

HLA ANTIGENS OF ARAB CHRISTIANS IN IRAQ

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Summary

BACKGROUND: Iraq had more than twenty-four millions inhabitants of populations. This nation is one of the most populated countries in the world. It is difficult to define Iraqi populations genetically (HLA polymorphism) because they are structured of a mixture of many groups. HLA phenotype frequencies that encoded by many closely linked genes that are responsible for a variety of cell surface alloantigen proteins that are responsible for differences in different ethnic groups. Arab Christians in Iraq, accounting for more than three millions inhabitant mostly the northwest and other parts of Iraq. This raised the need for a preliminary study of the HLA trend in this population.

Aim of study:

- 1- Estimating the gene frequency of HLA class I (A, B, Cw) and class II (DR and DQ) alleles in Iraqi Arab Christians.
- 2- Assessing the genetic relationship between Iraqi Arab Christians and other Arabian, Asian and European populations.

Materials and Methods: A total of unrelated 568 Iraqi Arab Christians (AC) healthy volunteers and individuals referred to Immunology and Tissue Typing Center in Al-Karamah Teaching Hospital for organ transplantation and Forensic medicine) were examined for HLA polymorphism using complement dependent cytotoxicity test from June-2003 to April-2004.

Results and conclusions: The phenotypes of all loci of (AC) were in agreement with Hardy-Weinberg equilibrium. In case of HLA-A locus, three variants dominate this locus A1(0.123), A2 (0.149) and A3(0.134) which showed some similarities with Arabian, Asian and European people in the world. A3 had been found to be associated with Hereditary Hemochromatosis (HH) but the risk increased when there is a linkage disequilibrium between A3/B14. Fortunately, B14 allele had a low frequency in this group and common allele was B35(0.154) and B51(0.128) which had an association with Behçet's syndrom. So one can predict high incidence of this disease in this group of population. Last locus was studied in class I was Cw4 that had a higher rate (0.173) in HLA -Cw loci.

In case of class II, it was done on small number of persons and the common allele was DR2(53.84%) which is protective from insulin dependent diabetes mellitus disease while DQ1 is common allele in HLA-DQ loci.

HLA typing of (AC) had some similarity with Arabian people because of their same ancestry and also had some similarity with Caucasoid Europeans because of outbreeding and intermixing with those populations due to migration.

Key wards: HLA, Christian, Arab, Iraq.

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Introduction

HLA antigens differ from one population to another. It is a highly polymorphic system in the human. Comparisons of different human populations show

that frequencies of certain HLA class I and II alleles are widely distributed, where as, others are found only in peoples from a particular geographical region. A pattern of nucleotide substitution indicates that the new alleles are often formed by a genetic recombination between existing alleles during the formation of germ cells (a segment of one allele is replaced by the corresponding segment of another). These mechanisms have been termed interallelic conversion or segmental exchange(1). Some alleles have been formed by similar events involving two different HLA genes, and this mechanisms is called gene conversion(2). In evolutionary terms,

polymorphism has arisen by gene duplication and point mutation(3). Within the HLA-complex, meiotic recombination occurs at a frequency of about 2%, and a further random combination of one maternal and one paternal HLA haplotype within each individual produces millions of different combinations of HLA class I and class II alleles in the human populations (4). This HLA polymorphism is important in protection the human being against pathogens such as bacteria and viruses that penetrate and infect the cells of the body. To deal with these infections, defending cells are required to mount an immune response against the cell harboring the invading organism. These cells must therefore be able to distinguish between infected and non-infected cells. This is achieved by displaying peptide derived from the foreign antigen on the surface of the host cells in which they were generated. Only these cells displaying foreign peptides in association with HLA molecules trigger an immune response(6). Populations are differing in gene frequencies; they are defined as races. The definition of races must exist in the human species and in most organisms. The geographical variety is an important factor in categorization of racial groups(5). Iraq is one of the countries that consist of many racial groups, one of them is Arab Christians that inhabitant different provinces of Iraq mostly northwest part of it. So this study tried to wrap out HLA typing in this group of populations in Iraq.

Materials and methods:

Population: A total of 568 unrelated Iraqi Arab Christians (AC) individuals (healthy volunteers and individuals referred to Immunology and Tissue Typing Center in Al-Karamah Teaching Hospital for organ transplantation and forensic medicine) were examined for HLA polymorphism. They were drawn from different provinces: (350)Baghdad and the rest from Nineveh. They were examined for HLA-class I (A, B and Cw) antigens, and 13 of them were examined for HLA-class II (DR and DQ) antigens.

