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Racial and Ethnic Distribution of ABO and Rh (D) blood groups in Thi-Qar, Iraq

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Abstract:

Most data in the literature include frequencies of these antigens in European and American countries. In this study for the first time we have reported frequencies of these antigens in the Thi-Qar of Iraq.

The aim of the present study was to record the various blood groups among the population of Thi-Qar and to compare it with other populations.

To determine the prevalence of different blood groups and Rh factors in a random population sample from urban and rural areas of Thi-qar of Iraq.

Blood group and Rh factor determination was carried out by the antigen-antibody agglutination test. The frequency of each type was calculated.

Out of 2841 subjects 4804 (59.1%) were male subjects and 1963 (40.9%) were female. The overall phenotypic frequencies of ABO blood in three groups in the total sample was O>A>B>AB.

The frequencies of ABO and Rh phenotypes in Thi-Qar are similar to those reported from most areas in the Arabian region.

الخلاصة:

شملت الدراسة 4804 شخص، كان (59,1%)2841 ذكور و (40,9%) 1963 إناث.

أظهرت الدراسة أن أعلى تكرار كان ضمن مجموعة الـ O حيث كان تردد المظهري يساوي 34,95% ومجموعة الـ AB كانت الأقل تكرارا حيث كان التردد المظهري يساوي 9,49%، أما مجموعة الـ A كانت أعلى تكرارا من مجموعة الـ B حيث يساوي 28.23%، 27.33% على التوالي.

أظهرت الدراسة أن تردد معامل الريصي الموجب كان 93,92%، وقد أظهرت الدراسة أن تردد أو تكرار المظهري لمجاميع الدم لنظام ABO ومعامل الـ Rh مشابه لما ورد في الدراسات السابقة الخاصة بالمنطقة العربية.

Introduction:

The human red blood cell membrane contains different types of antigens, it is a series of glycoproteins and glycolipids [1].

The ABO and Rh is recognized as the major (clinically significant) blood group antigens, the ABO was discovered by Karl Landsteiner in 1901 and it is the most important blood groups system in human blood transfusion.

The determination of the frequency of blood groups n the region would not only help in blood transfusion services, but also eliminate the risk of erythroblastosis foetalis in the neonates [2].

The need for blood group prevalence studies is multipurpose, as besides their importance; in relation to disease, relation to blood transfusion, and organ transplantation, and in their evolution, anthropology and training

ancestral relation of humans so they are useful in population genetic studies.

Furthermore, the discovery of ABO and Rh blood groups has contributed immensely to blood banking services and transfusion medicine in order to avoid morbidity and mortality [3].

The ABO blood types are controlled by 3 alleles of a single gene located on the long arm of the ninth chromosome: i, IA, and IB. IA and IB alleles are dominant over i, expressing a special dominance relationship (codominance)[4]. Variation in this allele frequency of the ABO gene reflects the social tendency of populations to marry and reproduce within their national, regional, or ethnic group.

As people throughout the world intermingle to a greater degree, the distribution of the different Blood types will continue to become more uniform. Red cell antigens are the pheno-typical expression of our inherited genes.

No comparative study was reported in literature regarding the population of Iraqi Arabs of Thi-Qar province with reference to distribution of ABO antigens in this region.

Material and methods:

All subjects were of known Arab Ethnicity tribes from different of Thi-Qar governorate includes the towns of Al-Shatrah, Suq al-Shuyouk, and Nasiriya; who were identified by their national Iraqi ID cards.

The subjects belonged to both rural and urban areas of Thi-Qar. The study population included a total of 4804 apparently healthy subjects; 2841 were men, and 1963 were women.

The majority of study populations were from attendants of Health Centre laboratory for health screening and counseling before marriage and Teaching Hospital Laboratory for health screening and blood grouping, which is mandatory for various purposes.

Blood Typing:

Three drops of blood were obtained from each person by pricking the tip of the index finger with a sterile lancet. Each drop of blood was placed on a slide containing a blood typing anti serum.

The following monoclonal antibodies were used: SPINREACT Anti-A, Anti-B and Anti-A+B monoclonal of Citra Santa Coloma (Spain) for the ABO blood type; SPINREACT Anti-D of Citra Santa Coloma (Spain) for the Rh Group. Agglutination of the blood drop with the three test sera was then assessed by gently probing through the mixture using a lancet.

