

Serological Polymorphisms of ABO and Rh(D) Blood Groups among Saraswat Brahmin Inhabiting Four States of North India

Bhuvnesh Yadav^{*1}, Anupuma Raina^{*2}, Tasaduk Abdulla^{**3} and T. D. Dogra^{**4}

^{*DNA Fingerprinting Laboratory, Department of Forensic Medicine and Toxicology, All India Institute of Medical Sciences, New Delhi 110 029, India}

^{**Indian Institute of Integrative Medicine, Jammu 180 001, Jammu and Kashmir, India}

E-mail: ¹<bhuvneshyadav@gmail.com>, ²<anupumaraina2001@yahoo.co.in>,

³<Tasduq11@yahoo.com>, ⁴<tdogra@hotmail.com>

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ABSTRACT The Saraswat Brahmin is a well spread community in India, with an interesting history of migration. This community belongs to the Indo-European linguistic family (Aryan sub-family). We have undertaken a comparative study of the blood groups among the Saraswat Brahmin subpopulations residing in four North Indian states of Jammu and Kashmir (J & K), Punjab, Himachal Pradesh (HP) and Rajasthan. The overall allele frequencies were found to be ABO*O= 0.5134, ABO*B= 0.3018 and ABO*A= 0.1847. The Rh*D allele frequency is 0.8419, which show a little high frequency as compared to Indian population groups (0.0803).

INTRODUCTION

The frequency distribution of blood groups varies in different geographical, ethnic, and socio-economic groups. Some variations may occur in different areas within the same country (Bhasin and Walter 2001). Various populations intermingle throughout the world with relative freedom, resulting in uniform distribution of different blood groups. However, a significant regional heterogeneity is also found in ABO and RhD blood group allele frequencies (Bhasin et al. 1994). India being the habitat of a vast diversity of linguistic, socio-cultural, ethnic and geographical scenarios provides interesting opportunities to study genetic variation. ABO is the most widely studied blood group genetic system, and more than one thousand studies have been conducted from the Indian subcontinent (Bhasin et al. 1992). In India, 72% blood group belongs to the Indo-Aryan, 25% to the Dravidian while only 3% belongs to the Mongoloid and other ethnic groups (<http://www.bloodbook.com/world-abo.html>).

Blood group testing plays a key role in medical treatment prior to blood transfusion and child birth. The blood group of an individual does not

change in its lifetime and hence, acts as a unique genetic marker for research. These features are also of great value forensically in the detection of crime, and in the determination of paternity (Jolly 2000). Even though around 300 blood group systems have been identified, ABO system still remains one of the best systems in transfusion medicine. Moreover, studies based on the distribution pattern of ABO and Rh system are very useful for studying complicated evolutionary history and human migration pattern. These studies are of immense assistance in finding out which disease is more prevalent in a particular blood group (You et al. 2000).

The blood group is determined by the genetic make-up of the alleles of a system. The present study was undertaken to estimate the existing frequencies of alleles and the expected frequencies of genotypes of both the systems (ABO and Rh) in the North Indian Saraswat population. Even if it is believed that all the Saraswat Brahmins have single origin, there must be some differentiation in the time frame due to such geographical and marital differentiation. So, the estimates of gene's frequency provide very valuable information on the genetic similarity of the Saraswat sub-populations and to some extent on their ancestral genetic linkage, despite the geographical differences of the sub-populations.

MATERIAL AND METHODS

The Brahmin community is included in the uppermost caste bracket in India. The Brahmins

Corresponding Author's address:

Bhuvnesh Yadav,
Room No. 313,
Department of Forensic Medicine, All India Institute of Medical Sciences, New Delhi, India 110 029,
Phone: 09899402613, 01126593329,
Fax: No.91-11-26588641, 26588663
E-mail: bhuvneshyadav@gmail.com

have reportedly originated from the banks of the mythological holy river Saraswati, and are thus known as Saraswat Brahmin. Gradually, the community migrated to the different states of India and differentiating features of the topography between the states created barriers to the mixing of local populations. In addition, subpopulations do not encourage inter sub-population marriages.