Serological typing: For several years, the most widely used procedure was serological detection of HLA antigens by microlymphocytotoxicity test, which was developed by Terasaki and McClelland (1964) and standardized in agreement with the National Institute of Allergy and Infectious Disease (7). This test is a complement dependent reaction, in which antibodies (antisera from Pel-Freez

Clinical System, USA., Biotest, Germany and BAG, Germany) recognize antigens on the surface of lymphocytes and form antigen-antibody complexes. The formed antigen-antibody complexes thus are able to activate the added rabbit complement which results in death of reacted cells. Then by a dye exclusion technique, it is possible to score the reaction and to determine the HLA-phenotype. Class I done on T cells while class II done on B cell separated by nylon wool method (8). Statistical methods: Several types of statistical analyses were employed. They included mainly:

- 1- Calculating the phenotype frequencies, which were expressed as percentages.
- 2- Estimation of gene frequencies from the observed phenotype numbers (9) .
- 3- Estimating equilibrium (10).

Results:

The distribution of HLA polymorphism (A, B, Cw, DR and DQ loci) was investigated in Iraqi Arab Christians populations (AC). This group their ages ranged from 1 year to 68 years (mean was 39 years). M female ratio was 2.1:1. The observed and expected phenotypes of all loci for the this population was in a good agreement with Hardy-Weinberg equilibrium (Table 1).

Arab Christians:

The observed and expected numbers, percentages and gene frequencies of HLA-A, -B and Cw alleles are given in tables (2,3 and 4).

- 1-HLA-A locus: Three variants dominated, the gene frequency of HLA-A polymorphism with a total frequency of 0.406. They were A1 (0.123), A2 (0.149) and A3 (0.134). A rare variant was also detected; it was A31 (0.008).
- 2-HLA-B locus: The most frequent alleles at HLA-B locus were B35 (0.154) and B51 (0.128). However, five rare variants (B37, B39, B45, B55 and B63) were detected in this population with a gene frequency less than 1% (0.004, 0.006, 0.008, 0.004 and 0.007, respectively).
- 3-HLA-Cw locus: Cw4 was the most frequent allele (0.173) at HLA-Cw locus, followed by the alleles Cw2 (0.042) and Cw3 (0.029). As in the population of Arab Muslims, the estimated gene frequency of undetected alleles accounted for more than two third of the total frequency at this locus (0.709).
- 4-In case of class II; DR2 is dominate this loci and DQ1 was most common as shown in table 5 and 6 (in spite of small numbers were studied).

Population	Locus	χ^2	D.F.	P
Iraqi Arab Christians	HLA-A	0.1933	12	N.S.
	HLA-B	1.3462	20	N.S.
	HLA-Cw	0.3220	06	N.S.
	HLA-DR	0.0002	02	N.S.
	HLA-DQ	0.0003	1	N.S.

Table (1) Hardy-Weinberg equilibrium in HLA-A, -B, -Cw, -DR and DQ loci of Iraqi Arab Christians populations.

HLA - A Alleles	Observed		Expected		Gene Frequency
	No.	%	No.	%	
1	132	23.23	135.01	23.77	0.123
2	157	27.61	156.65	27.57	0.149
3	143	25.17	142.02	25.00	0.134
11	078	13.73	077.79	13.69	0.071
23 (9)	016	02.81	015.79	02.78	0.014
24 (9)	079	13.90	078.84	13.88	0.072
26 (10)	051	08.97	050.05	08.81	0.045
28	049	08.62	048.88	08.60	0.044
29 (19)	017	02.99	016.91	02.97	0.015
30 (19)	044	07.74	043.44	07.64	0.039
31 (19)	010	01.76	009.05	01.59	0.008
32 (19)	049	08.62	048.88	08.60	0.044
33 (19)	060	10.56	059.68	10.50	0.054
others	-	-	193.48	34.06	0.188

Table (2) Observed and expected numbers , percentages and gene frequencies of HLA-A alleles in Iraqi Arab Christians .

