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Research Paper

Distribution of ABO Blood Groups and Rhesus Factor Percentage Frequencies Amongst the Populations of Sikkim, India

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The incidence of ABO and Rh blood group has been found to vary in various populations. The present investigation was undertaken with the aim to study ABO blood group frequency amongst a subset of population of Sikkim. A total of 5098 individuals were included in the study out of which 215 were students of Department of Zoology, Sikkim University and Government College, Tadong, East Sikkim, 3000 individuals were from Rinchenpong and 1883 individuals were from Bermiok, Berfok, Berthang, Martam, Chingthang, Deythang, Hatidhunga, Samdong, Sangadorjee and Yangsum of West Sikkim. The data for ABO blood group were collected from the register of Primary Health Centre, Rinchenpong and others by documenting blood group of the individuals who have undergone routine blood group testing in diagnostic laboratories. SPSS software Version 8 was used to perform statistical analysis. The results were calculated as frequencies of each of the blood group, expressed as percentages. The frequency of blood group A (35.34%) was found to be the highest, followed by blood group O (35.18%), B (21.99%) and AB (7.49%). The results also indicated that 99.47% of individuals were Rh positive and 0.53 % were Rh negative. One of the interesting findings in the present study is the absence of Rh negative individuals among Bhutia population. The study may give preliminary idea about blood group frequency distribution among the population of Sikkim.

Keywords: Sikkim; Blood Group; Frequency; Population; Lepcha; Bhutia; Nepali

Introduction

Sikkim is one of the states in North Eastern India which is divided into four districts, North, South, East and West. It is situated between 27º04' South to 28º 07' North and 88º01' to 88º55' East longitudes. The total population of Sikkim is 6,07,688 (census 2011), which mainly consists of Bhutia, Lepcha and Nepali.

The existence of ABO and Rhesus (Rh) antigens is clinically very important as it plays a major role in blood transfusion and organ transplantation. Though all the population of the world have same blood group system, but the frequency of ABO and Rh antigens is found to vary amongst all populations. Thus, many studies have found difference of ABO and Rh frequency among the world population (Zahra *et al*., 2014; Kostovski *et al*., 2014). Several studies have also been conducted to understand the distribution of ABO blood group frequency among the Indian population (Gauniyal, 2006; Subhashini, 2007; Periyavan *et al*., 2010; Rai and Kumar, 2011; Pathania, 2011; Haloi, 2011; Pandey *et al.,* 2012; Prakash *et al.,* 2013; Pandey *et al.,* 2013; Soram *et al*., 2014; Handoo and Bala, 2014; Rao and Shetty, 2014; Shrivastava *et al*., 2015; Sukumaran *et al*., 2016; Sah and Sahadalal, 2016). Overall distribution of ABO frequency in India shows the group B to be the commonest blood group in northern and western part of India whereas in eastern, southern and central part O is the most prevalent blood group. Cumulatively, O is the dominant blood group among the Indian population (Shekhar *et al*., 2014).

Till date, only very few of the studies have been conducted to understand the distribution of ABO blood group frequency among the north-eastern population. As per the literature review, only one study have been

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conducted by Dutta and Banerjee (2008) to understand the ABO frequency in Sikkim, where blood group O was found to be predominant followed by A, B, and AB. The major limitation of that study was very low sample size (142 individuals). Therefore, the present investigation was undertaken with the aim to study: (i) the ABO frequency among the population of Sikkim by taking larger sample size, (ii) incidence of ABO blood group among different communities of the state. The study may throw light on the distribution of blood group frequency in the state.

Methods

Subjects

A total of 5,098 individuals were included in this study, among them 2,490 (48.84%) were females and 2,608 (51.16%) were males. The ages of participants were from 5 to 99 years. The samples included populations such as Bhutia, Lepcha and Nepali. Further, the Nepali community itself consisted of Bhujel, Gurung, Jogi, Kami, Manger, Mukhia, Pradhan, Rai, Rawat, Sanayasi, Sharma, Sherpa, Subba, and Tamang.