Blood drops exhibiting a clotting reaction with the test sera were considered positive for that particular blood grouping reagent. Each reaction was recorded and subjected to pooling and statistical analysis.

Results were compared with similar group prevalence studies from neighboring countries and world ethnic groups and races.

Statistical analysis:

Preliminary estimates were calculated manually as:

$p = 1 - \sqrt{B+O}$, $q = 1 - \sqrt{A+O}$, $r = \sqrt{O}$ (p, q, r denote allele frequencies and A, B, O denote observed frequencies of blood groups A, B and O.

Allele frequencies were calculated under the assumption of Hardy–Weinberg equilibrium Law that says the equilibrium, $(p + q + r)^2 = p^2 + q^2 + r^2 + 2pq + 2rp + 2qr = 1$, where p^2 is the probability of I^AI^A and 2pr is the probability of I^Ai (thus probability of type A = $p^2 + 2pr$), q^2 is the probability of I^BI^B and 2qr is the probability of I^Bi (thus probability of type B = $q^2 + 2qr$), r^2 is the probability of ii (thus probability of type O = r^2),and 2pq is the probability of I^AI^B (thus probability of type AB = 2pq).

Chi-square test was used to compare observed allelic and genotypic frequency distributions of the blood group.

We use S2 ABO estimator by Silva Square is a program to estimate the allele frequencies of the ABO blood group system, and perform a couple of statistical tests on the data, particularly to compare simple heuristic estimates of the allele frequencies, to show the EM algorithm in action, to obtain maximum likelihood (ML) estimates of the allele frequencies and to perform goodness-of-fit tests of the Hardy-Weinberg assumption.

We calculated the allele frequencies (p, q, and r) for the ABO locus for each population, assuming Hardy-Weinberg equilibrium.

After making Bernstein's and maximum-likelihood estimate corrections, we obtained the adjusted estimates of the allele frequencies.

Also, to check the significant deviation of the studied populations from Hardy-Weinberg equilibrium, we performed a test of goodness-of-fit (chi-square test) based on allele frequencies.

Result:

The 4804 blood samples were selected randomly, belonging of the Thi-Qar governorate, consist of 2841 (59.1%) male and 1963 (40.9%) female; includes the three towns of Al- Shatrah (995), Suq al-Shuyouk (709), and Nasiriya (3100) table (1). In addition, the chi-square test (with 1 degree of freedom) based on allele frequencies showed significant deviation for Thi-qar (7.269) and the towns Al-Shatrah (x2 =15.0838), but no significant deviation was found for both the Nasiriya town (x2 =1.0243) and the Suq al-Shuyouk (x2 =1.2529) table (3).

Table-1: Total number of samples classified according to gender

	Nasiriya	Suq al-Shuyouk	Al- Shatrah	Thi-qar
Male	59.7%(1850)	40%(283)	71.2%(708)	59.1%(2841)
Female	40.32%(1250)	60.1%(426)	28.8%(287)	40.9%(1963)
Total	(100%)3100	(100%)709	(100%)995	(100%)4804

The overall phenotypic frequencies of ABO blood groups in the total sample was O>A>B>AB figure (1) were in Nasiriya and Al- Shatrah were O>A>B>AB while in Suq al-Shuyouk A>O>B>AB. So O group was dominant in the Thi-Qar governorate flowed by A and B, while AB was rare in three towns of Thi-Qar table-2 and figure-1.

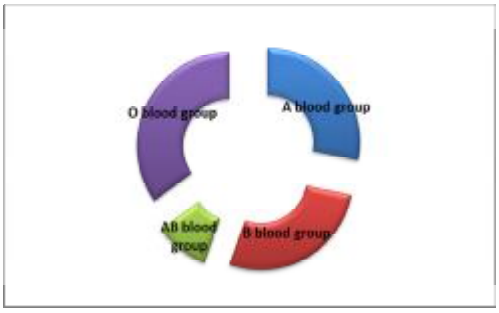

Figure-1: Prevalence of the ABO blood group in Thi-Qar populations sampled in the study.