HLA-B Alleles	Observed		Expected		Gene Frequency
	No.	%	No.	%	
7	039	06.86	037.96	06.68	0.034
8	032	05.63	030.91	05.44	0.028
13	024	04.22	023.60	04.15	0.021
14	040	07.04	039.06	06.87	0.035
17	037	06.51	036.86	06.49	0.033
18	063	11.09	062.90	11.07	0.057
27	049	08.62	048.88	08.60	0.044
35	162	28.52	161.47	28.00	0.154
37	005	00.88	004.53	00.79	0.004
38 (16)	030	05.28	029.15	05.13	0.026
39 (16)	007	01.23	006.79	01.19	0.006
40	013	02.28	012.42	02.18	0.011
41	035	06.16	034.67	06.10	0.031
44 (12)	042	07.39	041.25	07.26	0.037
45 (12)	010	01.76	009.05	01.59	0.008
49 (21)	038	06.69	037.96	06.68	0.034
50 (21)	047	08.27	046.71	08.22	0.042
51 (5)	137	24.11	126.79	22.32	0.128
52 (5)	043	07.57	042.34	07.45	0.038
55	005	00.88	004.52	00.79	0.004
63 (15)	009	01.58	007.92	01.39	0.007
Others	-	-	220.65	38.84	0.218

Table (3) Observed and expected numbers , percentages and gene frequencies of HLA-B alleles in Iraqi Arab Christian.

HLA-Cw Alleles	Observed		Expected		Gene Frequency
	No.	%	No.	%	
1	009.00	01.58	007.92	01.39	0.007
2	047.00	08.27	046.71	08.22	0.042
3	033.00	05.80	032.46	05.71	0.029
4	180.00	31.60	179.52	31.60	0.173
5	008.00	01.40	007.92	01.39	0.007
6	015.00	02.64	014.67	02.58	0.013
7	023.00	04.04	022.49	03.96	0.020
Others	-	-	437.37	77.00	0.709

Table (4) Observed and expected numbers , percentages and gene frequencies of HLA -C alleles in Iraqi Arab Christians.

HLA-DR* Alleles	Observed		Expected		Gene Frequency
	No.	%	No.	%	
1	4.00	30.76	3.97	30.61	0.167
2	7.00	53.84	6.98	53.76	0.320
3	6.00	46.15	5.99	46.12	0.266
Other	-	-	5.62	43.29	0.247

Table (5) Observed and expected numbers , percentages and gene frequencies of HLA -DR alleles in Iraqi Arab Christians.

HLA-DQ* Alleles	Observed		Expected		Gene Frequency
	No.	%	No.	%	
1	6.00	46.15	5.99	46.12	0.266
3	3.00	23.07	2.97	22.91	0.122
Other	-	-	11.03	84.91	0.612

Table (6) Observed and expected numbers , percentages and gene frequencies of HLA -DQ alleles in Iraqi Arab Christians.

Table (7) Percentage frequencies of HLA-A,-B, -Cw, -DR and -DQ antigens in some Arab antigen countries.

HLA Antigens	Saudia N=1145 (20)	Yemen N=197 (21)	Lebanon N=150 (22)	Egypt N=100 (23)	Libya N=89 (21)	Tunis N=109 (19)	Algeria N=88 (24)	Morocco N=141 (21)
A1	19.90	27.20	22.00	40.00	32.71	24.70	36.00	55.00
A2	43.60	36.00	33.00	27.00	34.79	35.70	32.00	34.32
A3	17.10	08.00	27.00	16.00	24.32	17.40	13.00	29.73
A11	06.80	04.00	16.00	17.00	23.21	09.10	20.00	02.21
A23(9)	10.10	NT	11.00	05.00	NT	15.50	NT	NT
A_ 4(9)	20.20	NT	21.00	NT	NT	21.10	NT	NT
A25 10)	00.00	NT	01.00	02.00	NT	01.80	NT	NT
. 26(10)	08.30	NT	05.00	NT	NT	05.50	NT	NT

