

## Study of Blood Groups and Hemoglobin Variants of the Sikhs in Calcutta

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IT IS well known that blood-group studies are useful in classifying populations and in tracing past migrations and mixings of ethnic groups. Such studies have been conducted for a number of years among different Indian castes, tribes and religious groups but most of them were based on the ABO system. More recently, other systems of blood groups and hemoglobin variants were investigated.

The present study deals with the distribution of ABO, MNSs and Rh blood groups and hemoglobin variants among the Sikhs in Calcutta, most of whom are reported to have migrated from the Punjab after the partition of India. The distribution of ABO and Rh blood groups among Punjabi people have been reported by Pathak<sup>1</sup>, Anand<sup>1</sup>, Talwar and Sawhney<sup>4</sup> and Pathak<sup>4</sup>, and a detailed investigation of blood groups and hemoglobin variants was made by Bird *et al.*<sup>2</sup>

### Materials and Methods

During the years 1963 to 65, 427 blood specimens were collected from 216 children belonging to a Sikh school, and from 211 adults attending morning prayer in a Sikh temple. Blood specimens were tested by standard methods for blood group antigens A, B, M, N, S, s, C, D, E, e and c but all of them were not tested for every antigen. Hemoglobin variants were detected by paper electrophoresis.

Gene frequencies of ABO and MN blood groups

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were determined by maximum likelihood and gene counting methods respectively, while chromosomal frequencies of MNSs and Rh blood groups were calculated by Mourant's<sup>3</sup> method.

### Results and Discussion

Of the 427 blood specimens analyzed, group B showed the highest frequency (38.2 percent) and was followed by group O (28.6 percent), group A (22.7 percent) and group AB (10.5 percent). The frequencies of genes *O*, *A* and *B* were 53.3, 18.3 and 28.4 percent respectively (Table I). The present blood group frequencies more closely resemble those of Anand<sup>1</sup> and Pathak<sup>2</sup> than those of Bird *et al.*<sup>2</sup> and Talwar and Sawhney<sup>4</sup>. However, it should be pointed out that like other north Indian people there is a preponderance of gene *B* over gene *A* among the Sikhs in Calcutta.

In a sample of 208 individuals, 50.5 percent belong to group M, 38.9 percent to group MN and 10.6 percent to group N. The gene frequencies for *M* and *N* are 70 percent and 30 percent respectively

Table I. ABO blood groups of the Sikhs in Calcutta

Phenotype	Observed number	Expected number	Observed frequency	Expected frequency
O	122	121.50	0.2857	0.2845
A	97	97.58	0.2272	0.2285
B	163	163.61	0.3817	0.3832
AB	45	44.31	0.1054	0.1038
Total	427	427.00	1.0000	1.0000

Gene frequencies:  
 $P = 0.1820 \pm 0.0130$   
 $q = 0.2837 \pm 0.0168$   
 $r = 0.5334 \pm 0.0180$

(Table II) and are comparable to those obtained by Bird *et al.*<sup>2</sup>

In the detailed analysis of 70 blood specimens with four antisera—anti-M, -N, -S and -s—gene S was more often found to be associated with M than with N resulting in a higher frequency for MS chromosomes (27.4 percent) than for NS (2.9 percent) chromosomes (Table III). However, Bird *et al.* obtained 24.2 percent for MS chromosomes and 6.0 percent for NS chromosomes.

On examining 411 individuals, the gene frequencies for D and d were found to be 72.5 percent and 27.5 percent, with approximately 92.4 percent Rhesus positive and 7.6 percent Rhesus negative individuals (Table IV). Similar results were previously reported by Pathak<sup>4</sup>, Talwar and Sawhney<sup>6</sup> and Pathak<sup>5</sup>. The incidence of Rh negative in the present investigation is 4.8 percent among females and 8.7 percent among males (Table IV) but earlier workers<sup>4, 6</sup> obtained values higher among females than among males.

