Blood Groups of a Population of Ashkenazi Jews in Brazil

F. OTTENSOOSER, N. LEON, M. SATO AND P. H. SALDANHA
Laboratório de Genética Médica, Faculdade de Medicina, Universidade de São Paulo, Brazil

Jewish communities, because of their historical uniqueness and persistence as isolates within other populations, bring up interesting anthropological problems. It is not possible to understand the genetic relationships between several Jewish groups and their neighbors without knowing the history of Jewish dispersal. Although small numbers of Jews had earlier migrated to Yemen, the prinicipal Jewish groups recognized today resulted from three main migratory movements, beginning in 586 B.C. In that year, Jerusalem was conquered by the Babylonians, ending the formation period of the Jewish people in Palestine. This first diaspora took the Jews into captivity in Mesopotamia; many returned to their homeland, but some formed the nuclei of the later oriental Jewish populations. The second diaspora, in 334 B.C., brought Hebrews from Israel to Northern Africa (especially Morocco and Egypt) and to Syria as well as to the Balkan and Caucasian regions. The last and most important diaspora, which began in 70 A.D. after the second destruction of the temple, took the Jews to the Roman World. From this dispersal movement, Jewish groups settled mainly in Spain and in the Rhine Valley in Germany. The remnants of the former are now spoken of as Sephardim and those of the latter as Ashkenazim. In 1492, Sephardi Jews together with the Moors were expelled from Spain, spreading towards several points of western Europe (France and Holland) and the Mediterranean Basin (Morocco, Italy, Bulgaria and chiefly Turkey). Ashkenazi Jews in the Rhineland were frequently expelled and persecuted. After the first crusade in 1096 the bulk of them migrated eastward and settled mainly in Poland. From there, they came to Russia and Romania. These Ashkenazi communities, however, absorbed some Jewish groups, previously living in the Caspian region where they arrived during the second diaspora. North and South American, British and South African Jews of today are mainly derived from Ashkenazim.

Before and during dispersal Jewish populations acquired various non-Jewish components. Gene flow into Jewish communities appears to have been important during the captivity in Egypt; Moses, when leaving Egypt (1445 B.C.), was accompanied by a mixed multitude of non-Hebrews. After settling in Palestine, Hebrews intermarried largely with Amorites and Philistines. Probably mixing was also strong in the third diaspora all over the Roman world. An important exogamic experience is represented by the conversion of Khazars, in the Volga region, to judaism, when in contact with Byzantine Jews around 966 A.D. The history of gene flow into Jewish people was recently considered by Leibowitz ('58). Figure 1 shows the main Jewish dispersal movements and the groups at present recognized. The figure is based on Coon's ('39) book to be consulted for further information.

Blood groups proved to be useful for comparing Jewish populations with their neighbors (Gurevitch and associates, '51–'62). Ashkenazim examined before World War II had, like their neighbors, lower B frequencies in Western Europe than in Eastern Europe, Poland and Russia. Their Rh gene frequencies, however, differed distinctly from those of Central or Eastern Europeans (Mourant, '54), and were very similar to those of Mediterraneans (see also Mourant, '50). Moreover, the incidence of non-tasters for phenylthiourea among Ashkenazi groups (Saldanha and Beçak, '59; Sheba et al., '62) is significantly lower than in Northern Europeans,

