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ABO AND RH FREQUENCY DISTRIBUTION AND GENE FREQUENCY AMONG THE MUNDA COMMUNITY OF JAJPUR DISTRICT, ODISHA

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ABSTRACT

Being a classical marker, knowledge of ABO and Rh blood of individuals in a population still remains significant to understand the influence of evolution causing factors like migration, genetic drift and genetic admixture. Blood group of an individual is very important characteristic to be considered in cases of blood and organ transfusion. The objective of the present study is to find out the percentage distribution and gene frequency of ABO and Rh blood types in the Munda population (an Austro-Asiatic population) from Jajpur District. The results showed that the frequency of blood group B is highest in the studied population. In other Austro-Asiatic populations also the B blood group is the highest. The present findings are consistent with earlier studies and the studied population is in Hardy Weinberg Equilibrium.

Key words: Blood Group, Chota Nagpur, Munda Tribe

INTRODUCTION

Blood is a specialized tissue of human body. The main functions of the blood is to supply nourishment, especially oxygen, to cellular elements to the tissues, help removing the waste products of the metabolic activities and to maintain required body temperature and also the fluid substances in the human body. Blood is composed of two types of materials, namely plasma and blood corpuscles. There are three kinds of blood corpuscles: red blood corpuscles or erythrocytes; white blood corpuscles or leucocytes and blood platelets.

The genetic markers in red blood cell can come under 3 major heads: Red cell antigens: blood group polymorphism; haemoglobins; and enzymes. In 1900 Karl Landsteiner, an Austrian scientist, discovered that all human beings fall into 3 principal blood groups according to their composition. He described A, B and O

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blood groups for which he was awarded the Nobel Prize in 1930. Alfred Von de castello and Adriano Sturli discovered the fourth type AB, in 1902 (Von de castello and Sturli, 1902). The classification of blood group types, A, B, AB and O in ABO system, Rh-positive and Rh-negative in Rh system, is based on the presence or absence of inherited antigenic substances on the surface of the red blood cells. The four main groups are determined by the fact that the blood corpuscles of certain individuals react with the serum or plasma causing agglutinations or clumping together of the red blood cells. These substances in the red corpuscles are called antigens. The antigens may be proteins, carbohydrates, glycoproteins and glycolipids depending on the group system (Alimba *et al*., 2010). The substances present in the serum with which antigens react are also of two different natures, and they are distinguished as anti- A and anti- B.

The need for the blood group prevalence studies is multipurpose, as besides their importance in evolution, their relation to disease like malaria (Panda *et al.,* 2011) and environment is being increasingly sought in modern medicine. The frequencies of ABO blood groups vary from one population to another and time to time in the same region. The knowledge of distribution of ABO and Rhesus (Rh) blood groups at local and regional levels is helpful in the effective management of blood banks and safe blood transfusion services (Patel *et al*., 2012). Thus, this shows that the need for estimates of blood group and gene's frequency studies is multipurpose and provides very valuable information on the genetic similarity of different populations and to some extent on their ancestral genetic linkage, despite the cultural and religious differences of the two populations (Khurshid *et al*., 1992).

The ABO blood group system is the earliest to be discussed and hence the most studied system among the blood groups in India. In general, a higher incidence of B than the A gene appears to be characteristic of the Indian subcontinent (Pingle, 1985).Work done in Poland show A blood group to be the commonest (Kelus *et al*., 1953; Tegowska *et al*., 1997). Agarwal *et al*. (2014), in their study on the ABO and Rh (D) group distribution and gene frequency among the different regions of India, found that overall the prevalence of O group was more common. Only in North-India frequency of B was high otherwise in all other regions O was the commonest (Agarwal *et al*., 2014). There are studies which report O blood group to be common among the Tibetans of India (Tiwari, 1966; Patel, 1971; Bhalla and Kaul, 1966; Bhalla, 1971; Singh *et al*., 1974). Patel in his study in Western Ahmedabad found that the commonest blood group was B (Patel *et al*., 2012).

In the present study the ABO blood group and Rh (D) frequency of the Munda community of Jajpur District was studied and the gene frequency was also calculated to see if the population is in Hardy-Weinberg equilibrium or not.

LAND AND PEOPLE

Munda tribe were originally from the Chota Nagpur plateau, apart from being one of the largest tribal populations of Odisha, they are also found in Jharkhand,

Chhattisgarh and West Bengal. They belong to the Austro-Asiatic linguistic family. The study was conducted in four villages namely Purnapani, Golakhpur, Upper Haridabari, Lower Haridabari from Sukinda Block, Jajpur District, Odisha. Sample was also collected from two localities in Gobarghati. This locality is rehabilitation from Tata Steel provided to those who were displaced due to industrialization in the studied area. This locality is named as Birsa Munda Rehabilitation Phase 1 and Phase 2. Jajpur district is located in the eastern region of the state. The district of Jajpur extends from 85° 40′ East longitude to 86°44′ East longitude and from 20°34′ north longitude to 21°10′ north latitude**.**

METHODOLOGY

The fieldwork was conducted in Jajpur District, Odisha. Individuals belonging to the Munda community were considered for the present study. The total sample size was 236. The study was carried out on adults above 18 years of age. The fieldwork was conducted in two phases. The first phase was for a period of 45 days during January and February 2016. The second phase was from July 2016 to September 2016.