A28	15.10	15.00	08.00	20.00	10.04	17.40	12.00	05.26
A29(19)	27.50	NT	03.00	07.00	NT	09.10	09.00	NT
A30(19)	12.80	NT	05.00	NT	NT	11.00	NT	NT
A31(19)	11.90	NT	07.00	NT	NT	01.80	NT	NT
A32(19)	03.70	NT	13.00	05.00	NT	10.00	01.00	NT
A33(19)	13.80	NT	07.00	NT	NT	05.50	08.00	NT
A34(10)	00.00	NT	NT	NT	NT	03.60	NT	NT
A36	00.90	NT	NT	NT	NT	00.90	NT	NT
A43	00.00	NT	NT	NT	NT	NT	NT	NT
B7	11.40	05.40	07.00	20.00	02.41	14.60	15.00	15.77
B8	14.70	03.63	04.00	04.00	13.84	19.20	15.00	09.41
B13	04.80	01.00	07.00	10.00	04.65	02.70	00.00	24.76
B14	04.10	16.42	09.00	07.00	06.91	08.20	14.00	09.41
B15	04.60	02.01	03.00	01.00	09.41	02.70	00.00	06.09
B17	11.00	10.88	10.00	13.00	08.16	14.60	17.00	03.63
B18	03.70	11.51	13.00	02.00	13.84	08.20	15.00	04.24
B27	02.60	02.61	05.00	04.00	09.62	08.20	02.00	07.32
B35	19.30	21.44	41.00	15.00	29.96	14.60	11.00	24.32
B37	01.60	NT	NT	06.00	NT	00.00	02.00	NT
B38(16)	04.60	NT	12.00	NT	NT	03.60	08.00	NT
B39(16)	01.80	NT	12.00	NT	NT	00.90	04.00	NT
B40	03.60	03.83	10.50	05.00	22.54	11.80	01.00	07.32
B41	03.80	NT	NT	NT	NT	05.50	00.00	NT
B42	01.00	NT	NT	NT	NT	00.90	NT	NT
B44(12)	04.60	NT	10.00	06.00	NT	15.50	NT	NT
B45(12)	00.00	NT	10.00	NT	NT	06.40	NT	NT
B46	00.00	NT	NT	NT	NT	NT	NT	NT
B47	00.00	NT	NT	NT	NT	00.90	NT	NT
B48	00.00	NT	NT	NT	NT	NT	NT	NT
B49(21)	02.80	NT	08.00	NT	NT	07.30	NT	NT
B50(21)	37.60	NT	09.00	NT	NT	11.00	NT	NT
B51(5)	25.70	NT	16.00	NT	NT	11.90	NT	NT
B52(5)	02.80	NT	16.00	NT	NT	01.80	NT	NT
B53	10.10	NT	NT	NT	NT	04.50	NT	NT
B55(22)	NT	NT	NT	00.00	NT	01.80	NT	NT
B56(22)	NT	NT	NT	00.00	NT	01.80	NT	NT
B57(17)	00.00	NT	10.00	NT	NT	NT	NT	NT
B58(17)	11.00	NT	10.00	NT	NT	NT	NT	NT
B59	00.00	NT	NT	NT	NT	NT	NT	NT
B60(40)	01.80	NT	04.00	NT	NT	10.00	NT	NT
B61(40)	01.80	NT	04.00	NT	NT	01.80	NT	NT
B62(15)	00.00	NT	03.00	NT	NT	01.80	NT	NT
B63(15)	04.60	NT	03.00	NT	NT	00.90	NT	NT
B71	02.80	NT	NT	NT	NT	00.00	NT	NT
B72	01.80	NT	NT	NT	NT	02.700	NT	NT
Cw1	03.50	NT	NT	NT	NT	NT	NT	NT
Cw2	19.90	NT	NT	12.00	NT	11.00	NT	NT
Cw3	18.40	NT	NT	06.00	NT	06.40	NT	NT
Cw4	48.70	NT	NT	13.00	NT	15.60	NT	NT
Cw5	03.20	NT	NT	NT	NT	NT	NT	NT
Cw6	03.50	NT	NT	NT	NT	04.60	NT	NT
Cw7	14.30	NT	NT	NT	NT	06.00	NT	NT
Cw8	00.00	NT	NT	NT	NT	NT	NT	NT