A total of 320 blood samples of Saraswat Brahmin were collected from four North Indian states of Jammu and Kashmir, Punjab, Himachal Pradesh and Rajasthan. Special care was taken during the process of sample collection in that the subjects should not be close relatives on either maternal or paternal sides. Information about their original states and the present one was also collected. The samples were collected from the individuals residing in the respective state for three generations and the collection was based on the gotras of Saraswat Brahmin community. The genealogical data like their gotras of father and maternal uncle gotra were recorded. The samples were analysed for blood groups ABO and Rh(D). The basic techniques were used after Bhasin and Chahal (1995) and the blood analysis was done using Eryclone monoclonal antibodies. The data were statistically analysed (expected frequencies and Chi square test for Hardy Weinberg equilibrium (HWE)) using S2ABO Frequency Estimator (<http://webpages.fc.ul.pt/~pjns/Soft/ABOestimator/>). The evolutionary relationship among the studied Saraswat populations was also calculated by DISPAN software (<http://oat.bio.indiana.edu>) and phylogenetic tree was constructed with Mega 4.1 software (Tamura et al. 2007).

RESULTS AND DISCUSSION

ABO Blood Groups

The distribution of phenotypes and allelic frequencies of ABO blood groups are listed in Table 1. The frequencies of alleles p , q , and r for the ABO blood group system were found to be 0.5134, 0.3018 and 0.1847, respectively for the total data. The frequencies of alleles ABO^*A varies from 0.19308 among Saraswat Brahmins Jammu to 0.25711 in Saraswat Brahmins of Himachal Pradesh, ABO^*B from 0.33835 in Saraswat Brahmins of Punjab to 0.46269 among Saraswat

Brahmins of Jammu and ABO^*O from 0.22024 among Saraswat Brahmins of Jammu to 0.30614 in Saraswat Brahmins of Punjab. Among total samples of Saraswat Brahmins from North India the allele frequency of ABO^*B is high (0.40103) as compared to allele ABO^*A (0.2238), whereas the frequency of allele ABO^*O is 0.2368 and similar pattern of distribution has been observed generally also among the caste population groups from India. Hardy Weinberg equilibrium is a useful indicator of genotype frequencies within a population and whether they are based on a valid definition of alleles and a randomly mating sample. HWE assumes a stable population of adequate size without selective pressures and is used in human genetic studies as a guide to data quality by comparing observed genotype frequencies to those expected within a population. All the populations (except Kashmir and Punjab) were found in Hardy Weinberg equilibrium (Table 2), indicating the random breeding of these populations. It also implied that the allele and genotypic frequencies remained constant from generation to generation for these Saraswat groups, whereas, the impact of inbreeding and migration was observed on the Kashmiri and Punjabi Saraswats. Using the allele frequency data for the ABO markers, genetic distance was calculated between the present Saraswat groups. Maximum genetic distance was observed between Punjabi and Jammu Saraswat Brahmins (0.0069) followed by Kashmiri Saraswat Brahmins (0.0041); whereas, the least distance was observed between the Brahmins of Jammu and Kashmir (0.0004), followed by Saraswat populations of Himachal and Punjab (0.0008). The Neighbour Joining tree of the five Saraswat populations illustrates two major clusters, and each consisting of two sub clusters (Fig. 1). The Kashmir along with Jammu Saraswat Brahmins formed one major cluster, whilst Himachal Pradesh, Punjab and Rajasthan Saraswat Brahmins appeared on another major cluster. This suggests a quite different genetic constitution of Punjabi Saraswat Brahmins compared to the other Saraswat groups.

Rh Blood Group

In the present study, frequency of allele Rh^*D is 0.8419 and that of Rh^*d is 0.1581 (Table 3), the frequency of Rh^*D alleles is 0.803 among the Indian population groups which varies from 0.53