Collection and Determination of Blood samples

Each individual was requested to sign on a consent form before blood collection for the serological test. A total of 2 ml of blood sample was collected in ethylene diamine tetra acetic acid (EDTA) vial for blood grouping and total cell count. This vial was marked with individuals name and the unique donor identification number. After collection of blood, the samples were packed with in a thermocol boxe, with ice packs and these were analysed within 24 hours. Each blood sample was grouped manually by adding anti sera, anti-A, anti-B and anti-D.

RESULTS

Demography

A total of 236 blood samples were obtained from Munda Population of Jajpur District. All the samples were included for the blood typing. The study revealed that in the studied population, frequency of the blood group type B (Table01) is highest (36.9%) followed by O (26.3%) and A (26.3%) and the frequency of AB blood group is least (10.6%). As shown in Table-2, the frequency of the Rh positive blood group is highest (99.2%) while that of Rh negative is only 0.8%.

Distribution of ABO and Rh (D) allele frequency in India

The allele frequency was calculated using maximum likelihood method. Table-3 and Table-4 show the allele frequency of ABO and Rh blood group systems, respectively. The frequency of O allele (I^o) is 0.5123, frequency of B allele (I^B) is 0.3724 and A allele (I^A) is 0.1148. In case of Rh system, the frequency of D allele was 0.91 and the recessive allele is 0.089.

Chi square test for goodness of fit between the observed and expected phenotypes was done to find if the observed frequencies follow Hardy Weinberg equilibrium. In the case (Table 5) of ABO blood group as well as Rh system, the frequencies were in Hardy Weinberg equilibrium, as the difference between observed and expected frequency was not found to be statistically significant ($p > 0.05$).

DISCUSSION AND CONCLUSIONS

Blood group investigations have been significant for years because of their importance in blood and organ transfusion. Blood group type has been associated with susceptibility to various diseases. For example Blood group O is associated with reduced and B blood group associated with increased risk of development of severe malaria in Odisha (Panda *et al.,* 2011). Investigation of ABO and Rh blood groups plays significant role not only in medical practices but also in determining genetic diversity and genetic history.

The distribution of ABO blood group genes shows a wide range of variation in terms of geographical areas and different population groups of the world. Table-6 shows variation of ABO frequency distribution of different populations across India. In most of the populations frequency of O allele is highest. Many studies have been done to investigate the ABO blood group frequency amongst various population groups from Odisha. In a study, ABO and Rh blood groups from 15 tribes were investigated. It was seen that Munda tribe had higher frequency of B blood group (Balgir, 2005). In another study done on Kharia and Bhuyan tribe from Odisha higher frequency of B blood group has been shown (Balgir, 2011). Both Kharia and Bhuyan belong to the Austro-Asiatic (Mundari) linguistic group. The present study was done on the Mundas from Jajpur District, Odisha. Munda belong to Austro-Asiatic linguistic group. The frequency of B blood group is highest in the studied population also. In many other Austro-Asiatic (Mundari) speakers from Odisha, for example Bhumias (Deka, 1977), Juang (Sarkar, 1956), Kharia (Mohanty, 1984), Santal (Sarkar, 1960) and Bonda (Das, 1988), it was seen that the frequency of B blood group is higher. However, in many tribes belonging to the Dravidian Linguistic group it was seen that the frequency of O blood group type is higher, for example Gond (Walter, 1992), Kissan (Walter, 1992), Kondha (Papiha, 1988), Paroja (Sarkar, 1960). Thus the blood group frequency difference acts as a marker in indicating the existence of genetic diversity between various tribes.

The studied Munda population is in Hardy Weinberg genetic equilibrium as shown in Table 6. Furthermore, the higher prevalence of B blood group in the population similar to other Austro- Asiatic linguistic groups and previous study done on Munda population indicating lack of factors that could bring about genetic disequilibrium in the population studied. The factors that contribute to change in gene frequency change and cause evolution are non-random mating, mutation, migration and genetic drift. Although a very classical marker, ABO blood groups are extensively studied among the regional, ethnic and linguistic groups to understand the genetic history, origin and affinities of the Indian population.

