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A GENETIC STUDY OF IRANIAN POPULATIONS: SERUM PROTEINS

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ABSTRACT

A total of 1611 serum samples collected from ten ethnically distinct populations of Iran (Turks and Kurds of Rezaieh, Lurs, Zabolis, Baluchis, Turks and Kurds of Shirvan, Zoroastrians, Tehranis and Kermanis) were examined for haptoglobin, transferrin and the third component of complement systems. The gene frequencies obtained in these samples were combined with those of the previous studies on other Iranian groups to determine the genetic structure of the Iranian population as a whole. The population of Iran was then compared with reported frequencies for neighbouring populations as well as with those for European and Indian groups.

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The generalized feature of serum protein gene frequencies for the whole country of about 27% HP^1; 13% C^F3 and the predominance of the Tf^D to the Tf^B allele, all show a departure from the values found in the countries to the west and an approach to those in the Indian region.

INTRODUCTION

In continuation of our previous study "A genetic study of Iranian populations I. Blood groups", an attempt has here been made to ascertain the extent of variation of serum proteins among Iranian population groups. The distribution of serum proteins in Iranian populations has been studied by different investigators (see Table 2). In most of the previous studies only Hp types were determined and relatively little attention was paid to the determination of Tf and very little indeed of C3 types. The present investigation of ten different not previously studied Iranian groups therefore extends genetic information to include the Tf and C3 systems in the country.

The present results together with those of earlier studies on other Iranian groups were used to determine the genetic structure of the Iranian population as a whole and the population was then compared with reported frequencies for neighbouring populations as well as European and Indian groups.

MATERIALS AND METHODS

In five field surveys between 1979 and 1982 blood samples were collected from ten ethnically distinct populations of Iran. There were 149 Turks and 147 Kurds from Rezaieh in the north west, 178 Lurs from Luristan in the south west, 118 Zabolis and 111 Baluchis from Sistan and Baluchistan in the south east, 122 Turks and 112 Kurds from Shirvan in the north east, 174 Zoroastrians from Yazd in central, 186 Tehranis and 312 Kermanis from Kerman in the south east of Iran.

The serum was separated from the blood samples on the day of the collection and stored at (-30) C until analysis. The electrophoretic studies were performed partly in Tehran and partly, by transporting the samples in dry ice to the department of Anthropology, in the University of Durham, U.K. The determination of Hp types was performed using horizontal starch gel electrophoresis(38) and discontinuous buffer system (30). The gels were stained with Leucomalachite green activated by a few drops of hydrogen peroxide. The typing of Tf and C3 was carried out by high voltage agarose gel electrophoretic method (41).

RESULTS AND DISCUSSION

The numbers of the phenotypes and the respective gene frequencies in the three serum protein systems are shown in Table 1. No system showed any deviation from Hardy-weinberg equilibrium. In Table 2 are shown gene

frequencies for the three serum protein systems in various populations of Iran.

Haptoglobin (HP)

Previous studies on the haptoglobin system show that the frequency of the Hp^1 gene ranges from 14.50 to 35.57% in Iranians. Values varying between 21.79 and 30.71% obtained in the present investigation are within this range of variation.

In general, the Hp^1 values averaging about 27% in Iranians are much lower than those around 40% in Europeans but higher than in Indians in whom Hp^1 values are mostly low, around 15%(26).

It is difficult to see any definite regional trends but the Hp^1 gene frequency tends to be lower in the east than the west.

The relatively lower Hp^1 frequencies in the Caspian sea area (12,23) could be related to tropical disease syndromes, such as malaria, sickle cell disease, G6PD deficiency, etc, which are more common in this area.

Reported Hp^1 frequencies for neighbouring populations (2,6,7,15,16,18,19,21,22,24,28,31,32,33,35,36,39,42,43,44) showed that, with the exception of the Arab groups of Kuwait and Saudi Arabia with their higher values, the frequency of the Hp^1 gene varying between 25% in the Pakistani population and 32% in the population of the Caucasus, is also lower than that found in Europeans but higher than in Indians. The overall frequency of

Hp^1 in Arab populations seems to be higher than other Asiatic populations. Generally, haptoglobin is a system indicating a substantial influx of African genes in the Arabian Peninsular populations.

However, in agreement with the suggestion of Farhud (1980), there appear to be a cline of decreasing Hp^1 gene frequencies from Europe to India via the Middle East. From the data available on Iranian and neighbouring populations the same trend seems to exist, as the Hp^1 frequency decreases obviously from the west (32% in the Caucasus) towards the east (25% in Pakistan), whilst the Hp^2 frequency increases. The precise significance of this cline in terms of environmental and genetic causation, can not at present be gauged.

Transferrin (Tf)

In the Tf system seven samples, out of ten, showed only the CC type. A single Zoroastrian and a single Kermani were typed as CD. In the Kurdish sample of Shirvan one CD and one CB were typed.

The earlier Tf studies showed that besides the common TfC, both TfB and TfD variants are found in Iranians but the TfD variant seems to be more frequent than the TfB, the highest frequency of the Tf^D allele being 2.56% in the Ghashghai tribe of southern Iran (4).

