

**A study of ABO blood group and Rhesus factor distribution
among sample of Missan province population**

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**Hasna Amer Mouhaus , Saleemh Hameed Abbas , Azhar Salih Musa
and Haider Kassim Mahawi**

Department of Science /College of Basic Education

Missan University

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Abstract

The distribution of ABO blood groups and Rh D factor have been studied among 926 individuals from Missan province, southern part of Iraq . The results revealed that phenotype O was the most frequently group while group AB records the lowest percentage in the whole sample .The O, B, A and AB blood groups percentage, were as follows: 35.4% , 33.2% , 22.5% and 8.7% respectively. Rhesus factor records: 88.66% for Rh⁺ and 11.34% for Rh⁻. The allele frequencies of ABO blood groups were found to be: 0.5951 0.2385 and 0.1663 for i , I^B and I^A respectively, with Rh D allelic frequency as 0.6633 for D and 0.3367 for d respectively .

Key words : ABO blood groups , Rh blood group , blood groups , population genetics .

Introduction

A blood type (also called a blood group) is a classification of blood based on the presence or absence of inherited antigenic substances on the surface of red blood cells (RBCs). These Antigens may be proteins , Carbohydrates, glycoproteins , or glycolipids , depending on the blood group system. Some of these antigens also present on the surface of other types of cells of various tissues . Several of these red blood cell surface antigens that stem from one allele (or very closely linked genes) collectively form a blood group system . If an individual is exposed to a blood group antigen that is not recognized as self , the immune system will produce antibodies that can specifically bind to that particular blood group antigen , on the surface of the red blood cells and leading to the destruction of that cells (agglutination) , low blood pressure , and even death [1,2].

Blood types are inherited and they represented contributions from both parents.

A total of 30 human blood group systems are now recognized by the International Society of Blood Transfusion (ISBT)[3] .

The ABO system is the most important blood-group system in human blood transfusion . Anti – A

and Anti – B , The common ABO antibodies are produced in the first years of life by the sensitization to environmental substances such as food , bacteria , and viruses . ABO blood types are also present in some animals , such as cows , sheep and apes (Chimpanzees & gorillas) [1] .

The Rhesus system is the second most significant blood – group system in human blood transfusion .The two most significant blood group systems were discovered during early experiments with blood transfusion : the ABO group in 1900 and the Rhesus group in 1940 [2,4].

The ABO blood types are controlled by a single gene locus located on the autosomal chromosome number 9 ,the gene encodes a glycosyltransferase , that is an enzyme that modifies the carbohydrates content of the red blood cell antigens .It has three alleles : i , I^A and I^B . I^A allele is Co – dominate with allele I^B and both are dominant over i , (I^B = I^A > i) . These three alleles combine to yield six genotypes and four phenotypes [5 ,6].

There are six common suballeles of the ABO gene that produce one's blood type : [7,8]

- | | | |
|--------------------------|------------------------|------------------------|
| A | B | O |
| • A101 (A ₁) | B101 (B ₁) | O01 (O ₁) |
| • A201 (A ₂) | O03 (O ₂) | O02 (O _{1v}) |

Two alleles D and d are responsible for the inheritance for Rhesus blood group, allele D for Rh⁺ and d for Rh⁻. (Positive) or (negative) refer to either the presence or absence of the RhD antigen on the surface of Rbcs, which indicate that allele D is dominant over the allele d [2,4].

Apart from their importance in blood transfusion practice, the ABO and Rh blood groups are useful in population genetic studies, population migration patterns, as well as resolving certain medico – legal issues, particularly of disputed parentage [9].

ABO blood groups have been also used as a genetic marker in the studies of associations with the infectious and non infectious diseases[10]. The

great importance of the Rh system for human health is to avoid, the danger of RhD incompatibility between mother and fetus which cause the disease called the hemolytic disease of the new born (HDN)[4].

ABO blood groups provide the clearest example of simple mendelian inheritance and afford a new criteria of race [11].

The distribution of the blood groups (A, B, O and AB) varies all over the world according to the population [2]. Also there are variations in blood type distribution within human sub populations [12,13,14](table 1).

Table (1) : ABO and Rh blood phenotypes distribution around world [2].