Determination of Blood Groups

The ABO blood group data presented here is documented from 215 individuals of Sikkim University and Government College, Tadong who have undergone routine blood group testing in diagnostic laboratories. Further, ABO blood group data of 3000 individuals were collected from the recorded data of Rinchenpong, Primary Health Care unit. Moreover, the ABO blood frequency data were also generated from 1883 individuals of Bermiok, Berfok, Berthang, Martam, Chingthang, Deythang, Hatidhunga, Samdong, Sangadorjee, Yangsum by documenting the blood group from individuals who had undergone routine blood group testing in diagnostic laboratories.

Statistical Analysis

Statistical analysis was performed with the help of SPSS software, Version 8. The frequency of each A,B,AB,O and Rh+, Rh- blood group was calculated by direct count and later converted into percentage. The result was calculated as the frequency of each blood group expressed as percentage. Chi-square test was used to test the heterogeneity of population on the basis ABO frequency.

Results

In the present study, blood group A (35.34%) was found to be the highest among the studied population followed by blood group O (35.18%), B (21.99%) and AB (7.49%). The frequency was in the order of A> O > B > AB. Among the total population studied, 99.47 % of individuals were Rh positive and 0.53 % was Rh negative (Table 1).

Table 1. Distribution of ABO and Rh blood group percentage frequencies amongst the populations of Sikkim

Blood groups	Total	Male individuals	Female	%
A	1802	951	851	35.34
O	1793	878	915	35.18
B	1121	601	520	21.99
AB	382	178	204	7.49
Total	5098	2608	2490	100
Rh +ve	5071	2601	2470	99.47
Rh-ve	27	7	20	0.53
Total	5098	2608	2490	100

Further, attempts were also made to study ABO frequency separately among Bhutia, Lepcha and Nepali population. The results showed that among 297 individuals of Bhutia community, blood group O (41.75%; n=124) was most prevalent followed by blood group B (26.60%; n=79), A (25.59%; n=76) and AB (6.06%; n=18). The frequency of blood group was in the order of O > B > A > AB. With reference to Rh factor, Sikkimese Bhutia population showed presence of only Rh+ blood group while Rh- group were completely absent in this ethnic group (Table 2). On the other hand, ABO frequency among 688 Lepcha individuals showed a high percentage of blood group A (36.48%; n=251) followed by blood group O (33.87%; n= 233), B (20.20%; n=139) and AB (9.45%; n=65). Most of the individuals were found to be Rh+ (99.7%; n=686). The frequency of blood group among the Lepcha population was in the order of A > O > B > AB. Among the Nepali community of Sikkim, blood group A (35.89%; n=1476) was the most prevalent blood group, followed by blood group O (34.91%; n=1436), B (21.93%; n= 902), and AB (7.27%; n=299). The percentage of Rh + (99.39%; n=4088) was found to be the highest and Rh– was

Table 2. ABO blood group distribution and its frequency among Bhutia, Lepcha and Nepali populations

	Bhutia			Lepcha			Nepali			
Blood groups	Rh positive	Rh negative	%	Rh positive	Rh negative	%	Rh positive	Rh negative	%	χ^2
O	124	0	41.75	232	1	33.87	1426	10	34.91	0.994 df = 2P>5%
B	79	0	26.60	139	0	20.20	896	6	21.93	0.956 df = 2P>5%
A	76	0	25.59	251	0	36.48	1470	6	35.89	2.297 df = 2P>5%
AB	18	0	6.06	64	1	9.45	296	3	7.27	0.777 df = 2P>5%
Total	297	0	100	686	2	100	4088	25	100	

only 0.61% (n=25). Distribution of ABO blood groups among the Nepali population was in the order A > O > B > AB. Chi-square test was also performed to study the heterogeneity among these populations on basis of ABO frequency distribution, which did not reveal any significant difference (P>0.05).

The Nepali community of Sikkim comprises number of populations within itself. The ABO and Rh blood group frequency of different populations under the Nepali community is presented in Table 3. The results show that O is the most frequent blood group among Chettri, Gurung, Sharma, Kami, Tamang, Jogi, and Rawat and group A is the most frequent blood group among Rai, Subba, Sherpa, Manger, Pradhan, Sanayasi, Bhujel, Rawat, whereas, B is the most frequent blood group among Mukhia population. Chi-square test among the Nepali population who have got sample size of more than hundred showed that the frequency of blood group A and O was significantly different (P<0.01) among Rai, Subba, Chettri, Gurung, Sharma, Kami, and Tamang (Table 3). On the other hand, frequency distribution of blood group B and AB were not significantly different. Moreover, there was no significant difference between Rh positive and negative frequency amongst all the populations.

