7. Distribution pattern of ABO gene among the tribals (Santal, Munda and Oraon):

7.1 Introduction :

Blood groups carry various types of genetic information in man. ABO blood groups follow certain pattern of inheritance (Epstein and Othenberg, 1908; Bernstein, 1925; Landsteiner and Levine, 1928; Race and Sanger, 1962). The distribution of these blood markers in a population usually stays at genetic equilibrium (Mondal, 1992). Genetical analysis of ABO blood group reveals a variety of diseases, which are found among various tribal and nontribal populations (Gupta and Raichoudhury, 1980; Kulkarni and Agarwal, 1987; Kshatriya and Kapoor, 1991). In extant native American populations, ABO system, HLA and other genetic markers are consistent with genetic differentiation occurring concomitantly with colonization (Tourret et al., 2000). Genetic differentiation of human populations to a large extent depends on frequency of ABO blood groups (Piplai et al., 1985; Pandey et al., 1992).

The present study reports the findings on phenotypic and genotypic frequencies of ABO blood groups among the Santals, Mundas and Oraons at Hili Block.

7.2 Materials and methods:

A total of randomly selected 755 Santals, 794 Mundas and 433 Oraons of both sexes served as subjects of this study. The individuals belonging to A, B, AB, O and Rh^+ and Rh^- groups were detected by mixing one volume of 1 to 2% cell suspension to one volume of anti-A, anti-B and anti-Rh reagents in tubes (4×50 mm). After mixing the tubes were allowed to stand for one hour at room temperature and results were read for agglutination by naked eye. All negative results, however, were confirmed under microscope.

The phenotypic and genotypic frequencies of ABO blood groups in randomly mating populations of the three ethnic communities were evaluated with the help of gene frequencies (p, q and r) based on the data presented in the table 7.1 and 7.2. The frequency of AA, AO, BB, BO, AB and OO genotypes in a population at equilibrium are p^2, 2 pr, q^2, 2qr, 2pq and r^2 respectively.

7.3 Results and discussion:

The present study reveals four types of blood groups (A, B, AB and O) with Rh^+ and Rh^- factors in the Santals, Mundas and Oraons at Hili Block. Blood group 'B' with Rh factor are much higher among the Santals (33.25%) and Oraons (34.64%) in comparison to the Mundas (30.35%), but 'A' blood group is lower among the Oraons (28.64%) than the Santals (32.85%) and Mundas (31.99%). AB blood group with Rh factor among the three ethnic communities are closer to each other i.e. Santals (9.80%), Mundas (8.82%) and Oraons (9.01%). On the other hand percent O blood group individuals among the Santals (24.10%) is lower compared to the Mundas (28.84%) and the Oraons (27.71%) (Table – 7.1).

Phenotypic frequencies of A, B, AB and O groups have been found to be 0.3285, 0.3325, 0.0980, 0.2410 in Santals, 0.3199, 0.3035, 0.0882, 0.2884 in Mundas and 0.2864, 0.3464, 0.0901, 0.2771 in Oraons respectively (Table – 7.1). AB, AA, AO, BB, BO, OO genotypes are observed in the three ethnic communities and their genotypic and phenotypic proportions are presented in table – 7.2.

From Table – 7.3 it is evident that the gene frequencies of A (p), B (q) and O (r) of Santals are 0.2427, 0.2453, 0.5120; of Mundas are 0.2306, 0.2201, 0.5493 and of Oraons 0.2103, 0.2493, 0.5404 respectively.

Table – 7.4 shows the genotypic frequencies of AA, AO, BB, BO, AB, OO are 0.0589, 0.2485, 0.0602, 0.2512, 0.1191, 0.2621 respectively in the Santal populations based on table – 3. Among the Mundas the genotypic frequencies are 0.0532, 0.2533, 0.0485, 0.2418, 0.1015 and 0.3017, where as comparable figures in the Oraons are 0.0442, 0.2273, 0.0622, 0.2694, 0.1049 and 0.2920 respectively.

Comparing the χ^2 value (5.8670) of Santal populations with Fisher's table (7.82), df-3 at 5% level, it has been found that the probability value lies between 0.10 to 0.20. Thus the difference is statistically significant ($P< 0.05$). In Mundas, the χ^2 value (2.5528) lies between 0.20 to 0.30 and χ^2 value of Oraon is 1.6001

Table – 7.1 : ABO blood group frequency among the Santals, Mundas and Oraons at Hili Block.

Types of blood groups	Number of individuals			Phenotypic frequencies			Percent		
	Santal	Munda	Oraon	Santal	Munda	Oraon	Santal	Munda	Oraon
A	248	254	124	0.3285	0.3199	0.2864	32.85	31.99	28.64
B	251	241	150	0.3325	0.3035	0.3464	33.25	30.35	34.64
AB	74	70	39	0.0980	0.0882	0.0901	9.80	8.82	9.01
O	182	229	120	0.2410	0.2884	0.2771	24.10	28.84	27.71
Total	755	794	433	1.00	1.00	1.00	100.00	100.00	100.00

Table – 7.2 : Genotype and phenotype proportion of ABO blood groups in a randomly mating population.