In a detailed analysis of the Rh-test of 300 individuals, seven phenotypes were obtained. Of these, CDe (38.0 percent), CeDe (29.3 percent) and CcDEe (16.3 percent) comprised nearly 83.6 percent of total individuals. With respect to Rh chromosomes, the Sikhs have a high frequency of CDe (60.8 percent) and low frequencies of cde (25.3 percent) and cDE (11.5 percent) (Table V). But Bird *et al.*<sup>2</sup> observed a high incidence of CDe (65.4 percent) and a low incidence of cde (17.0 percent).

The Sikhs in Calcutta possess abnormal hemoglobin D at a low frequency as observed by Bird

*et al.*<sup>2</sup> Of 427 individuals, 6 were found to be heterozygous, 5 of them carrying hemoglobin D and one, hemoglobin E. The incidence of HbE among the Sikhs in the present investigation has not been reported earlier. In the absence of a propositus' family it is very difficult to explain the cause of the sporadic occurrence of HbE.

### Summary

In a serological survey the Sikhs in Calcutta showed a preponderance of genes B and M over genes A and N respectively. Chromosome MS was more frequent than chromosome NS. About 8 percent of the Sikhs examined were found to be Rhesus negative. The incidence of chromosome CDe was higher than chromosomes cde and cDE. Abnormal hemoglobin D occurred at a very low frequency, and one individual with abnormal hemoglobin E was detected.

### Literature Cited

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Table II. MN blood groups of the Sikhs in Calcutta

Phenotype	Observed number	Expected number	Observed frequency	Expected frequency
MM	105	101.77	0.5048	0.4803
MN	81	87.44	0.3804	0.4204
NN	22	18.78	0.1034	0.0903
Total	208	207.99	1.0000	1.0000

Gene frequencies:  
M = 0.6995  
N = 0.3005

Table III. MNSs blood groups of the Sikhs in Calcutta

Phenotype	Observed number	Expected number	Observed frequency	Expected frequency
MMSs	5	5.24	0.1143	0.0749
MNSs	18	15.24	0.2143	0.2177
MNs	11	11.07	0.1571	0.1582
MNSs	1	1.13	0.0143	0.0151
MNs	10	13.10	0.1428	0.1871
MNs	15	18.60	0.2143	0.2380
NNSs	0	0.06	0.0000	0.0000
NNs	2	1.23	0.0286	0.0176
NNs	8	6.26	0.1143	0.0805
Total	70	69.89	1.0000	1.0000

Chromosome frequencies:  
MS = 0.2737  
Ma = 0.3977  
NS = 0.2354  
Na = 0.2992

Table IV. Observed frequencies of Rh blood groups in both sexes of the Sikhs in Calcutta

Sex	Gene frequency			
	Rh + ve (D)	Rh - ve (d)	Total	Rh (D) Rh (d)
Male	262	25	287	0.7048 0.2952
Female	0.9129	0.0871	1.0000	
Total	118	6	124	0.7600 0.2400
	0.9516	0.0484	1.0000	
	380	31	411	0.7253 0.2747
	0.9245	0.0755	1.0000	

Table V. Rh blood groups of the Sikhs in Calcutta. (Samples tested with anti-C, -D, -E, -c and -e.)

Phenotype	Observed number	Expected number	Observed frequency	Expected frequency
CDe	114	111.00	0.3800	0.3700
CcDEa	40	41.07	0.1633	0.1389
cDE	2	3.96	0.0067	0.0132
CcDe	88	100.08	0.2933	0.3366
cDEe	16	10.08	0.0543	0.0636
cde	20	10.26	0.0867	0.0642
cDe	6	3.72	0.0167	0.0124
Total	300	290.07	1.0000	0.9999

Chromosome frequencies:  
CDe = 0.0000 cDE = 0.1150  
CDe = 0.4085 cDE = 0.0000  
CDe = 0.0000 cDe = 0.0233  
Cde = 0.0000 cde = 0.2534