure 5. Distribution of rhesus positive and rhesus negative among men and women in the Algerian population under study.

2.2. Distribution of rhesus positive and rhesus negative for each blood group

In order to clearly visualize the distribution of rhesus positive and rhesus negative in Algeria, it was decided to group the different Wilayas of the country into four groups, according to their geographical locations, namely the eastern group, western group, northern group and southern group. The distribution of rhesus positive and rhesus negative in the Wilayas of the four groups is shown in Figures 6 and 7.



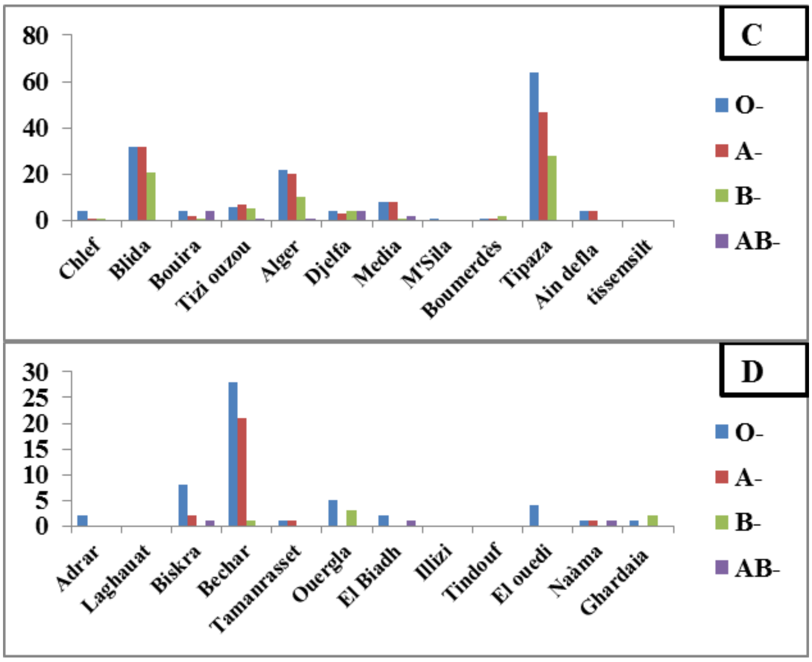


Figure 6. Regional distribution of rhesus negative for each blood group, in the East (A), West (B), North (C), and South (D) of Algeria.

The highest rhesus negative frequencies are above 11%; they vary between 11 and 16%. They were found in the Wilayas of Constantine in the eastern region of Algeria, Tlemcen and Oran in the western region, Blida, Tipaza and Algiers in the northern region, and Biskra and Bechar in the southwestern region.

On the other hand, the average frequencies vary between 7% and 10%. They are found in the Wilayas of Tébessa, Sétif, Mila, Bejaia, Skikda, Annaba in eastern Algeria, Tiaret, Mostaganem, and Saida in the western part, Tizi-Ouzou, Médéa, and Djelfa in the northern part, and Adrar, Ouargla, and El Oued in the southern part.

Furthermore, the lowest percentages, which range between 2% and 6%, are found in the Wilayas of Souk Ahrass, Khenchela, M'Sila, Guelma, Jijel, Batna, Oum El Bouaghi, Bordj Bouarreridj, and El Taraf in eastern Algeria, Ain Témouchent and Sidi Bel Abbes in the western region, Boumerdès in the northern region, and Tamanrasset, El Bayadh, Naama, and Ghardaia in the southern part of the country.

