

# ABO Blood Groups and Sickle-cell Trait Investigations in Madhya Pradesh Indore District (Central India)

**Narendra Kumar**

From May to July 1963, the Author conducted field investigations on ABO blood groups and sickle-cell trait distributions in Indore district of Madhya Pradesh. Five hundred individuals belonging to four castes, the Kulmi, the Khati, the Mali and the Balai or Balahis, and a tribe, the Bhil, were tested. Ninety-five blood samples collected from a number of other castes were also tested.

The Kulmi or Kulambi caste is distributed throughout Central India. This caste is known as the Patidar in Gujerat and Kunbi in Maharashtra. In Indore division of Madhya Pradesh, the Kulmi are subdivided into a number of subsections such as the Kadve, the Leve, the Khade and the Moria Kulmi. The present study was restricted to the Kadve subsection only. The Mali are also divided into a number of subcastes and the present study has been conducted among the Rami Mali subcaste. The Khati are generally known to be artisans as in Sitamau of Mandsaur district. But the Khati investigated in the present study are actually agriculturists living in Rangwasa and Tihi, the two villages situated on the outskirts of Indore and Mhow towns respectively. The Balai is a scheduled caste of weavers and watchmen (Russel, 1916) and occupy a low social status in caste hierarchy. Their caste structure, social life and material culture have been studied by Fuchs (1950). The Bhil, a scheduled tribe of central and west India has also been investigated. In rural areas around Manpur, there are numerous Bhil settlements and the present study has been conducted in that area.

Grouping tests were performed by the tube method (Das *et al.*, 1961) with the sera procured from Haffekine Institute, Bombay. Known O, A, B, and AB blood types were included as controls in every series of tests. Daland and Castle's (1948) method was employed in the detection of sickle-cell trait using sodium-metabisulphite ( $\text{Na}_2\text{S}_2\text{O}_5$ ) as the reducing agent. Sickling was detected in all positive cases within half an hour.

## Results

The results of the present investigations among different population groups from the district are presented in Tab. 1. The gene frequencies have been calculated by Bernstein's improved formulae (Mourant, 1954). The expected and the observed phenotype numbers agree quite well, as indicated by the chi-square values. In the investigated groups, the sample on the Kadve Kulmi has the highest percentage for

**Tab. 1. ABO blood groups with gene frequencies in various castes and tribes from Indore district, in Madhya Pradesh**

N.	Group	Phenotype				$\chi^2$	Gene frequency			
		O	A	B	AB		O	A	B	
1.	Kadve Kulmi (100)	obs.	29	12	53	6	0.180	0.5442	0.0948	0.3610
		exp.	29.61	11.22	52.32	6.85				
2.	Khati (100)	obs.	28	18	45	9	0.055	0.5318	0.1458	0.3223
		exp.	28.29	17.64	44.68	9.39				
3.	Rami Mali (100)	obs.	24	18	45	13	1.443	0.4551	0.2013	0.3436
		exp.	20.71	22.37	43.08	13.83				
4.	Balai (100)	obs.	25	27	35	13	0.837	0.5227	0.2287	0.2486
		exp.	27.32	29.14	32.17	11.37				
5.	Bhil (100)	obs.	26	19	44	11	0.012	0.5081	0.1631	0.3288
		exp.	25.82	19.23	44.22	10.73				
6.	Twenty other castes (95)	obs.	33	19	34	9	0.274	0.5817	0.1594	0.2589
		exp.	32.15	20.03	31.98	7.84				
		Obs. %	34.74	20.00	35.79	5.47				
Total (595)		obs.	165	113	256	61	0.043	0.5251	0.1587	0.3162
		exp.	164.04	114.18	257.04	55.74				
		Obs. %	27.73	18.99	43.03	10.25				

the phenotype B and the lowest for the phenotype A. The reverse is the case in the Balai sample. A comparison of the two samples by the  $2 \times 4$  contingency table, reveals that the Kadve Kulmi and the Balai samples are significantly differentiated ( $\chi^2 = 12.32$ , 3 d.f.,  $0.01 > P > 0.001$ ).

No other blood group data on the Khati and the Rami Mali are available. From Gujerat, the state adjoining to the western Madhya Pradesh, data on the Kunbi Patidar (Majumdar, 1950) are available for comparison with the Kadve Kulmi. The only blood group data on the Balai are those from the East Nimar district, from where a sample on the Bhil was also tested (Macfarlane, 1941).

Group	N. tested	O	A	B	AB	Author
Balai	200	61	64	60	15	Macfarlane, 1941
Bhil	140	26	33	58	23	Macfarlane, 1941
Bhil	534	185	150	150	49	U. Bose, 1952
Kunbi Patidar	134	40	34	44	16	Majumdar, 1950

The results of chi-square tests of homogeneity by  $2 \times 4$  contingency tables are presented in Tab. 2. It is interesting to note that the Balai of Indore and the Balai of East Nimar district are homogeneous. The Bhils tested in the present study are also undifferentiated from the Bhil sample of East Nimar district. However, the present Bhil data reveal considerable heterogeneity with the Bhil sample from Dhar district (Bose, 1952). Regarding the Kunbi Patidar sample taken from widely dis-

**Tab. 2. Chi-square values: Inter-group differences between populations investigated in the Indore district and the other populations ( $2 \times 4$  contingency table, 3 d.f.)**