DR1	11.30	NT	NT	NT	NT	18.30	NT	NT
DR2	17.80	NT	NT	NT	NT	19.30	NT	NT
DR3	25.20	NT	NT	NT	NT	28.40	NT	NT
DR4	30.90	NT	NT	NT	NT	20.20	NT	NT
DR5	12.20	NT	NT	NT	NT	NT	NT	NT
DR6	08.20	NT	NT	NT	NT	NT	NT	NT
DR7	35.20	NT	NT	NT	NT	25.70	NT	NT
DR8	02.90	NT	NT	NT	NT	02.70	NT	NT
DR9	02.70	NT	NT	NT	NT	00.00	NT	NT
DR10	01.00	NT	NT	NT	NT	00.00	NT	NT
DR11	NT	NT	NT	NT	NT	29.40	NT	NT
DR12	NT	NT	NT	NT	NT	03.70	NT	NT
DR13	NT	NT	NT	NT	NT	15.80	NT	NT
DR14	NT	NT	NT	NT	NT	04.60	NT	NT
DQ1	51.40	NT	NT	NT	NT	51.30	NT	NT
DQ2	NT	NT	NT	NT	NT	NT	NT	NT
DQ3	45.79	NT	NT	NT	NT	39.40	NT	NT
DQ4	NT	NT	NT	NT	NT	NT	NT	NT

NT = Not tested.

Table (8) Percentage frequencies of HLA-A, -B, -Cw, -DR and -DQ antigens in some Asian countries.

HLA Antigens	Iran N=150 (25)	Turkey N=117 (21)	India N=385 (26)	China N=229 (27)	Philippine N=86 (28)	Indonesia N=175 (29)	Mongol * N=106 (30)
A1	18.00	21.22	25.19	06.52	00.00	03.40	17.90
A2	21.30	56.00	30.13	51.30	05.81	32.00	45.30
A3	25.30	17.28	12.21	00.87	01.16	01.10	32.10
A11	18.70	16.85	30.39	55.65	20.93	38.90	17.90
A23(9)	NT	NT	NT	00.00	NT	00.00	NT
A24(9)	NT	NT	NT	28.70	NT	72.00	NT
A9	20.70	36.42	30.65	28.70	59.30	72.00	40.60
A25(10)	NT	NT	NT	00.00	NT	00.00	NT
A26(10)	NT	NT	NT	04.78	NT	11.40	NT
A10	14.70	22.54	06.75	04.78	27.91	11.40	07.60
A28	10.00	15.99	12.73	00.00	06.98	00.00	01.90
A29(19)	NT	NT	NT	00.87	00.00	00.00	00.00
A30(19)	NT	NT	NT	03.48	00.00	00.00	01.90
A31(19)	NT	NT	NT	04.53	02.32	00.00	04.70
A32(19)	NT	NT	NT	00.43	00.00	00.00	00.00
A33(19)	NT	NT	NT	12.17	40.70	02.30	00.00
A19	40.70	26.78	21.82	21.30	NT	NT	NT
A34(10)	NT	NT	NT	00.00	NT	NT	00.00
A36	NT	NT	NT	00.00	NT	NT	NT
B5	53.30	33.63	32.99	15.22	11.57	18.90	19.50
B7	06.70	06.09	19.22	05.22	01.16	00.00	14.20
B8	04.00	08.78	03.64	02.17	00.00	00.00	01.90
B12	10.00	16.20	10.39	01.30	00.00	10.90	08.50
B13	05.30	07.12	05.97	16.96	10.47	10.90	17.90
B14	08.70	04.44	00.26	00.00	00.00	00.00	00.90
B15	04.70	07.12	11.43	13.04	27.91	52.60	09.40
B16	06.70	09.62	00.78	10.43	18.60	07.50	03.80