Blood groups	AB	A	B	O
Genotypes	AB	AA, AO	BB, BO	OO
Proportion of Genotypes	2pq	P^2 , 2pr	q^2 , 2qr	r^2
Proportion of phenotypes	2pq	$P^2 + 2pr$	$q^2 + 2qr$	r^2

* p = frequency of gene A; q = frequency of gene B; r = frequency of gene O
From Strickberger (15).

(Table-7.5&7.8) which lies between 0.30 to 0.50 at df-3 against Fisher's χ^2 table. Thus in both Mundas and Oraons the P-values are much less than determinant level 0.05 ($P<0.05$) These showed that the discrepancy from equilibrium was not significant and had a high probability of occurrence in normal sample of an equilibrium population.

Phenotypic frequencies of ABO blood group distribution of the Santals, Mundas and Oraons are different from that of the Totos (Pal and Sinha, 1990), Mixed Indians, Ladakhies and Rajasthanis (Nei and Roychoudhury, 1982; Dutta and Sen, 1974; Lall and Hurkat, 1977) which is shown in Table – 7.6.

Table – 7.3 : Calculation of gene frequency for A(p), B(q) and O(r) among the Santals, Mundas and Oraons

Phenotypes	No. observed			Frequency			$\sqrt{\text{Frequency}}$			Gene frequency		
	Santal	Munda	Oraon	Santal	Munda	Oraon	Santal	Munda	Oraon	Santal	Munda	Oraon
B+O	433	470	270	0.5735	0.5919	0.6236	0.7573	0.7694	0.7897	p= 0.2427	p=0.2306	p=0.2103
A+O	430	483	244	0.5695	0.6083	0.5635	0.7547	0.7799	0.7507	q=0.2453	q=0.2201	q=0.2493
O	182	229	120	0.2410	0.2884	0.2771	0.4909	0.5370	0.5264	r= 0.5120	r=0.5493	r=0.5404

Table –7.4 : Determination of genotypic frequencies among the Santals, Mundas and Oraons.

Phenotypes	Phenotypic frequencies			Genotypic frequencies			No. of different genotypes		
	Santal	Munda	Oraon	Santal	Munda	Oraon	Santal	Munda	Oraon
A	0.3285	0.3199	0.2864	AA (p^2)=0.0589	AA (p^2)=0.0532	AA (p^2)=0.0442	44.50	42.20	19.10
				AO(2pr)=0.2485	AO(2pr)=0.2533	AO(2pr)=0.2273	187.60	201.10	98.40
B	0.3325	0.3035	0.3464	BB(q^2)=0.0602	BB(q^2)=0.0485	BB(q^2)=0.0622	45.40	38.50	26.90
				BO(2qr)=0.2512	BO(2qr)=0.2418	BO(2qr)=0.2694	189.70	192.00	116.70
AB	0.0980	0.0882	0.0901	AB(2pq)=0.1191	AB(2pq)=0.1015	AB(2pq)=0.1049	89.90	80.60	45.40
O	0.2410	0.2884	0.2771	OO(r^2)=0.2621	OO(r^2)=0.3017	OO(r^2)=0.2920	197.90	239.60	126.50
Total				**= 1.0000**	**=1.0000**	**=1.0000**	**755.00**	**794.00**	**433.00**

Table – 7.5 : Observed and expected frequencies for the ABO Phenotypes among the Santals, Mundas and Oraons.

	Phenotypes														
	A			B			AB			O			Total		
	Santal	Munda	Oraon	Santal	Munda	Oraon	Santal	Munda	Oraon	Santal	Munda	Oraon	Santal	Munda	Oraon
Observed number	248	254	124	251	241	150	74	70	39	182	229	120	755	794	433
Equilibrium frequencies	(p^2+2pr) N			(q^2+2qr)N			(2pq)N			(r^2)N			N		
Expected	232.10	243.30	117.50	235.10	230.50	143.60	89.90	80.60	45.40	197.90	239.60	126.50	755	794	433
χ^2 (with yates correction)	1.0218	0.4276	0.3064	1.0088	0.4338	0.2424	2.6380	1.2656	0.7667	1.1984	0.4258	0.2846	5.8670	2.5528	1.6001

Table –7.6 : Comparative phenotypic frequency distribution of ABO Blood group among the Santals, Mundas, Oraons, Totos, Mixed Indian, Ladakhies and Rajasthanis.