Table 1: ABO blood groups and allele frequencies in the Saraswat community

<i>Place/ Blood group</i>	<i>Observed number</i>	<i>Expected number</i>	<i>Genotypes</i>	<i>Genotypic frequency</i>	<i>Percentage frequency</i>
<i>Jammu</i>					
A	12	12.16	AA	0.03014	3.014
			AO	0.16294	16.294
B	29	29.15	BB	0.12752	12.752
			BO	0.33517	33.517
O	14	13.88	OO	0.22024	22.024
AB	8	7.81	AB	0.12399	12.399
Total	63	63	Total	1.000	100
<i>Kashmir</i>					
A	9	13.54	AA	0.0324	3.24
			AO	0.175896	17.5896
B	24	28.19	BB	0.10983	10.983
			BO	0.32384	32.384
O	19	15.52	OO	0.23873	23.873
AB	13	7.75	AB	0.119304	11.9304
Total	65	65	Total	1.000	100
<i>Jammu and Kashmir</i>					
A	21	25.7	AA	0.03147	3.147
			AO	0.16955	16.955
B	53	57.31	BB	0.11806	11.806
			BO	0.32951	32.951
O	33	29.43	OO	0.22992	22.992
AB	21	15.56	AB	0.12149	12.149
Total	128	128	Total	1.000	100
<i>Punjab</i>					
A	11	15.43	AA	0.03889	3.889
			AO	0.21822	21.822
B	16	20.3	BB	0.06225	6.225
			BO	0.2761	27.61
O	22	18.37	OO	0.30614	30.614
AB	11	5.9	AB	0.0984	9.84
Total	60	60	Total	1.000	100
<i>Rajasthan</i>					
A	17	13.87	AA	0.02762	2.762
			AO	0.17936	17.936
B	30	27.07	BB	0.08655	8.655
			BO	0.31751	31.751
O	17	19.51	OO	0.29117	29.117
AB	3	6.55	AB	0.09779	9.779
Total	67	67	Total	1.000	100
<i>Himachal Pradesh</i>					
A	18	16.66	AA	0.04326	4.326
			AO	0.21299	21.299
B	25	23.71	BB	0.0784	7.84
			BO	0.28672	28.672
O	16	17.06	OO	0.26214	26.21
AB	6	7.56	AB	0.11648	11.648
Total	65	64.99	Total	1.000	100
<i>North Indian Saraswats</i>					
A	67	71.62	AA	0.0341	3.41
			AO	0.1897	18.97
B	124	128.34	BB	0.09108	9.108
			BO	0.30995	30.995
O	88	84.37	OO	0.26368	26.368
AB	41	35.68	AB	0.11149	11.149
Total	320	320.0	Total	1.000	100

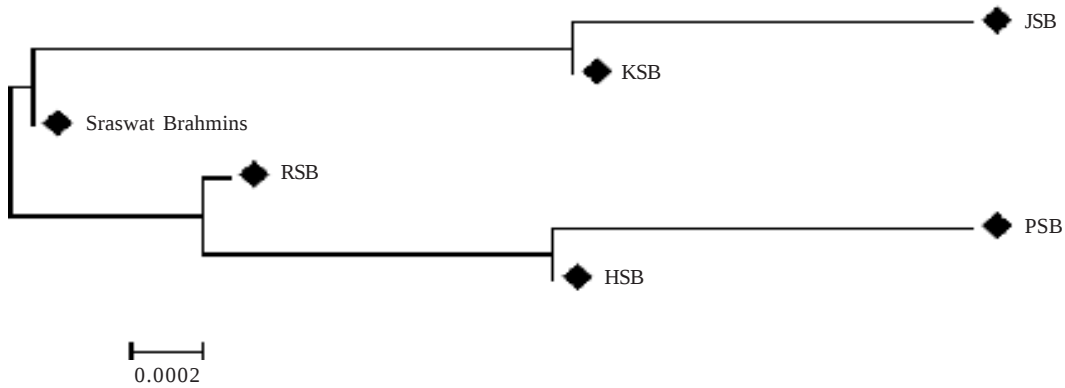


Fig. 1. Evolutionary relationships of 6 taxa belonging to the North Indian Saraswat Brahmins
The evolutionary history was inferred using the Neighbour-Joining method. The optimal tree with the sum of branch length = 0.00375 is shown.

*JSB-Jammu Saraswat Brahmin, KSB- Kashmir Saraswat Brahmin, RSB- Rajasthan Saraswat Brahmin, HSB- Himachal Pradesh Saraswat Brahmin, PSB- Punjab Saraswat Brahmin.

to 1.00 (Bhasin et al. 1994). The frequency of alleles Rh*D is a little higher among North Indian Saraswat Brahmins as when compared with Indian population groups (0.803, varies from varies from 0.53 to 1.00 by Bhasin et al. 1994).

Table 2: Hardy Weinberg parameters used for Saraswat populations

Place	χ^2	df	P
Jammu	0.0087	1	0.9258
Kashmir	6.4739	1	0.0109
Jammu and Kashmir	3.5227	1	0.0605
Punjab	7.2969	1	0.0069
Himachal Pradesh	0.5657	1	0.452
Rajasthan	3.2723	1	0.0705
Total Saraswats	1.3938	1	0.2378

Table 3: Rh blood group frequencies of Saraswat Brahmins

Group	Number observed	% observed	Allele frequency
Rh(D)+	312	97.5	0.8419
Rh(D)-	8	2.5	0.1581

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