Country	Blood Groups	O	A	B	AB	Rh⁺	Rh⁻
Australia		49	38	10	3	81	19
Denmark		41	44	10	5	84	16
France		42	44	10	4	85	16
Germany		41	43	11	5	85	15
Saudia Arabia		52	26	18	4	92.5	7.5
UK		44	42	16	4	83	17
USA		43	41	10	4	85	15
Nigeria ⁽⁹⁾		53.22	23.73	20.09	3.01	93.8	6.2
Pakistan (Bannu) ⁽¹²⁾		25	31	36	7	67	32
India (Jaunpur) ⁽¹³⁾		30	29	31	8	95	4
India(Pondicherry) ⁽¹⁴⁾		34	39.5	20.5	6.5	93.5	6.5
Iran ⁽¹⁵⁾		37	33.14	23.72	0.7	89.6	10.4
Yemen (hahdramout) ⁽¹⁶⁾		51.5	29.5	16.6	2.3	93	7
Turky		32.4	43.7	16.5	7.43	89	11
China		40.3	26.19	27.14	7.05	99.3	0.69

The incidence of the various alleles of ABO gene in world populations is not well known except for selected populations, such as the Japanese [17] and there seems to be a difference in the frequency among different ethnic groups [18].

Mourant's [1954-1976] pioneer compilation first clearly demonstrated the importance of geographical factors in gene frequency distribution, maps of the ABO and Rhesus gene frequencies in indigenous populations. Allele B is the highest in central Asia and the lowest in America and

Australia, while the A blood allele is more frequent in Europe, it was apparently absent among central and south American Indians [19,20].

The O blood type is very common around the world, about 63% of humans share it. Type O is particularly high in frequency among the indigenous populations of central and south America where it approaches 100%. The lowest frequency of (O) is found in Eastern Europe and central Asia, where B is common [12, 19, 20].

Of the Rhesus blood group system, the gene D which gives rhesus positive status is at its lowest in

Europe . It increases in frequency east world and south world to approximately 80% over almost all of Africa south of the Sahara . In eastern Asia , Australia and Indonesia ; it often attains 100% . The same matter holds for American indigenous population in many of whom the D frequency is 100% [20].

Population genetics has made extensive use of this genetic marker(ABO blood groups). It seems that adjacent populations differ only slightly in the

frequencies of particular genes and that these differences tend to increase with the distances separating populations [11] .

Therefore, it is important to have information on the distribution of these blood groups in any population group. The present study has been carried out to record the phenotypes and allele frequency of ABO and Rh blood groups distribution among Missan population .

Materials & Methods

The subjects of this study are a total of 926 unrelated individuals from Missan Population who referred to the blood bank in AL - Zahraui Hospital for different reasons during the year (2007-2008).

The ABO grouping and Rhesus typing antiserum were used for ABO and Rh typing , the allele frequencies for these two systems were calculated

according to Hardy – Weinbergs law using the following equations[11,21]:

$p = 1 - \sqrt{B+O}$; $q = 1 - \sqrt{A+O}$; $r = \sqrt{O}$; $E = 1 - e$; $e = \sqrt{dd}$, where p,q,r, E and e represents the frequencies of the alleles for i , I^B , I^A,D and d respectively.

Results

Table (2) presents the percentages and allele frequencies of ABO blood groups in Missan population , it shows that the ABO phenotypes were as follows : 35.4 % , 33.2 % , 22.5 % and 8.7 % for each of O,B,AandAB blood groups respectively.

Allele frequencies shows a high frequency of the allele i over I^B and I^A alleles in the order of (i > I^B > I^A) respectively.

Rh factor records : 88.6% , 11.3% for Rh⁺ and Rh⁻ respectively in Missan population , with frequency of 0.6633 for allele D and 0.3367 for d respectively (table 3) .The value of χ^2 for ABO and Rh blood groups shows goodness of fit of the sample .