ABO blood group	Number observed							Phenotypic frequency						
	Santal	Munda	Oraon	Toto	Mixed Indian	Ladakhy	Rajasthany	Santal	Munda	Oraon	Toto	Mixed Indian	Ladakhy	Rajasthany
A	248	254	124	22	235	31	831	0.328	0.319	0.287	0.171	0.235	0.215	0.238
B	`251	240	150	74	369	41	1214	0.333	0.304	0.346	0.574	0.369	0.285	0.349
AB	74	70	39	18	106	09	252	0.098	0.088	0.090	0.139	0.106	0.063	0.073
O	182	229	120	15	290	63	1181	0.241	0.289	0.277	0.116	0.290	0.437	0.339
Total	755	794	433	129	1000	144	3478	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table – 7.7 : ABO gene frequencies among the Asian Mongoloids, Rajasthanis, Totos, Santals, Mundas and Oraons.

Allele	Gene frequency					
	Asian Mongoloid	Rajasthani	Toto	Santal	Munda	Oraon
A	0.27	0.1709	0.1716	0.2427	0.2306	0.2103
B	0.17	0.2404	0.4705	0.2453	0.2201	0.2493
O	0.56	0.5887	0.3579	0.5120	0.5493	0.5404

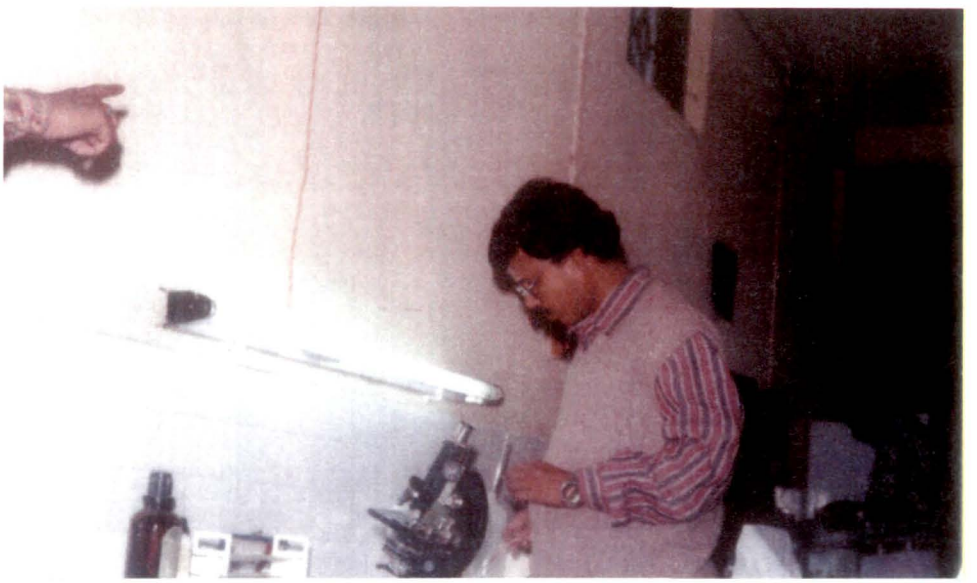
Among the Totos phenotypic frequencies of blood group B is as high as 57.40% (Pal and Sinha, 1990) which is considerably higher than that of the Santals (33.25%), Mundas (30.35%) and Oraons (34.64%) (Table – 7.1).

On the basis of ABO gene frequency distribution, it is apparent that the three ethnic groups (Santal, Munda, Oraon) are closer to Asian Mongoloids and Rajasthanis and far from the Totos (Table – 7.7).

Nei and Roychoudhury (1982) showed that the proportion of loci that are polymorphic in the three races i.e., Caucasians (whites), Africans (Blacks), Asians (Mongoloids) ranged from 45 to 52% for proteins and from 34 to 56% for blood groups. The average heterozygosity per locus ranged from 13 to 16% for proteins and from 11 to 20% for blood groups. In view of these findings the mythical nature of the concepts of pure races becomes apparent. Members of a race are not genetically pure in the sense of sharing a uniform genetic identity nor does genetic uniformity apply even to members of the same family. Gene frequencies observed among the three ethnic groups reflect that they are different from each other due to the transmission of their unchanged genetic materials from generation to generation.

Table – 7.8 : ABO gene distribution among the Santals, Mundas and Oraons.

Ethnic groups	Blood groups	No. observed	Phenotypic frequencies	genotypic frequencies	χ^2 value	P value
SANTAL	A	248	0.3285	0.3074	5.8670	P<0.05
	B	251	0.3325	0.3314		
	AB	74	0.0980	0.1191		
	O	182	0.2410	0.2621		
MUNDA	A	254	0.3199	0.3065	2.5528	P<0.05
	B	241	0.3035	0.2903		
	AB	70	0.0882	0.1015		
	O	229	0.2884	0.3017		
ORAON	A	124	0.2864	0.2715	1.6001	P<0.05
	B	150	0.3464	0.3316		
	AB	39	0.0901	0.1049		
	O	120	0.2771	0.2920		



Blood group test under progress in a laboratory.

Collection of blood by the author for blood group test.