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A_1, A_2, *B*, 0, *MN*, *Rh*, *Kell* AND *Duffy* BLOOD GROUPS AND SICKLE CELL TRAIT AMONG THE KODAVAS OF KODAGU DISTRICT, KARNATAKA STATE, INDIA

In Kodagu district of Karnataka are found the Kodavas who may be said to be one of the most picturesque people. They are also one of the marital castes of South India. They number about 60,000. They speak Kodagi language. They are divided into two endogamous groups: Kodavas and Amma Kodavas. The Kodavas are non-vegetarians and follow non-brahmanical customs while the Amma Kodavas follow Brahmanical rites and are strict vegetarians.

There is hardly any published physical anthropological data on these people. With a view to study their demographic, morphological, genetical and serological aspects, a team of anthropologists belonging to the Southern Regional Office of Anthropological Survey of India undertook field investigations among them for about a month. These studies included: (i) Blood groups, (ii) Sickle Cell trait, (iii) Anthropometry, (iv) Dermatoglyphics, (v) Taste sensitivity to P.T.C. (vi) Colour blindness, (vii) M.P.H. and (viii) Demography.

In the present report, the results on blood groups and the sickle cell trait are being presented. Care was taken to see that only unrelated individuals were included in the sample as far as possible. The data was collected from Caveri College, Gonikoppal; Government College, Mercara; Industrial Training Institute, Mercara; and from a few villages.

A1 A2 B 0 BLOOD GROUPS

High titre anti-*A*, anti-*B* and Group 0 sera were used for *AB*0 testing. All these were obtained from Haffkins Institute, Bombay. The moist chamber method [Boorman and Dodd, 1957] was used for *AB*0 testing. Group *A* bloods were subsequently tested by anti-A_1 serum by "micro tube" technique [Race and Sanger, 1954]. Controls were included in all series of tests. Results are presented in the table 1. Gene

* It is with grief that we announce the sudden demise of D. B. Sastry.

frequencies were calculated following formulae given by Mourant [1954]. The χ^2 value at $P=0.95$ indicates a satisfactory agreement of present data with the known mode of inheritance [Bernstein, 1930].

Table 2 compares the Kodava *AB0* blood group data with other *AB0* data from Karnataka state [Sastry, 1970]. The data when compared on a "8×4" contingency table yields a χ^2 of 18.29 for 21 degrees of freedom which is insignificant.

MN BLOOD TYPES

The anti-*M* and anti-*N* sera were supplied by Bio-test Laboratories, Vienna. A 2% saline suspension of washed red cells were used in the tests. The "micro-tube" technique as suggested by Race and Sanger [1954] was employed. Table 1 presents the data and gene frequency estimates by the direct gene counting method [Wiener and Vaisberg, 1931]. Observed and expected values agree very well with each other. The Chi^2 value is insignificant.

MN blood groups of the Kodavas agree very well with that of Todas of neighbouring Nilgiri hills of Tamilnadu. Stories that are prevalent in these areas indicate that both these populations have come from some other distant area and settled here. Thus it may be opined that these populations might have migrated from other places and settled here and are interrelated to each other.

Rh BLOOD GROUPS

5 anti sera, anti-*C*, anti-$\bar{c}$, anti-*D*, anti-*E* and anti-*e* were employed in performing the tests. Anti-*D* was supplied by Haffkins Institute, Bombay and is albumin agglutinating. The rest were all saline agglutinating and were the products of Bio-test Laboratories, Vienna. The tests were performed by "micro tube" technique and in strict accordance with the directions given by the manufacturers. Controls were included in each series of the tests. The basic data and results are given in the table 1. Chromosome frequencies have been estimated by the method given in Mourant [1954]. The frequencies, are found to resemble, in a general way, those found in non-tribal segments of the Indian population [Mourant 1954]. They have a fairly high frequency (24.57%) of *r* chromosome and a low frequency (3.80%) of R_o chromosome.

KELL BLOOD GROUP

The *Kell* antiserum was supplied by Bio-test Laboratory, Vienna Results are given in the table 1.