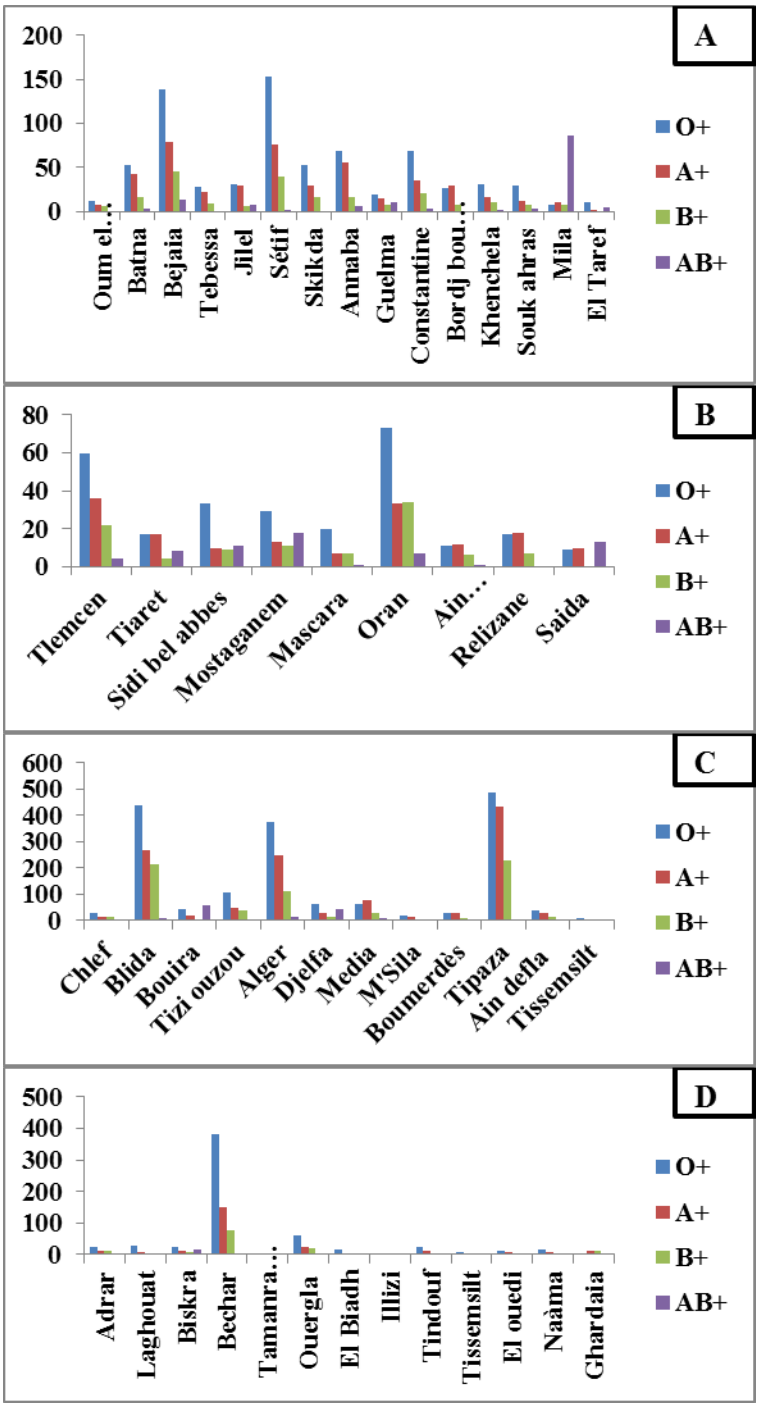


Figure 7. Regional distribution of rhesus positive for each blood group, in the East (A), West (B), North (C), and South (D) of Algeria.

The highest Rh positive (Rh+) frequencies are greater than 90% and vary between 92% and 98%. These frequencies were recorded in the Wilayas of Bejaia, Annaba, Constantine, Mila, Sétif in eastern Algeria, Tlemcen and Oran in the western region, Algiers, Blida, and Tipaza in the northern part, and Bechar in the southern part of the country.

The average frequencies, which vary between 90% and 88%, were found in the Wilayas of Batna, Tébessa, Jijel, Skikda, Bordj-Bou-Arreridj, Khenchela, Souk-Ahras in eastern Algeria, Relizane, Mascara, Sidi Bel Abbes, Mostaganem, and Saida in the west, Tizi-Ouzou, Médéa, and Djelfa in the northern region, and Ouargla in the southern region of the country.

On the other hand, the Wilayas of El-Taref, Oum El Bouaghi, and Guelma in eastern Algeria; Chlef, Bouira, Djelfa, M'Sila, Boumerdès, Ain Defla, and Tissemsilt in northern Algeria; and Ghardaïa, El Biadh, Tamanrasset, Naama, El Oued, Tindouf, Illizi, Biskra, Laghouat, and Adrar in southern Algeria exhibited low frequencies, varying between 86% and 83%.

3. The distances χ^2 associated with the different Wilayas

Table III presents the value of χ^2 calculated for each Wilaya.

The analysis of the results reported in Table III makes it possible to note that the value of χ^2 is lower than the threshold value for the majority of Wilayas such as Adrar, Chlef, Laghouat, Oum-El-Bouaghi, Batna, Bejaia, Biskra, Bechar, Blida, Bouira, Tamanrasset, Tebessa, Tlemcen, Tiaret, Tizi-Ouzou, Alger, Jijel, Sétif, Skikda, Annaba, Guelma, Médéa, Mostaganem, M'Sila, Mascara, Ouargla, Oran, El Bayadh, Bordj Bou Arreridj, Boumerdès, Tissemsilt, El-Oued, Khenchela, Souk-Ahras, Tipaza, Mila, Ain-Defla, Naâma, Ain Témouchent, Ghardaia, Relizane. This justifies the reason why the populations of these Wilayas obey the law of Hardy-Weinberg. These populations undergo a panmictic reproductive cycle where individuals choose their sexual partner neither according to their genotype, nor according to their phenotype (panmixia); gametes combine at random (pangamy).

As for the other Wilayas, the value of χ^2 is greater than the threshold value, which suggests that the populations of these regions are not at the Hardy-Weinberg equilibrium. This may be due to the high rate of consanguinity due to consanguineous marriages, knowing that consanguinity has a significantly detrimental effect on the abortion and death rates. It is widely acknowledged that inbreeding significantly increases the number of mentally ill and deaf-mute people (Sidi-Yakhlef et *al.*, 2013). Inbreeding rates are very high in some regions of Algeria. This phenomenon can be much accentuated due to the migratory flows that affect the coastal towns and large Wilayas like Skikda and Constantine.