Table-2: Distribution of the ABO groups and their allele frequencies among Thi-Qar population.

Allele frequency of the ABO blood groups in Nasiriya				
Allele frequency	**p(A)**	**q(B)**	**r(O)**	**Total**
Allele frequency	0.190473	0.210215	0.599309	0.999997
Stander Deviation	0.0052635	0.0054982	0.0067246	
Hardy-Weinberg Log Likelihood=-3988.1734 P-value=0.3139				
Allele frequency of the ABO blood groups in Suq al-Shuyouk				
Allele frequency	0.318418	0.161191	0.520372	0.99998
Stander Deviation	0.013682	0.010203	0.0148503	
Hardy-Weinberg Log Likelihood=-906.5466statistic test=1.2346 P-value=0.2665				
Allele frequency of the ABO blood groups in Al- Shatrah				
Allele frequency	0.199457	0.217735	0.582662	0.999872
Stander Deviation	0.0094812	0.0098533	0.0120037	
Hardy-Weinberg Log Likelihood=-1318.6718 statistic test=14.2926 P-value=0.0002				
Allele frequency of the ABO blood groups in Thi-qar				
Allele frequency	0.210059	0.204429	0.585499	0.999987
Stander Deviation	0.0044145	0.0043621	0.0054525	
Hardy-Weinberg Log Likelihood=-6260.719 statistic test=7.132 P-value=0.0072				

The allelic frequencies of O, A, and B alleles were 0.5855, 0.21006 and 0.20443 respectively in Thi-Qar, figure-2.

The test of goodness of fit indicates that there is significant deviation from Hardy-Weinberg equilibrium among the studied populations for the ABO system table-3.

The frequencies of the phenotypes for Rh blood group were 93.92% for DD and Dd and 6.1% for dd table -4 and figure-3.

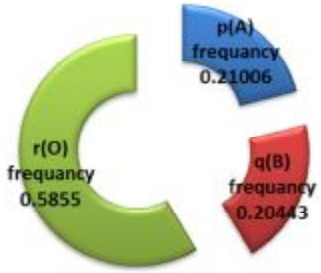

Figure-2: Allele Frequency (p, q, r) Variation at the ABO Locus among Thi-Qar population.

Table-3: Distribution of the ABO blood group among Thi-Qar town's population

Prevalence of the ABO blood group in Nasiriya					
Blood group	**A**	**B**	**AB**	**O**	**Total**
Observed No.	809	907	261	1123	3100
Expected No.	820.21	918.09	248.25	1113.44	3099.99
x2 test	0.153	0.134	0.0823	0.655	1.0243
Pearson's x2 test=1.0243 df=1 P value=0.3115					
Prevalence of the ABO blood group in Suq al-Shuyouk					
Observed No.	301	131	80	197	709
Expected No.	306.85	137.37	72.78	192	709
x2 test	0.112	0.295	0.716	0.13	1.253
Pearson's x2 test=1.2529 df=1 P value=0.263					
Prevalence of the ABO blood group in Al- Shatrah					
Observed No.	246	275	115	359	995
Expected No.	270.39	299.69	86.43	337.96	994.47
x2 test	2.294	2.034	9.446	1.31	15.084
Pearson's x2 test=15.0838 df=1 P value=0.0001					
Prevalence of the ABO blood group in Thi-qar					
Observed No.	1356	1313	456	1679	4804
Expected No.	1393.68	1350.8	412.59	1646.93	
x2 test	1.019	1.058	4.568	0.625	
Pearson's x2 test= 7.269 df=1 P value=0.007					

Table-4: Distribution of the Rh blood groups among Thi-Qar population

	Nasiriya	**Suq al-Shuyouk**	**Al- Shatrah**	**Thi-Qar**
Rh+	94.35%(2925)	92.8%(658)	93.37%(929)	93.92%(4512)
Rh-	5.6%(175)	7.2%(51)	6.6%(66)	6.1%(292)
Total	(100%)3100	(100%)709	(100%)995	(100%)4804

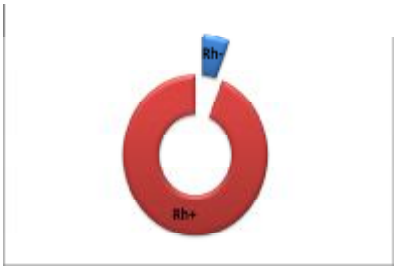

Figure-3: Percentage distribution of the Rh blood groups among Thi-Qar population

Discussion:

Thi-Qar Province was located in southern Iraq. The provincial capital is Nasiriyah. Thi-Qar was the heartland of the ancient Iraqi civilization of Sumer and the ruins of Ur, Eridu, Lagash, Larsa, and other.