B17	02.70	08.16	19.22	08.26	04.65	10.30	17.90
B18	08.70	07.95	01.04	00.87	00.00	09.70	03.80
B21	09.30	21.00	05.46	01.30	04.65	00.00	00.00
B22	10.70	05.26	04.94	10.43	01.16	00.00	05.70
B27	04.70	04.44	01.82	02.61	04.65	25.70	03.80
B35	36.00	32.71	19.48	10.00	04.65	27.40	01.90
B37	02.70	NT	NT	01.74	NT	03.40	03.80
B38(16)	NT	NT	NT	04.78	NT	06.90	NT
B39(16)	NT	NT	NT	04.78	NT	00.60	NT
B40	08.00	10.04	15.58	33.91	63.95	03.40	34.90
B41	NT	NT	NT	00.00	NT	00.00	00.00
B42	NT	NT	NT	00.00	NT	NT	NT
B44(12)	NT	NT	NT	01.30	NT	10.90	NT
B45(12)	NT	NT	NT	00.00	NT	00.00	NT
B46	NT	NT	NT	26.96	00.00	NT	03.80
B47	NT	NT	NT	00.00	NT	NT	00.00
B48	NT	NT	NT	03.48	NT	00.00	NT
B49(21)	NT	NT	NT	00.00	NT	02.30	NT
B50(21)	NT	NT	NT	01.30	NT	NT	NT
B51(5)	NT	NT	NT	12.17	NT	NT	NT
B52(5)	NT	NT	NT	03.04	NT	NT	NT
B54(22)	NT	NT	NT	03.04	00.00	NT	NT
B55(22)	NT	NT	NT	06.09	NT	NT	NT
B56(22)	NT	NT	NT	01.30	NT	NT	NT
B57(17)	NT	NT	NT	NT	NT	NT	NT
B58(17)	NT	NT	NT	NT	NT	NT	NT
B59	NT	NT	NT	00.43	NT	NT	NT
B60(40)	NT	NT	NT	22.17	NT	NT	NT
B61(40)	NT	NT	NT	11.74	NT	NT	NT
B62(15)	NT	NT	NT	13.04	NT	52.60	NT
B63(15)	NT	NT	NT	00.00	NT	00.00	NT
B67	NT	NT	NT	00.87	NT	NT	NT
B71	NT	NT	NT	01.74	NT	NT	NT
Cw1	NT	NT	03.53	07.83	03.49	04.90	16.00
Cw2	NT	NT	05.88	00.87	04.65	03.30	28.30
Cw3	NT	NT	23.53	50.00	30.23	11.50	50.00
Cw4	NT	NT	40.00	09.57	00.00	06.60	09.40
Cw5	NT	NT	01.18	00.00	NT	01.60	00.90
Cw6	NT	NT	24.71	08.70	NT	11.50	NT
Cw7	NT	NT	25.88	23.48	NT	NT	NT
Cw8	NT	NT	02.35	00.00	NT	NT	NT
DR1	NT	NT	NT	01.36	NT	01.10	NT
DR2	NT	NT	NT	33.94	NT	65.70	NT
DR3	NT	NT	NT	09.50	NT	09.70	NT
DR4	NT	NT	NT	19.00	NT	00.00	NT
DR5	NT	NT	NT	30.77	NT	35.40	NT
DR6	NT	NT	NT	21.72	NT	46.90	NT
DR7	NT	NT	NT	04.98	NT	16.00	NT
DR8	NT	NT	NT	17.65	NT	NT	NT
DR9	NT	NT	NT	30.77	NT	NT	NT
DR10	NT	NT	NT	01.36	NT	NT	NT
DR11	NT	NT	NT	13.12	NT	NT	NT
DR12	NT	NT	NT	17.65	NT	NT	NT
DR13	NT	NT	NT	16.74	NT	NT	NT

DR14	NT	NT	NT	04.98	NT	NT	NT
DQ1	NT	NT	NT	57.92	NT	NT	NT
DQ2	NT	NT	NT	NT	NT	NT	NT
DQ3	NT	NT	NT	71.49	NT	NT	NT
DQ4	NT	NT	NT	NT	NT	NT	NT

NT = Not tested.

* mongol: are nomadic and move around the vast arae of north central china.

Discussion:

Iraqi population emerged from a common ancestor, especially if we think about Iraqi populations, that they are the most ancient civilization. Therefore, Iraq can be regarded as a region of Arab inhabitant with some purity because this region was subjected to invasions, with major influences from north (Turkey) and east (Iran). However, their effect on gene frequencies may have not established equilibrium in the Iraqi populations, although an introduction of some gene may have happened through mating. So when considering HLA typing of Arab population in Iraq with different religion like Christians, one can find the frequency of A2(27.61%) is the highest rate which is similar to other Arabian, Asian and European nations in the world as mentioned in table(7,8 and 9). Such observation may suggest that this antigen is involved in the early development of HLA polymorphism, and may involved in the protection of human body from introducing microorganisms. So far, to my knowledge no disease has shown association with this antigen, an observation that may support the forthcoming conclusion. Other common alleles were A3(25.17%) and A1(23.23%). Concerning HLA-A3, Iraqi groups revealed frequencies partially comparable with Arab and Asian populations as reported in tables -7- and -8-, and in contrast with Europeans frequencies that mentioned in table -9-. This allele showed an association with hereditary hemochromatosis (HH) disease with a relative risk about 9.3 and this value increased to 90 when there is a linkage disequilibrium between A3/B14 (11). This disease is the most common genetic disorder in North Americans of European descent and several studies in USA and France showed high incidence of HH in their countries due to high frequencies of these HLA alleles (12).