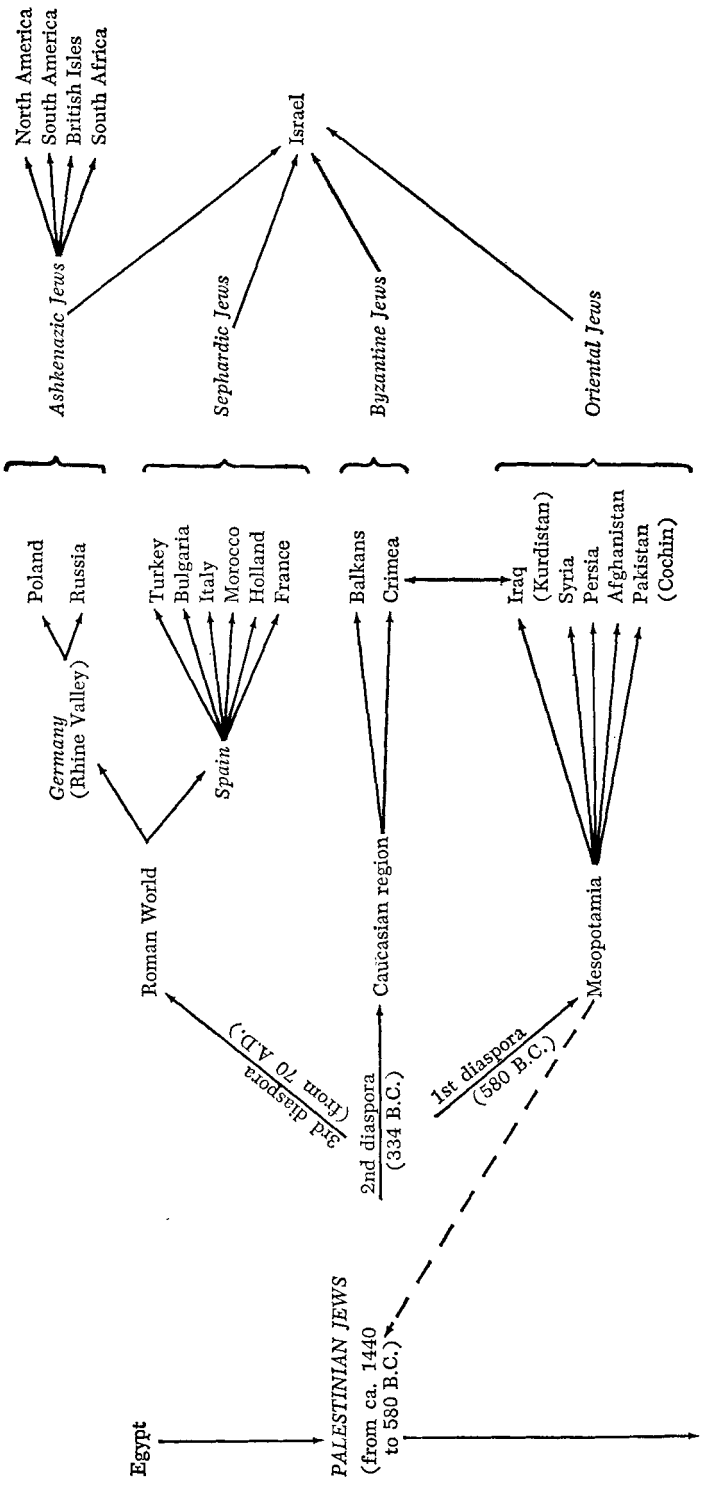

Fig. 1 Main Jewish dispersal movements and groups currently recognized.

resembling mongoloid as well as Mediterranean values. Thus decreased frequency of non-tasters and Rh-negatives as well as increased B frequency in the Ashkenazim might be taken as "mongoloid" influence. Furthermore, the only Diego positive whites so far found have all been of Polish descent: one in Buffalo, New York and two in Milwaukee, Wisconsin (Chown, '62); among them, one is known to be of Jewish origin. Therefore, the possibility of a "mongoloid" component among Ashkenazim prompted this investigation.

MATERIAL AND TECHNIQUE

The Diego factor, Rh types and ABO blood groups of 100 Ashkenazic Jews were investigated in São Paulo, Brazil. The sample includes only unrelated subjects whose parents or grandparents were born in Central or Eastern Europe, especially Poland. In every case, Jewish extraction was confirmed and people with known non-Jewish ancestors were excluded from the sample. Subjects were identified as Ashkenazim by personal inquiry, surname, customs and association to the cultural organizations where the blood samples were collected. About 50% of the families of the 100 Ashkenazic Jews examined, came from Poland or Russia and about 30% from Germany. The remaining 20% include subjects with ancestors from other central European or Slavic countries.

Jewish and control blood samples were collected in test tubes containing ACD for preservation and kept in the ice-box. Tests were done within 24 hours after blood collection.