It is worth noting that the figures in the Wilayas of Tindouf, El Taref and Djelfa are too low; those in the Wilayas of Saida and Illizi are not high either. Therefore, it cannot be concluded whether their populations are in equilibrium or not.

Table III. Values of the calculated distances χ^2 associated with the different Wilayas.

Wilaya	A	B	O	AB	Total
Adrar	0,054	0,054	0,018	0,387	0,514
Chlef	0,003	0,003	0,001	0,016	0,022
Laghouat	0,032	0,056	0,008	0,521	0,617
Oum El Bouaghi	0,136	0,159	0,072	0,767	1,134
Batna	0,448	1,168	0,381	3,661	5,657
Bejaia	0,067	0,119	0,035	0,558	0,779
Biskra	0,082	0,144	0,033	0,830	1,088
Béchar	0,040	0,096	0,015	0,575	0,726
Blida	0,023	0,030	0,012	0,146	0,212
Bouira	0,048	0,128	0,021	0,679	0,875
Tamanrasset	0,064	0,064	0,021	0,442	0,591
Tébessa	0,030	0,083	0,020	0,312	0,445
Tlemcen	0,149	0,249	0,068	1,307	1,772
Tiaret	0,010	0,047	0,008	0,152	0,216
Tizi Ouzou	0,199	0,259	0,090	1,397	1,945
Alger	0,234	0,566	0,144	2,264	3,208
Djelfa	0,309	0,590	0,148	2,973	4,021
Jijel	0,001	0,007	0,001	0,021	0,031
Sétif	0,195	0,376	0,094	1,858	2,524
Saida	0,000	-	-	-	-
Skikda	0,613	1,048	0,347	4,671	**6,679**
Sidi Bel Abbes	1,298	1,400	0,567	8,120	**11,386**
Annaba	0,291	1,024	0,224	3,364	4,904
Guelma	0,019	0,045	0,013	0,167	0,244
Constantine	0,914	1,401	0,421	7,441	**10,177**
Médéa	0,059	0,188	0,060	0,498	0,806
Mostaganem	0,039	0,052	0,014	0,342	0,446
M'Sila	0,027	0,093	0,019	0,317	0,457
Mascara	0,389	0,389	0,147	2,519	3,445
Ouargla	0,152	0,165	0,056	1,067	1,440
Oran	0,074	0,086	0,030	0,509	0,698
El Biadh	0,123	0,173	0,027	1,724	2,048
Illizi	-	-	-	-	-
Bourdj Bou Arreridj	0,006	0,027	0,006	0,074	0,113
Boumerdès	0,012	0,031	0,010	0,096	0,149
El Taref	0,252	0,879	0,063	7,739	**8,934**
Tindouf	0,608	1,568	0,376	6,399	**8,952**
Tissemsilt	0,093	0,126	0,039	0,702	0,960
EL Oued	0,164	0,762	0,097	3,104	4,127
Khenchela	0,010	0,020	0,005	0,096	0,132
Souk-Ahras	0,126	0,213	0,050	1,264	1,653
Tipaza	0,083	0,170	0,060	0,607	0,920
Mila	10,376	0,505	0,218	2,113	3,213
Ain Defla	0,059	0,169	0,042	0,597	0,867
Naâma	0,000	0,000	0,000	0,001	0,002
Ain Témouchent	0,019	0,041	0,016	0,129	0,205
Ghardaia	0,905	0,905	0,602	3,367	5,779
Rélizane	0,019	0,044	0,013	0,163	0,239
Total	2,014	3,876	1,132	16,919	**23,941**

Algeria has its own phenotypic and allelic distributions of the ABO blood group systems that are specific to it. The findings show that these distributions are heterogeneous; they are characterized by a high number of mixed-race people, a fact can only be explained by many geographical, historical and social reasons. It should be noted that the Algerian population today is a mixture of several ethnic groups, i.e. Berbers, Arabs, Africans and Europeans. It is a mixed population resulting from the migration of populations from various regions of the world, which facilitated the introduction of new parents. Exchanges between the Algerian population and many others throughout the world played a major role in the genetic enrichment of the population. In addition, this mixture can be explained by the transmission of genes, through sexual reproduction (marriage), between individuals belonging to these different ethnic groups. It is worth mentioning that, due to its strategic geographical position, Algeria has always been a target of conquests and migrations from all part of the world (Musette and Khaled, 2011).

Conclusion

The present study aims to compare the distribution of ABO and Rhesus blood group systems in different regions of Algeria. To do this, data were collected by directly questioning the 7549 members of the selected sample. These data were processed for the purpose of calculating the phenotype and allele frequencies and applying the χ^2 test.

The blood group distribution was found in accordance with the order of O > A > B > AB in the entire Algerian population. Indeed, it was found that a frequency of 47.52% was found for gene O, 30.14% for gene A, 16.62% for gene B and 5.72% for gene AB. Regarding gene frequencies, the allele O (68.32%) turned out to be globally the most predominant in the Algerian population, followed by the gene A (19.84%) and the gene B (11.84 %). As for the rhesus blood group system, rhesus positive proved to be more predominant (91.8%) than rhesus negative (8.1%).

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