The study of human genetic variation has both evolutionary signifi-cance and medical applications, and can help scientists understand ancient human population migrations as well as how different human groups are biologi-cally related to one another.

Frequency distribution of blood groups is important as it is used in modern medicine, genetic research, anthropology, and tracing ancestral relations of humans[5].

The earlier surveys carried out on the ABO and Rh (D) distribution for the Iraqi population include Al-Khafaji & Al-Rubeai[6] and Jaff[7] for Kurdish population of Iraq and Abdullah[8] for the local population of Basrah.

No comparative study is reported in literature regarding the population of Thi-Qar. The aim of the present study was to record the various blood groups among the population of Thi-Qar, and also to compare the data with the population of other provinces, as well as some other countries of the world, with a view to generate data with multipurpose future utilities for the health planners and also see the common trend of the prevalence of various blood groups. We see in table-5 globally, group O had the highest frequency followed by A, B and AB between the different ethnic groups.

The Arabs from the Thi-Qar show very high O and low AB frequencies which agree well with those found in the non-Iraqi Arabs inhabitants of most parts of Arabia like Syria, Kuwait, Bahrain, Jordan, Saudi Arabia and almost nowhere of the world. Rhesus study showed that Rh (D) positive is by far the most prevalent, and frequencies agree well with the rest of Arabia and almost nowhere of the world. The frequency of ABO and Rh phenotypes in Thi–Qar population appears to be similar to Asian data, Taking into account the few markers, we should not read too much but some pattern are clear that signature of social force still persist in the genome of cast and tribes of Iraqi (Thi-ar) population. Some variations may even occur in different areas within one small country, in the Bahraini population appears to be intermediate between eastern (Asian) and western (Caucasian) data [14].

Table-5: ABO and Rh blood phenotypes distribution among other population

Population	A f.	B f.	AB f.	O f.	Rh f.	reference
Thi-Qar population	28.23	27.33	9.49	34.95	93.92	Present study
Kurd/ population	32.47	23.84	6.53	37.16	91.73	[7]
Basrah/Iraqi population	27.8	29.1	6.3	36.8	91.8	[8]
Syrian Arabs population	46.25	13.13	3.12	37.5	ND	[9]
Jordanian population	38.36	18.04	6.98	36.62	ND	[10]
Kuwaiti population	26.7	24.1	4.6	44.6	ND	[11]
Southwest Saudi Arabia	33.4	6	3.8	56.8	92.8	[12]
Mashhad, Iran	29.5	28.7	7.9	33.9	ND	[13]
Bahraini population	20.1	23.1	3.44	53.4	92.82	[14]
Kunbis Population(India)	27.02	33.06	8.33	31.04	4.26	[15]
Rawalpindi/Islamabad	25.53	33.33	10.04	31.10	92.45	[2]
Uttar Pradesh, India	23.66	36.81	6.85	32.68	95.59	[1]
Mauritanian population	28.28	18.56	4.05	49.10	94.23	[16]

This frequency distribution supports the mixed-race composition of Thi-ar population.

The genetic and environmental factors responsible for varying frequency of the blood groups among the Iraqi population needs to be probed further.

The data generated in the present study and several other studies of different geographica

One region of Iraq may be useful for health planners, while making efforts to face the future health challenges in the region.

Conclusions:

Generation of a simple database of blood groups, not only provides data about the availability of human blood in case of regional calamities, but also serves as a fore warner of future burden of disease. Such studies need to be carried out at regional levels, wherever humanity resides.

n coming years the selection of more markers and typing using DNA marker will provide better insight into the genetic landscape of Iraqi population.

Acknowledgement:

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