ABO: Sera from various sources were used.

M–N: Tube tests were performed with anti-M (Ortho Research Foundation) and with extract of *Vicia graminea* (Ottensooser and Silberschmidt, '53).

Rh: The Rh_0 (D)-tests were done on slides twice, on different days with sera of Ortho Research Foundation and of Banco de Sangue de São Paulo. Tube tests were done for rh′(C), rh″(E) and hr′(c) with sera from Ortho Research Foundation.

Diego: The Diego factor was determined with serum kindly furnished by Dr. Miguel

TABLE 1

Distribution of ABO, MN and Rh among 100 Ashkenazic Jews

Blood group	Phenotypic frequencies (%)					Gene frequencies (%)					χ^2	P
ABO	O	A	B	AB		r	p		q		0.09	0.75
	35	37	21	7		59	25		16		(1 d.f.)	
MN	M		MN	N		m			n		0.67	0.45
	25		54	21		52			48		(1 d.f.)	
Rh	rh	Rh_0	Rh_1Rh_1	Rh_1rh	Rh_2	Rh_1Rh_2	Rh_1Rh_z	r	R^0	R^1	R^2	R^z	1.44	0.90
	ccddee	ccDee	CCDee	CcDee	ccDE	CcDE	CCDE	cde	cDe	CDe	cDE	CDE		
	4	7	25	32	14	17	1	20	13	50	16	1	(5 d.f.)	
Diego	100 subjects were tested, all were negative										—	—		

TABLE 2

Distribution of ABO and MN genes among Jewish and Gentile pertinent populations

Populations	Gene frequencies (%)					Author and number tested*
	O	A	B	M	N	
Swedes	64.1	28.4	7.5	55.4	44.6	Grubb and Wiklund, '53 (600) Grubb, '53 (1368)
Germans (Western)	65.2	27.7	7.6	53.4	46.6	Mayser, '51 (1300 and 2578)
Poles	52.9	32.7	14.4	59.7	40.3	Dunsford, '53 (183) Kelus et al., '52 (3100)
Ashkenazim:						
in Canada	60.0	28.5	9.1	—	—	Chown et al., '49 (140)
in Israel	61.7	27.4	10.9	—	—	Gurevitch et al., '51 (946)
	61.9	26.6	11.5	53.5	46.5	Margolis et al., '60 (465)
in Russia (Moscow)	59.5	24.7	15.7	—	—	Grigorova, '31 (371)
in Brazil	58.9	25.6	15.6	52.0	48.0	Present series (100)
Sephardim	62.4	22.9	14.7	—	—	Gurevitch et al., '51 (252)
	54.2	32.2	13.7	50.0	50.0	Margolis et al., '60 (200)
Other Jewish groups in:						
Persia	55.0	26.4	14.7	59.2	40.8	Gurevitch et al., '56 (200)
Morocco	62.2	23.1	14.7	55.9	44.1	Margolis et al., '57 (220)
Tunisia	62.9	21.2	15.9	55.5	44.5	Margolis et al., '57 (200)
Yemen	72.4	18.5	16.4	75.6	24.4	Gurevitch et al., '56 (500)
Kurdistan	51.2	32.0	16.8	52.9	47.1	Gurevitch et al., '56 (129 and 120)
Baghdad	49.3	30.1	16.8	60.5	39.4	Gurevitch et al., '56 (162)
Tripolitania	62.5	21.1	18.6	50.5	49.5	Gurevitch et al., '56 (200)
Cochin	73.1	10.1	20.6	60.0	40.0	Gurevitch et al., '56 (275)
Spaniards	64.7	29.2	6.1	51.1	48.9	Hoyos Sainz, '47 (6428) Carrion et al., '57 (535)
Greeks	66.5	24.3	9.2	—	—	Constantoulis and Paidoussis, '57 (6378)
Egyptians	54.1	24.4	21.5	51.4	48.6	Donegani et al., '50 (144)
Northern Nilotes	74.7	13.4	10.9	54.7	45.3	Roberts et al., '55 (300)

* The first author or number refers to ABO and the second to MN gene frequencies. For full reference see the books by *Mourant* ('54) and *Mourant et al.* ('58).