Discussion

In this study alleles frequency were found to be in the order of (i > I^B > I^A) for ABO .The present investigation showed a slight increase in case of I^B on the expense of i . These results are in accordance with the other previous studies in the southern and central parts of Iraq which stated that the gene frequencies were (I^A = 0.19 , I^B = 0.20 and i = 0.61) in Basrah [22]and (I^A = 0.187 , I^B = 0.22 and i = 0.59) in Baghdad [11] Respectively , while it differs from the results of [23] in Nianwa , the northern part of Iraq which stated that the allele frequencies were in the order of (i > I^A > I^B), where (i = 0.647 , I^B = 0.172 , I^A = 0.194).

Iraq by its geographic location represents a common basin where several nationalities and minorities live together with little intermarriage

among them . Individuals who inhabit the central and southern part of Iraq , had known to have a high intermarriage and intermixing between them [11]. In northern part of Iraq , Turkman , Kurds and Christians who live as a distinguishable groups from the Arabs , had been reported to have a high percentage of A blood group [24] .

The results of this study in Missan population , are in accordance with AL-Rubeai's , Farhan's and Sadiq's studies which recorded high prevalence of Rh⁺ over the Rh⁻ [11,22,23].

These results show that the ABO blood groups and Rhesus factor frequencies are in broad general agreement with most of the other published studies for Arabian population which record a high frequency of O blood type and positive Rh factor [16 ,2].

Table (2) : ABO blood phenotypes and allele frequencies among Missan population .

phenotypes	genotypes	Observed No.	%	genotypic frequency	allelic frequency
O	ii	328	35.42	327.94	i=0.5951
A	I ^A I ^A , I ^{Ai}	209	22.57	209.18	I ^A = 0.1663
B	I ^B I ^B , I ^{Bi}	308	33.26	315.52	I ^B = 0.2385
AB	I ^A I ^B	81	8.75	73.45	
Total		926	100.00	926	1.000

$\chi^2 = 0.951$, d.f = 3, $p \leq 0.25$ it is non significant

Table (3) : Rh phenotype and allele frequencies among Missan population .

phenotypes	genotypes	Observed No.	%	genotypic frequency	allelic frequency
Rh ⁺	DD,Dd	821	88.66	821.4	D=0.6633
Rh ⁻	Dd	105	11.34	104.6	d=3367
Total		926	100.00	926	1.000

$\chi^2 = 0.026$, d.f = 1, $p \leq 0.25$ it is non significant

ABO and Rh genes and phenotypes vary widely across races and geographical boundaries[25,9] and there are a great variation occurs in different groups within even a small country , as one ethnic group mixes , or not with another [26] .

A large number of studies have examined the association between ABO blood groups and variety of diseases or conditions. Such association with several diseases[10,27,28,29], would make this study to be useful for health planners and help

making efforts to face the future health challenges in the region.

Conclusion : The distribution of ABO blood groups and Rh factor in a sample from Missan population were as follows : O blood group record the highest frequency followed by blood groups B,A and AB respectively, while the Rh⁺ record the highest rhesus phenotype frequency. These results are in accord with those found among the region population.

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دراسة توزيع مجاميع الدم حسب نظامي ABO والـ Rh في عينة عشوائية من سكان محافظة ميسان

حسنه عامر مهوس وسليمة حميد عباس وازهار صالح موسى و حيدر قاسم مهاوي

جامعة ميسان / كلية التربية الاساسية / قسم العلوم العامة

الخلاصة

أظهرت دراسة فصائل الدم حسب نظامي ABO والـ Rh في عينة عشوائية من سكان محافظة ميسان مؤلفة من 926 فرداً : شيوخ مجموعة الدم O على مجاميع الدم الأخرى حيث بلغت : 35.4% ، 33.2% ، 22.5% و 8.7% على التوالي لكل من AB ، B ، O ، A والتي سجلت أوطأ نسبة في العينة المدروسة . كما أظهرت الدراسة ارتفاع تكرار النمط الموجب للعامل الرئيسي Rh⁺ ، حيث بلغ 88.66% فيما بلغ تكرار النمط السالب Rh⁻ 11.33% . وقد تبين من حساب التكرارات الاليلية لمجاميع دم هذين النظامين ظهور أعلى تكرار للاليل i يليه الاليل I^B ثم الاليل I^A في نظام الـ ABO، فيما أظهر الاليل السائد D للعامل الرئيسي شيوخاً على اليله المتنحي d ، حيث بلغا : 0.663، 0.336 لكل منهما على التوالي .