Available reports on Tf frequencies in neighbouring populations (5,18,22,24,28,31,33,42) showed that in these populations also, on the whole, the TfD variant

is mor frequent than the TfB.

According to Mourant et al (1976) the transferrin B variants, though always rare, are the main ones found in European populations while the main distribution of the TfD variants are in the peoples of southern and wouth eastern Asia including India. In Iranian and neighbouring populations, as in other Asian groups, transferrin D seems to be the main Tf variant.

The third component of complement (C3)

For the complement system the $C3^F$ gene frequency ranges from 5.78 to 22.43% in the ten Iranian samples. Together with the results of previous studies in other Iranian groups (1,12,14) mean $C3^F$ value of around 13% is obtained for Iranians which is considerably lower than that of about 21% in Europeans (17) but higher than in Indians in whom $C3^F$ values vary between 2.5 and 9.8% (29).

In neighbouring populations (18,31,34) also, with the exception of the Iraqi populations with their higher $C3^F$ values which are more similar to the European frequencies, the frequency of the $C3^F$ gene is lower than that found in Europeans but higher than in Indians.

In conclusion, the generalized feature of serum protein gene frequencies for the whole country of about 27%Hp^1; 13% $C3^F$; and the predominance of the Tf^D to the Tf^B allele, all show a departure from the values found in the countries to the west and an approach to those in the Indian region.

Table 1. Phenotypes and gene frequencies for serum protein groups in ten populations of Iran

System	Turks Rezaieh	Kurds Rezaieh	Lurs	Zabolis	Baluchis	Turks Shirvan	Kurds Shirvan	Zoroas-trians	Tehranis	Kermanis
HP_{1-1}	11	18	10	3	5	3	4	15	9	31
2-1	51	50	61	45	43	43	39	56	51	108
2-2	79	72	106	69	59	57	58	95	71	141
0-0	4	5	1	1	4	3	1	5	5	14
Total	145	145	178	118	111	106	102	171	136	294
HP^1	25.89	30.71	22.28	21.79	24.77	23.79	23.27	25.90	26.34	30.36
HP^2	74.11	69.29	71.12	78.21	75.23	76.21	76.73	74.10	73.66	69.64
χ^2	0.46	3.62	0.10	1.92	0.66	2.36	0.67	2.44	0.00	2.16
Tf										
CC	149	147	178	118	111	120	112	174	186	312
CB	-	-	-	-	-	1	-	-	-	-
CD	-	-	-	-	-	1	-	1	-	1
Total	149	147	178	118	111	122	112	175	186	313
Tf^C	100.00	100.00	100.00	100.00	100.00	99.18	100.00	99.71	100.00	99.84
Tf^B	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00
Tf^D	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.29	0.00	0.16
$C3$										
S-S	77	76	101	80	67	70	53	93	44	177
S-F	12	12	37	27	32	11	6	34	7	21
F-F	1	1	5	2	8	1	1	4	-	1
Total	90	89	143	109	107	82	60	131	51	199
$C3^F$	7.78	7.87	16.43	14.22	22.43	7.92	6.67	16.03	6.87	5.78
$C3^S$	92.22	92.13	83.57	85.78	77.57	92.08	93.33	83.97	93.13	94.22
χ^2	0.43	0.43	0.60	0.02	2.11	0.55	2.32	0.17	0.27	0.18

Table 2. Serum protein gene frequencies in various populations of Iran

Sample	No. Tested	Hp		No. Tested	Tf			No. Tested	C3		Authors
		Hp^1	Hp^2		Tf^C	Tf^B	Tf^D		$C3^F$	$C3^S$	
Iranians	34	25.00	75.00	-	-	-	-	-	-	-	Harris (1959)
Jews	91	30.22	69.78	-	-	-	-	-	-	-	Ramot et al (1962)
Jews	101	29.21	70.79	-	-	-	-	-	-	-	Fried et al (1963)
Shiraz	97	33.57	64.43	-	-	-	-	-	-	-	Walter & Djahanshahi(1963)
Zoroastrians Tehran & Yazd	145	18.97	81.03	145	99.31	0.00	0.69	-	-	-	Bowman (1964)
Moslems Shiraz	429	28.44	71.56	429	97.67	0.35	1.98	-	-	-	Bowman (1964)
Ghashghais	117	32.48	67.52	117	97.44	0.00	2.56	-	-	-	Bowman (1964)
Eastern Iran	179	24.90	75.10	-	-	-	-	-	-	-	Bajatzadeh & Walter (1969)
Central & Southern Iran	245	26.30	73.70	-	-	-	-	-	-	-	Bajatzadeh & Walter (1969)
North western Iran	250	27.60	72.40	-	-	-	-	-	-	-	Bajatzadeh & Walter (1969)
Western Iran	313	28.20	71.80	-	-	-	-	-	-	-	Bajatzadeh & Walter (1969)
Northern Iran	179	31.00	69.00	-	-	-	-	-	-	-	Bajatzadeh & Walter (1969)