HLA, DNA markers used to study genetic history and origin indicate that Austro-Asiatic (Mundari) speaking Indian population shows much lesser genetic variability then Dravidian population (Ricco *et al.*, 2011). The ABO and Rh markers used in the present study are classical markers. Yet, the finding is in sync with result obtained using DNA markers. The genetic equilibrium is indicative of steady genetic identity maintained by the Munda population despite industrialization in the area of study.

Table 1: Phenotypic distribution of ABO blood group among the studied population

Ethnic group	*ABO blood group type frequency*				*Total*
	Type A	*Type B*	*Type O*	*Type AB*	
Munda	62(26.3%)	87(36.9%)	62(26.3%)	25 (10.6)	236

Table 2: Phenotypic distribution of Rh blood group among the studied population

Ethnic group	*Rh blood group type frequency*		*Total*
	Rh Positive	*Rh Negative*	
Munda	234(99.2%)	2(0.8%)	236

Table 3: The phenotype and allele frequency of ABO blood group

Ethnic Group	*Total (N)*	*Observed Phenotype Frequency*				*Allele Frequency*		
Munda	236	A	B	AB	O	A	B	O
		0.263	0.369	0.103	0.263	0.1148	0.3724	0.5123

Table 4: The phenotype and allele frequency of Rh blood group

Ethnic Group	*Total (N)*	*Observed Phenotype frequency*		*Allele Frequency*	
Munda	236	Rh Positive	Rh Negative	Rh Positive	Rh Negative
		0.992	0.008	0.91	0.089

Table 5: Genotype frequency, observed, expected frequency, Chi square value in both ABO and Rh blood group system

Ethnic Group	*Genotype*	*Genotype Frequency*	*Observed Phenotype*		*Expected Frequency*		*Chi-square value (df)*
Munda	AA	0.01	A	0.263	A	0.1308	0.181(3)
	AO	0.102					p-0.98061
	BB	0.13	B	0.369	B	0.5205	
	BO	0.37					
	AB	0.072	AB	0.103	AB	0.0855	
	OO	0.26	O	0.263	O	0.2629	
	Rh Positive (DD)	0.8281	Rh Positive	0.992	Rh Positive	0.99	0 (1)p- 1
	Dd	0.1619					
	Dd	0.0079	Rh Negative	0.008	Rh Negative	0.0079	

Table 6: ABO blood groups phenotype frequency among different populations

Study Population	*N*	*A*	*B*	*AB*	*O*	
Tripathy *et al*. (2006)	Tibetians	923	18.20	38.35	5.96	37.49
Tiwari (1966)	Tibetians	290	21.38	32.07	5.86	40.69
Patel (1971)	Tibetians	230	22.61	32.61	10.0	34.78
Bhalla and Kaul (1966)	Tibetians	62	22.58	25.81	9.68	41.94
Bhalla (1971)	Tibetians	182	18.68	32.42	8.24	40.66
Singh *et al*. (1974)	Tibetians	256	21.48	35.16	8.20	35.16
Patel *et al.* (2012)	Tibetians	5316	21.94	39.40	7.86	30.79
Kelus *et al.* (1953)	Poland	40000	38.51	19.51	8.62	3.37
Tegowska *at al.* (1997)	Poland	355962	38.91	19.58	8.40	33.11
Agarwal *et al.* (2014) North India		2042	24.53	34.47	11.55	29.43
Agarwal *et al.* (2014) South India		1808	20.68	33.07	6.25	38.99
Agarwal *et al.* (2014) East India		1595	21.88	33.85	6.70	37.55
Agarwal *et al.* (2014) West India		2220	23.69	32.74	6.80	36.75
Agarwal *et al.* (2014) Center India		2021	23.10	26.57	7.07	43.24
Balgir *et al.* 2005	Munda		32.3	35.4	10.4	21.9
Balgir *et al*. 2011	Kharia		28.0	33.5	5.9	24.2
Balgir *et al*. 2011	Bhuyan		30.3	32.4	10.4	26.9
Deka *et al.* 1977	Bhumias	141	19.9	57.5	4.3	18.4
Sarkar *et al.* 1956	Juang	115	21.7	47.8	8.7	21.7
Mohanty *et al*. 1984	Kharia	-	27.0	28.2	18.8	26.0
Sarkar *et al.* 1960	Santhal	14	14.3	57.1	14.3	14.2
Das *et al.* 1988	Bonda	100	21.0	40.0	10.0	29.0
Walter *et al.* 1992	Gond	107	32.6	30.8	6.5	29.1
Walter *et al.* 1992	Kissan	108	27.7	30.0	10.0	32.3
Papiha *et al.* 1988	Kondha	115	28.7	20.9	12.2	38.3
Sarkar *et al.* 1960	Paroja	108	31.5	29.6	2.8	36.
Present Study Munda	236	26.3	36.9	10.6	26.3	

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