N.	Group	$\chi^2$ values	P
1.	Kadve Kulni & Khati	0.871	$0.90 > P > 0.80$
2.	Kadve Kulni & Rami Mali	4.905	$0.20 > P > 0.10$
3.	Kadve Kulni & Balai	12.325	$0.01 > P > 0.001$
4.	Kadve Kulni & Bhil	4.049	$0.30 > P > 0.20$
5.	Khati & Bhil	0.311	$0.98 > P > 0.95$
6.	Balai & Bhil	2.504	$0.50 > P > 0.30$
7.	Khati & Rami Mali	1.035	$0.80 \approx P$
8.	Khati & Balai	3.947	$0.30 > P > 0.20$
9.	Rami Mali & Balai	3.071	$0.50 > P > 0.30$
10.	Rami Mali & Bhil	1.472	$0.70 > P > 0.50$
11.	Kadve Kulni & Kunbi Patidar (Gujerat)	12.991	$0.01 > P > 0.001$
12.	Balai (Indore) & Balai (East Nimar)	3.944	$0.30 > P > 0.20$
13.	Bhil (Indore) & Bhil (Dhar)	11.763	$0.01 > P > 0.001$
14.	Bhil (Indore) & Bhil (East Nimar)	0.997	$0.90 > P > 0.80$

tributed areas, such as Cutch, Rajpipla and Ahmedabad districts of Gujerat state, it is found that the Kunbi Patidar group is significantly different from the Kadve Kulmi sample.

The six samples from Indore district (Tab. 1) have also been subjected to the test for homogeneity by using  $4 \times 6$  contingency table. The nonsignificant chi-square value ( $\chi^2 = 17.676$ ,  $0.30 > P > 0.20$ ), reveals that all the six samples, namely: the Bhil, the Balai, the Kadve Kulmi, the Rami Mali, the Khati and the mixed group are mutually indistinguishable so far as the ABO blood groups distributions are concerned. Since these samples are homogeneous, the gene frequencies have also been estimated from the pooled data for all the six groups.

## SICKLE-CELL TRAIT

Sickling has been found in Bastar district of Madhya Pradesh (Negi, 1964). In the present study, sickling tests were performed on two hundred and ninety three individuals belonging to various castes and the Bhil. Positive cases of sickling were detected among the Bhil, the Balai and the Charmakar or the Chamar. The sickling frequency was found to be 11 in 46 among the Bhil, 4 in 73 among the Balai and 2 in 22 among the Chamar. No sickling was detected among the Rami Mali (52), the Kadve Kulmi (33), the Nai (5), the Khati (21), the Dholi (6), the Brahmin (6), the Thakur (5), the Darzi (4), the Bagri (4), The Teli (4), the Rajput (3), the Soni (2), the Muslim (2) and Miscellaneous (5). The figures in brackets denote the numbers of persons tested from each group.

### Summary

Blood samples from five hundred and ninety five individuals belonging to Indore district of west Madhya Pradesh were tested for ABO blood groups, and two hundred and ninety three of them were tested for the sickle-cell trait.

The investigated groups include: the Kadve Kulmi, the Khati, the Rami Mali, the Balai, the Bhil and a mixed sample of various castes. The aforesaid groups, within the district, are found to be homogeneous, as far as the ABO blood groups distributions are concerned. Frequencies for the O, A and B genes have been found to be 0.5251, 0.1587 and 0.3162, respectively, in the pooled data.

Sickle-cell trait has been detected in the Balai, the Charmakar or Chamar and the Bhil.

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RIASSUNTO

Campioni di sangue di 595 individui del distretto Indore del Madhya Pradesh occidentale sono stati sottoposti ad analisi gruppale per il sistema ABO, e 293 di essi all'esame per il carattere falciforme. Il gruppo studiato comprende i Kadve Kulmi, i Khati, i Rami Mali, i Balai, i Bhil e un campione misto di varie caste. Tali gruppi, all'interno del distretto, risultano essere omogenei per quanto riguarda la distribuzione dei gruppi sanguigni ABO. Nei dati riassuntivi le frequenze dei geni O, A e B risultano essere rispettivamente 0,5251, 0,1587 e 0,3162. Il carattere falciforme è stato riscontrato nei Balai, nei Charmakar o Chamar e nei Bhil.

RÉSUMÉ

L'A. a analysé les groupes sanguins de 595 individus du district Indore du Madhya Pradesh Occidental; pour 293 d'eux, l'analyse du caractère falciforme a aussi été effectuée. Le groupe étudié comprend les Kadve Kulmi, les Khati, les Rami Mali, les Balai, les Bhil, ainsi qu'un échantillon mixte de plusieurs castes. Ces groupes, au sein du district, résultent homogènes en ce qui concerne la distribution des groupes sanguins ABO. Les fréquences des gènes O, A et B résultent être respectivement 0,5251, 0,1587 et 0,3162, dans les données réunies. Le caractère falciforme a été trouvé chez les Balai, les Charmakar ou Chamar et chez les Bhil.

ZUSAMMENFASSUNG

An Blutproben von 595 Personen aus dem Distrikt Indore im westlichen Madhya Pradesh wurden Gruppenanalysen für das ABO-System vorgenommen und 293 davon auf Sichelzellen untersucht.

Die Gruppe bestand aus Angehörigen der Kasten Kadve Kulmi, Khati, Rami Mali, Balai, Bhil sowie aus einer Mustergruppe aus verschiedenen Kasten. Es ergab sich, dass im Inneren des Distriktes die Volksgruppen in Bezug auf die Verteilung der ABO-Blutgruppe homogen sind.

Bei den zusammenfassenden Erhebungen treten die Gene O, A und B im Verhältnis von 0,5251 zu 0,1587 zu 0,3162 auf. Sichelzellen wurden bei den Balai, den Charmakar oder Chamar und bei den Bhil gefunden.