Regarding HLA-B locus, B51 had a higher frequency rate (24.11%). One can predict high incidence of Behcet's syndrome in this group of Iraqi population. This disease was common in other Mediterranean countries(13) like Turkey(14), Iran (15), which they had a higher incidence of this syndrome due to its relation with B5. Regarding HLA-B35, had a higher rate in (AC). This may be due to cross-reaction with B5 because

B51(5) had a strong cross-reactivity with B35 (16,17). So the need for molecular typing is mandatory to resolve this mystery.

About HLA-Cw locus, Cw4 was common allele in this group (31.60%). The variation with other nations like increased Cw3 in fare East Asia may be due to linkage disequilibrium B46/Cw3 (18)

In spite of small number of people studied for class II, the higher frequency was DR2 which is protective from insulin dependent diabetes mullets and systemic lupus erythematosus showed higher relation with DR2 in Orientals (11,13). The last locus studied was DQ, it showed a higher rate in DQ1(46.15%), which is similar to Saudi Arabia and Tunis as reported in table -7-.

The winding up this study, the Iraqi (AC) people had some similarities with Arab nations due to their ancestor as Arab nation and had some similarities with European Caucasoid due to migration, outbreeding and intermixing with those populations. They differ from African population due to their Negroid origin.

Conclusions:

The resemblance of HLA typing with Saudi Arabia may reflect the fact that Iraqi Arab Christians had a same ancestors from Arabian peninsula with different religions and because of several phases of emigrations to the Tigris-Euphrates (Ashor, Uor in the south of Iraq and Al-Hadar in the north of Iraq) and Nile valleys. In addition to that, there was some likeliness of alleles frequencies with Turkish, Iran, Caucasoid and oriental populations because of the influence of invasion, emigration to other parts of the world and outbreeding .

Table (9) Percentage frequencies of HLA-A, -B, -Cw, -DR and -DQ antigens in some European, African and American countries.

HLA Antigen s	European Caucasoid N=2648 (19)	U.K. N=187 (31)	France N=591 (32)	Nigeria N=114 (31)	Zambia N=166 (31)	U.S.A. N=80 (30)	Mexico N=300 (32)
A1	27.50	32.00	23.00	04.40	04.20	07.50	14.30
A2	45.30	47.00	44.00	27.20	27.10	52.50	51.70
A3	21.90	27.80	26.00	18.40	09.00	05.00	14.30
A11	11.50	13.90	12.00	00.00	00.00	38.80	06.70
A23(9)	04.50	03.70	05.00	18.40	NT	NT	05.30
A24(9)	18.20	12.30	19.00	00.90	NT	NT	19.70
A25(10)	03.70	04.80	04.00	00.00	NT	NT	02.70
A26(10)	07.20	05.80	08.00	01.70	NT	NT	03.00
A28	07.70	06.40	06.00	19.30	17.00	02.50	16.30
A29(19)	07.40	09.60	11.00	05.30	15.10	03.80	07.70
A30(19)	04.70	04.30	10.00	20.20	31.60	06.30	08.00
A31(19)	05.40	06.40	NT	07.00	05.60	02.50	08.00
A32(19)	08.80	08.60	05.00	01.70	01.20	00.00	05.00
A33(19)	03.30	02.60	01.00	24.60	26.60	13.80	05.00
A34(10)	01.20	00.00	NT	11.40	04.50	NT	NT
A36	00.70	00.00	NT	15.80	09.00	NT	00.30
B5	16.80	08.00	13.00	04.40	02.40	12.50	18.00
B7	16.80	24.00	19.00	14.00	19.30	05.00	12.00
B8	15.40	25.60	17.00	00.00	05.40	01.30	09.70
B12	22.90	35.80	29.00	14.90	33.90	01.30	18.00
B13	05.60	03.20	03.00	01.70	01.80	13.80	02.30
B14	05.80	10.10	09.00	00.00	09.00	00.00	07.70
B15	11.40	09.10	08.00	07.90	05.40	27.50	10.00
B16	09.10	04.20	NT	04.40	03.60	07.50	14.70
B17	08.40	06.40	07.00	32.50	30.30	28.80	04.00
B18	11.20	09.00	12.00	10.50	07.90	01.30	11.00
B21	07.00	01.00	09.00	07.90	05.50	00.00	09.70
B22	05.50	03.70	05.00	00.00	00.00	08.80	03.00
B27	07.70	12.80	07.00	00.00	00.00	06.30	04.70
B35	18.20	14.40	19.00	11.40	14.40	08.80	35.30
B37	03.00	04.20	02.00	01.70	NT	00.00	01.30
B38(16)	05.00	01.60	07.00	00.00	NT	NT	NT
B39(16)	04.10	02.60	NT	04.40	NT	NT	NT
B40	10.00	12.80	10.00	00.90	00.60	41.30	16.30
B41	02.00	01.60	NT	01.70	NT	00.00	01.00
B42	00.60	00.00	NT	13.20	06.00	NT	01.00
B44(12)	20.70	35.80	NT	10.50	NT	NT	NT
B45(12)	02.20	01.00	NT	04.40	NT	NT	NT
B46	NT	NT	NT	NT	NT	NT	NT
B47	00.70	01.60	NT	00.00	NT	NT	NT
B48	01.00	NT	NT	NT	NT	NT	NT
B49(21)	04.50	01.00	NT	07.90	NT	NT	NT
B50(21)	02.50	00.00	NT	00.00	NT	NT	NT
B51(5)	13.90	08.00	NT	01.70	NT	NT	NT
B52(5)	02.90	00.00	NT	02.60	NT	NT	NT
B53	01.70	00.00	NT	39.50	21.10	NT	NT
B55(22)	NT	NT	NT	NT	NT	NT	NT