Layrisse. To one drop of anti-Diego serum, diluted one-third to one-fourth in saline, two drops of 5% of saline suspension of twice-washed red cells were added. After incubation at 37° for one hour and four washings, the tubes were warmed at 37° for one minute, and one drop of antiglobulin serum (Cert. Blood Donor Service, N.Y.) was added. Spinning at 500 to 1,000 rpm during one minute was followed by readings. Two Diego positive bloods (of Japanese) were always included as controls.

RESULTS

Table 1 shows phenotypic and gene distributions for ABO, MN and Rh blood groups of 100 Ashkenazi Jews. They were all Diego-negative. The present report is the first one on the Diego factor in Jews, yet, according to Layrisse and Wilbert ('60) such studies had been initiated by Gurevitch among oriental Jews, the "Black Jews" of Cochin.

When compared with other series (tables 2 and 3) our value of r (cde) appears lower and that of R^0 (cDe) higher than might be expected. Therefore, as stated above, the Rh-positives of our series were reexamined with a second anti-Rh_0 serum whereby the previous results were confirmed. Moreover the usual statistical tests were extended to the comparison of our results with those of others.

The frequencies of Rh-negatives found by Lubinski ('45), Chown et al. ('49) and Berner ('60) among Ashkenazim are low and not far from our value. Chown et al. ('49) tested in Canada 140 European Jews, probably mainly Ashkenazim, with the four prinicipal anti-Rh sera. There are no significant differences between the Canadian data and ours as can be seen from the following schedule.

		Rh_1 (CDee)	Rh_2 (ccDE)	Rh_0 (ccDee)	rh (ccddee)	Remainder
Manitoba series	$\chi^2 = 0.21$	2.25	0.57	0.58	0.02
	$P = 0.75$	0.17	0.45	0.40	$\simeq$0.95
Present series	$\chi^2 = 0.29$	3.15	0.80	0.81	0.03
	$P = 0.60$	0.08	0.35	0.35	$\simeq$0.95

Considering the smallness of our series the high R^0 value and the low r value may be due to chance, as suggested by the statistical test. In the large series of Ashkenazim examined by Gurevitch et al. ('51) and Margolis et al. ('60b) the r frequencies were higher and the R^0 frequencies lower than in our series, their values still being "Mediterranean." Gurevitch's data could be "slightly affected by the fact that his subjects were apparently mainly maternity patients" who present an excess of Rh-negatives (Mourant, '54, p. 72). No information is available whether this applies also to Margolis' series.

DISCUSSION

Several polymorphic traits have been studied among Jewish populations of various origin, mainly by Gurevitch's and Sheba's groups making use of mass immigration to Israel.

Thus, ABO, M–N and Rh blood groups, taste sensitivity to phenylthiourea, G-6-PD deficiency, haptoglobins, finger prints as well as other genetical characters have been compared in Jewish populations (see

TABLE 3

Frequencies of the four most important genes or chromosomes in Jewish and pertinent Gentile populations