Table 1. Blood groups phenotype distribution and gene frequencies among the Kodavas of Karnataka

System (total N)	Phenotype	*N*	%	Gene Frequencies
ABO (209)	0	97	46.41	$P_1=0.1367$
	A_1	46	22.01	$P_2=0.0457$
	A_2	12	5.74	$q=0.1394$
	B	43	20.57	$r=0.6782$
	A_1B	7	3.35	
	A_2B	4	1.91	
MN (150)	*MM*	90		$m=0.77\pm0.02$
	MN	52		$n=0.23\pm0.82$ $\chi^2=$
	NN	8		$=0.03$
Kell (75)	*Kell*+	1	1.33	
	Kell−	74	98.67	
Hb S (202)	*Sickler*	4		
	Non Sickler	198		% of sickling 1.98
Rhesus (112)	R_1R_1	36		$R_1=0.5373$
	R_1r	31		$r=0.2457$
	R_1R_2	17		$R_2=0.1099$
	rr	9		$R'=0.0317$
	R_2r	7		$R0=0.0380$
	R_1R_z	2		$R''=0.0216$ $\chi^2=2.23$
	R_0r	3		$R_z=0.0158$
	$R'r$	2		
	R_2R_2	1		
	R_2R_z	1		
	R_zR_z	1		
	$R''r$	1		
	$R'R'$	1		
Duffy (75)	Fy^a+	68	90.67	
	Fy^a−	7	9.33	

Table 2. Comparison of Kodava with other Karnataka population groups [Sastry 1970]

No.	Population	No. tested	Phenotype frequencies			
			0	*A*	*B*	*AB*
1	Brahman	133	.42	.23	.27	.08
2	Iyengars	100	.39	.24	.28	.09
3	Vokkaliga	100	.46	.23	.25	.06
4	Lingayat	110	.45	.17	.34	.04
5	Adi Karnataka	225	.42	.23	.30	.05
6	Adi Jambuva	100	.43	.22	.26	.09
7	Muslim	100	.45	.24	.29	.02
8	Kodava	209	.46	.28	.21	.05

Table 3. Comparative picture of *MN* blood groups

No.	Population	*M*	*MN*	*N*	Total	Investigators
1	Garhwal up Brahman	49	56	20	125	Tiwari & Bhashin, 1968
2	Garhwal up Rajput	76	79	20	175	,,
3	Rana Tharu	86	63	7	156	Srivatsav, 1965
4	Badaga	20	34	3	57	Lehman & Cutbush, 1952
5	Kanerese	17	11	9	37	,,
6	Toda	46	31	5	82	,,
7	Toda	57	29	3	89	Kirk et al, 1962
8	Kodava	90	52	8	150	Present data

Table 4. *Kell* blood groups

Population	Number tested	Phenotype %		Investigator
		Kell+	*Kell*−	
Chenchu	24	12.50	87.50	Simmons et al
Kodava	75	1.33	98.67	Present study

Table 5. *Duffy* blood groups

Population	Number tested	Phenotype %	
		Fy^a+	Fy^a−
Asiatic Indians	55	92.73	7.27
Todas	60	91.67	8.33
Badagas	64	65.63	34.37
Kodavas	75	90.67	9.33

This system is rather rare in India. However, it is to be pointed out that not much data is available about this system of blood groups for India.

DUFFY BLOOD GROUPS

Anti-Fy^a sera were supplied by Bio-test Laboratories, Vienna. The tests were done in accordance with the directions given by the manufacturers. Results are given in the table 1.

SICKLE CELL TRAIT

A sample of 202 individuals were tested for this trait by the sodium metablisulphite technique of Daland and Castle [1948]. Fresh metabisulphite solution was prepared every day before tests. Testing was done as described by Das et al. [1961].

Though the Kodavas do not possess sickling in a high percentage they are yet another non-tribal group who possess this gene. They join the other non-tribal groups like Mahars, Adi Karnataka, Adi Jambuva, Badaga who probably got this through admixture in olden days.

Incidentally, cases of sickling were detected in two groups from this district: Malai Lingayat (2 individuals) and Gowda (1 individual). These two non-tribal groups claim that they are originally from the South Kanara District. Thus it may be worthwhile to search for this trait in the adjoining districts of South Kanara and Cannanore.

Our results indicate that the Kodavas who resemble local groups of Karnataka state are also part of the same and thus belie the speculation about their origin from middle east. At least these are the tentative conclusions based on our serological data.

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UKŁADY GRUPOWE KRWI I SIERPOWATOŚĆ KRWINEK U KODAVAS Z DYSTRYKTU KODAGA, STAN KARANATAKA W INDIACH

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Autorzy przedstawili częstość grup krwi układów: *AB0*, *MN*, *Rh*, *Kell* i *Duffy* wśród 209 osób należących do grupy etnicznej Kodava z południowych Indii. Wśród badanych stwierdzono także 4 przypadki sierpowatości krwinek. Porównanie częstości genów i genotypów z innymi grupami ludności z terenu Indii wskazuje iż badana grupa jest pochodzenia miejscowego.