B56(22)	NT	NT	NT	NT	NT	NT	NT
B57(17)	06.20	04.30	NT	16.70	NT	NT	NT
B58(17)	02.20	01.00	NT	15.80	NT	NT	NT
B59	00.90	NT	NT	NT	NT	NT	NT
B60(40)	06.70	10.30	NT	00.00	NT	NT	NT
B61(40)	03.30	01.00	NT	00.90	NT	NT	NT
B62(15)	10.40	09.10	NT	00.00	NT	NT	NT
B63(15)	01.00	00.00	NT	06.10	NT	NT	NT
B70	NT	00.00	NT	21.00	34.80	NT	NT
B71	NT	00.00	NT	10.60	NT	NT	NT
B72	NT	00.00	NT	10.50	NT	NT	NT
Cw1	NT	07.80	08.00	00.00	00.00	25.00	NT
Cw2	NT	10.60	12.00	14.90	20.10	02.50	NT
Cw3	NT	24.00	18.00	15.80	18.30	40.00	NT
Cw4	NT	19.50	19.00	49.10	21.10	08.80	NT
Cw5	NT	23.40	15.00	08.80	NT	00.00	NT
Cw6	NT	15.60	NT	21.1	NT	NT	NT
Cw7	NT	36.60	30.00	22.80	NT	NT	NT
Cw8	NT	07.10	NT	05.30	NT	NT	NT
DR1	NT	16.10	NT	11.60	05.10	17.90*	NT
DR2	NT	31.70	NT	38.80	20.30	23.00*	NT
DR3	NT	31.70	NT	12.60	37.00	30.90*	NT
DR4	NT	36.70	NT	00.90	12.30	NT	NT
DR5	NT	14.30	NT	32.00	18.10	27.00*	NT
DR6	NT	19.30	NT	41.50	36.20	36.00*	NT
DR7	NT	27.30	NT	17.50	13.80	23.90*	NT
DR8	NT	07.40	NT	15.50	09.40	NT	NT
DR9	NT	01.20	NT	02.90	05.10	NT	NT
DR10	NT	01.20	NT	00.00	05.80	NT	NT
DR11	NT	NT	NT	NT	NT	NT	NT
DR12	NT	NT	NT	NT	NT	NT	NT
DR13	NT	NT	NT	NT	NT	NT	NT
DR14	NT	NT	NT	NT	NT	NT	NT
DQ1	NT	NT	NT	NT	NT	NT	NT
DQ2	NT	NT	NT	NT	NT	NT	NT
DQ3	NT	NT	NT	NT	NT	NT	NT
DQ4	NT	NT	NT	NT	NT	NT	NT

NT = Not tested.

- American blacks.

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