Table 2. Continued

Sample	No. tested	Hp		No. tested	Tf			No. tested	C3		Authors
		Hp^1	Hp^2		Tf^C	Tf^B	Tf^D		$C3^F$	$C3^S$	
Tehran	400	32.40	67.60	-	-	-	-	-	-	-	Bajatzadeh & Walter(1969)
Tehran	366	27.00	73.00	-	-	-	-	-	-	-	Farhud & Walter (1972)
Kurdish Jews	94	22.04	77.96	-	-	-	-	-	-	-	Godber et al (1973)
Kurds Sanandaj	108	26.89	73.11	105	100.00	0.00	0.00	-	-	-	Lehmann et al (1973)
Kurds Baneh, Marivan	77	32.64	67.36	-	-	-	-	-	-	-	Lehmann et al (1973)
Tehran	186	29.30	70.70	186	100.00	0.00	0.00	-	-	-	Sawhney (1975)
Isfahan	91	30.34	69.66	89	99.44	0.00	0.56	-	-	-	Sawhney (1975)
Jews	158	31.00	69.00	-	-	-	-	-	-	-	Sinhai (1976)
Jews	159	32.00	68.00	-	-	-	-	-	-	-	Tabatabai (1977)
Armenians	228	34.40	65.60	-	-	-	-	-	-	-	Tabatabai (1977)
Northern Gorgan	38	14.50	85.50	38	100.00	0.00	0.00	-	-	-	Kirk et al (1977)
Southern Gorgan, Behshahr, Sari	52	20.20	79.80	52	100.00	0.00	0.00	-	-	-	Kirk et al (1977)

Table 2. Continued

Sample	No. tested	Hp		No. tested	Tf			No. tested	C3		Authors
		Hp^1	Hp^2		Tf^C	Tf^B	Tf^D		$C3^F$	$C3^S$	
Babol, Shahi Amol	61	21.30	78.70	61	100.00	0.00	0.00	-	-	-	Kirk et al (1977)
Gonbad	153	21.70	78.30	153	100.00	0.00	0.00	-	-	-	Kirk et al (1977)
Shahsavar, Rudsar, Rudbar, Rasht, Langarud, Lahijan, Bandar-Pahlavi	84	22.20	77.80	84	100.00	0.00	0.00	-	-	-	Kirk et al (1977)
Tavalesh Astara	60	25.00	75.00	60	100.00	0.00	0.00	-	-	-	Kirk et al (1977)
Kurdish Jews	106	25.24	74.76	106	100.00	0.00	0.00	-	-	-	Tills et al (1977)
Dezfool	545	26.30	73.70	587	99.07	0.42	0.51	-	-	-	Farhud et al (1977)
Bandar-Abbass	1246	26.60	73.40	901	99.56	0.16	0.28	-	-	-	Farhud et al (1978)
Caspian sea area	240	24.90	75.10	344	99.42	0.15	0.43	43	23.30	76.70	Farhud et al (1979)
Ghashghais	510	27.50	72.50	548	98.55	1.27	0.18	-	-	-	Farhud et al (1979)
Iranians	627	28.07	71.93	-	-	-	-	-	-	-	Farhud (1980)
Guilanians	508	28.10	71.90	511	99.22	0.00	0.78	-	-	-	Ohkura et al (1984)

Table 2. Continued

Sample	No. tested	Hp		No. tested	Tf			No. tested	C3		Authors
		Hp^1	Hp^2		Tf^C	Tf^B	Tf^D		$C3^F$	$C3^S$	
Mazandaranians	508	28.40	71.60	520	99.81	0.00	0.19	-	-	-	Chkura et al (1984)
Bandari	161	27.00	73.00	161	99.40	0.30	0.30	133	12.00	88.00	Akbari et al (1984)
Turkoman	97	28.00	72.00	97	100.00	0.00	0.00	85	12.00	88.00	Akbari et al (1984)
Zabolis	118	21.79	78.21	118	100.00	0.00	0.00	109	14.22	85.78	Present study
Lurs	178	22.88	77.12	178	100.00	0.00	0.00	143	16.43	83.57	Present study
Kurds.Shirvan	102	23.27	76.73	112	100.00	0.00	0.00	60	6.67	93.33	Present study
Turks.Shirvan	106	23.79	76.21	122	99.18	0.41	0.41	82	7.92	92.08	Present study
Baluchis	111	24.77	75.23	111	100.00	0.00	0.00	107	22.43	77.57	Present study
Turks Rezaieh	145	25.89	74.11	149	100.00	0.00	0.00	89	7.87	92.13	Present study
Zoroastrians	171	25.90	74.10	175	99.71	0.00	0.29	131	16.03	83.97	Present study
Tehranis	136	26.34	73.66	136	100.00	0.00	0.00	101	20.79	72.21	Present study
Kermanis	294	30.36	69.64	313	99.84	0.00	0.16	199	5.78	94.22	Present study
Kurds Rezaieh	145	30.71	69.29	147	100.00	0.00	0.00	89	7.87	92.13	Present study

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