Population	Number tested	R^1 CDe	R^2 cDE	R^0 cDe	r cde	Author*
Swedes	2768	41.6	15.9	1.8	38.5	Broman, '52
Dutch	342	44.3	15.3	1.8	37.6	Van der Heide et al., '51
English	1798	41.4	14.5	2.6	39.0	Race and Sanger, '50
Germans	2472	43.9	13.7	2.6	37.8	Nagel et al., '53
Poles (Sheffield)	182	35.5	14.2	5.5	42.2	Dunsford, '55
Ashkenazi Jews in:						
Israel	946	45.1	12.7	4.6	36.0	Gurevitch et al., '51
	465	52.2	11.1	5.3	30.6	Margolis et al., '60
Canada	140	53.4	11.5	5.4	26.3	Chown et al., '49
Brazil	100	50.0	15.8	13.2	20.0	Present series
Oriental Jews	137	46.8	9.3	5.8	37.3	Gurevitch et al., '51
Sephardi Jews	252	49.0	6.5	8.9	34.5	Gurevitch et al., '51
	200	45.8	9.2	11.0	26.6	Margolis et al., '60
Other Jewish groups in:						
Baghdad	162	53.5	15.8	4.1	19.8	Gurevitch et al., '56
Kurdistan	129	53.0	17.9	5.1	15.0	Gurevitch et al., '56
Persia	200	60.5	10.9	6.0	22.3	Gurevitch et al., '56
Cochin	275	41.5	5.0	6.2	44.4	Gurevitch et al., '56
Yemen	500	56.1	7.9	6.5	28.2	Gurevitch et al., '56
Morocco	220	53.4	6.3	9.5	30.8	Margolis et al., '57
Tunisia	200	56.1	6.6	8.5	28.5	Margolis et al., '57
Tripolitania	200	43.0	7.9	9.5	36.4	Gurevitch et al., '56
Sardinians	107	66.8	8.8	2.1	22.2	Morganti et al., '49
Spaniards (Madrid)	1848	51.7	9.1	3.3	35.7	Elosegui, '51
Greeks (Athens)	578	45.1	7.3	5.6	35.4	Pangalos, '53
Egyptians	184	49.5	9.0	16.1	24.3	Donegani et al., '50
Pakistanis (Peshawar)	155	55.7	8.8	4.8	25.1	Boyd and Boyd, '53
Northern Nilotes	310	0	1.6	78.0	19.3	Roberts et al., '55

* For full references see Mourant's ('54) book.

Mourant, '59). However, sometimes it is difficult to evaluate information obtained from different investigations. First of all, the advantage of the convergence of different Jewish groups into Israel, mostly during the last 30 years, might be counterbalanced, in part, by the selective nature of those movements. Motivation to migrate to Israel or to other regions has been associated with social and psychological factors and, consequently, with racial stratification. Secondly, the differences of genetical traits between Jewish and other communities are sometimes very small. Thirdly, there are clearly adaptive traits like G-6-PD deficiency (Motulsky and Campbell-Kraut, '60) which display great variability among Jews in different regions but reflect present or not very remote ecological diversity, rather than racial divergence. Finally, the origin of some subjects included in the series as Jews is doubtful for various reasons.

Data on finger prints, taste sensitivity to phenylthiourea and distribution of haptoglobins among different Jewish groups and pertinent Gentile populations are given by Sachs and Bat-Miriam ('57), Sheba et al. ('62) and Ramot et al. ('61). Distinction should be made between information based on monogenic and polygenic traits. Thus frequencies of fingerprint patterns are surprisingly homogeneous among Jewish population in different regions, but non-taster and ABO frequencies vary considerably. While the finger prints could suggest remote relations, ABO and taste dimorphism may indicate more recent racial divergence. Ashkenazim and less clearly, some Jewish populations in near Asia closely resemble Egyptians not only in the pattern of finger prints but also in the frequencies of non-tasters for phenylthiourea, as shown in table 4.

The blood groups contribute valuable information on racial relationships of Jewish populations. ABO and M-N frequencies of various Jewish and some other populations are presented in table 2. There are a few outstanding findings which have been discussed by Mourant ('54, '59). The Ashkenazim of the present series approach the B value of Russian Jews, surpassing those of other Ashkenazim and even Sephardim series. Most Jewish communities have M-N values similar among them and

TABLE 4

Frequencies of non-tasters for phenylthiourea among Jewish and pertinent Gentile populations, obtained by means of sorting technique

Population	Number tested	Non-tasters (%)	Author
Swedes	200	32.0	Åkesson, '59
Dutch (in Brazil)	190	27.9	Saldanha et al., '60
English	541	32.9	Harris and Kalmus, '49
Danes	314	34.1	Mohr, '51
Russians (in Brazil)	60	43.3	Freire-Maia et al., '60
Ashkenazi Jews	440	20.7	Sheba et al., '62
Polish Jews (in Brazil)	102	21.6	Saldanha and Beçak, '59
Other Jewish groups in:			
Balkans (non-Ashkenazim)	101	21.8	Sheba et al., '62
Iraq and Persia	336	16.1	Sheba et al., '62
North Africa	340	15.0	Sheba et al., '62
Yemen	261	18.0	Sheba et al., '62
Cochin	41	31.7	Sheba et al., '62
Gerba	41	41.7	Sheba et al., '62
Egyptians* (Mohammedans)	459	21.1	Boyd and Boyd, '37
Spaniards	306	24.8	Pons, '55
Sudan Arabs	63	25.4	Allison, '51
Hindus	256	29.3	Das, '58
Japanese	295	7.1	Saldanha, '58
West African Negroes	74	2.7	Barnicot, '50

* Value obtained by different technique. For full references see Saldanha's ('60) review.

also to the corresponding non-Jewish communities. Incidentally, results of the same workers in the same population may vary considerably, as shown by the A and Rh frequencies of the two Sephardim series. The Rh system is more efficient as a marker of Jews than the ABO and M-N systems (table 3). While North Europeans have less than 45% R^1, Mediterranean populations and Jews of various origin have more. On the other hand R^2 is low in Sephardim and other Mediterranean populations but higher in Ashkenazim, particularly in our series which could indicate influences either from Northern Europe or from Southeastern Asia; the latter assumption is to be preferred as may be seen from R^0 frequencies and other data.

Mourant, ('59); Margolis et al. ('60a, b); Gurevitch et al. ('62), have pointed out that the high R^0 frequency found in Ashkenazim, Sephardim, and other Jewish populations as well as in Egyptians and Moslems of the near East is an African feature. As to Sephardim, the penetration of this gene could be associated to a long process of mixing after dispersal throughout the Mediterranean Basin, having probably absorbed a considerable Arabic component in Spain and North Africa. However, this explanation fails to apply to the high R^0 frequencies of Ashkenazim who since the first centuries of the Christian era remained in Central and Eastern Europe without contact with R^0 rich people.

It seems likely that the ancient Palestine Jews had, besides a high R^0 frequency, also a high *B* frequency and low incidence of non-tasters and Rh-negatives.

Such figures are found at present in Egypt (Donegani et al., '50) and also in Kurdistan Jews who claim to be direct and unmixed descendants from Hebrews deported from Palestine to Babylonia in 586 B.C. and to have preserved in remote hills the customs of their ancestors (Gurevitch and Margolis, '55). They "might be considered as a pure stock" (Gurevitch et al., '53). The Kurdistan Jews differ only slightly from Egyptians on one hand and from Ashkenazim on the other in three of those four frequencies. The Ashkenazim would have maintained these values after dispersal in Europe, even if they appear to have acquired a moderate portion of "nordic" characteristics, such as blond hair, not present in the basic Palestine type (Coon, '39).

That the high *B* values of the Ashkenazim and their low values of non-tasters and Rh negatives are a Mediterranean heritage, and not derived from intermarriage with Mongoloid people is evidenced by the high R^0 value of the Ashkenazim, and, besides, by the virtual absence of Diego-positives among them. However the lack of Diego-positive in our small sample does not exclude that a mongoloid component among Eastern European Jews may exist. Diego tests would be of interest in Jews of near East Asia whose higher B values and lower Rh-negative and non-taster values as compared to those of Ashkenazim suggest "Armenoid" and mongoloid influences — a hypothesis supported by historical facts. As mentioned above, "Black Jews" of Cochin were perhaps already examined for Diego.

On the whole one may assume that an African component similar to that found today in Egyptians was present in the ancient Hebrews already before the diaspora. Admixture began under slavery in Egypt if not before. The Jews who preserved an African component during thousands of years are an example of a social isolate comparable to endogamous groups in India.

SUMMARY

ABO, M-N, Rh and Diego blood groups of 100 Ashkenazic Jews in São Paulo, Brazil were investigated. All subjects were Diego-negative. ABO and M-N frequencies were similar to those found in previous Ashkenazi samples. Rh frequencies showed typical Mediterranean distribution, Ashkenazi Jews showing higher *B* and R^0 gene frequencies and lower *r* frequency than their neighbors. Probably these characteristics were inherited from ancient Hebrews in Palestine.

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