Table 3. Distribution of ABO and Rh blood group within different populations of Nepali Community

Nepali community	Total population	A(%)	B(%)	O(%)	AB(%)	Rh+ve(%)	Rh-ve(%)
Rai	959	47.96	15.84	9.30	6.88	99.89	0.10
Subba	798	43.98	16.54	28.69	10.77	99.74	0.25
Chettri	601	27.95	25.12	40.93	5.99	98.50	1.49
Gurung	658	32.82	24.92	37.38	0.04	100	0
Sharma	465	16.98	30.10	46.02	6.88	99.78	0.21
Kami	220	21.36	34.09	37.72	6.81	97.27	2.27
Tamang	201	31.34	20.39	40.79	7.46	100	0
Chi square value		23.7 df=6 P<0.01*	11.6 df=6 P>0.05	26.2 df=6 P<0.01*	9.6 df=6 P>0.05	0.06 df=6 P>0.05	7.4 df=6 P>0.05
Sherpa	64	48.43	23.43	21.87	6.25	100	0
Manger	54	35.84	22.27	30.18	13.20	100	0
Pradhan	43	44.18	18.60	32.55	4.65	100	0
Mukhia	22	36.36	40.90	13.63	9.09	100	0
Sanayasi	14	50	21.42	28.57	0	100	0
Bhujel	8	62.5	12.5	12.5	12.5	100	0
Jogi	4	25	0	50	25	100	0
Rawat	2	50	0	50	0	100	0

*significant

Discussion

It was observed in the present study that blood group A is the most frequent blood group among the population of Sikkim followed by O, B and AB. However, frequency of A (35.34%) and O (35.18%) was found to be almost similar. In previous study by Dutta and Banerjee (2008), frequency of blood group O was found to be highest followed by A, B and AB, which is not in agreement with the present study. The present study found the highest frequency of blood group A among the population of Sikkim, which stands as a new finding. The difference between the present and previous study may be due to the large population size of the present study. Another reason for non-concordance of the results may be confinement of previous study within Gangtok and East Sikkim areas only, whereas the present study was undertaken on samples from Gangtok, East Sikkim and from different parts of West Sikkim. Our result is in agreement with study by Gauniyal (2006) and Haloi (2011), but not in accordance to the study by Rai and Kumar (2011), Pathania (2011), and Saha and Sahadalal (2016).

A majority of people in the world have the Rh(D) positive blood group. Similarly, in the present study, the frequency of the Rh(D) among all ethnic population was found to be more than 95%. On the other hand, the frequency distribution of Rh factor among Bhutia population shows the total absence of Rh negative group, which is a unique finding of the present investigation. The complete absence of Rh negative frequency was also observed among the tribal population of Jharkhand (Pandey *et al*., 2012). Comparative data on ABO and Rh frequency of various Indian populations at different geographical areas in India and abroad is presented in Table 4.

The study of ABO frequency separately among Bhutia, Lepcha and Nepali population showed variability in the distribution pattern, but when compared statistically it was not found to be significant. Therefore, it can be mentioned here that there is no heterogeneity among these populations on the basis of ABO blood group frequency (Table 2). On the other hand, comparison of ABO frequency among the various population of Nepali community revealed

Table 4. Comparison of frequency percentages of ABO and Rh groups at different geographical areas in India and abroad

Location	Place of study	Blood group A %	Blood group O%	Blood group B%	Blood group AB %	Rh +ve %	Rh –ve%
Eastern India	Present study	35.34	35.18	21.99	7.49	99.47	0.53
	Manipur (Soram *et al*., 2014)	23.9	34.4	35.7	7.6	94.2	5.8
	Arunachal Pradesh (Prakash *et al*., 2013)	13.0	42.0	40.0	5.0	99.0	1.0
	Meghalaya (Haloi 2011)	25.37	41.36	22.87	10.49	98.77	1.23
	West Bengal (Sah and Sahadalal, 2016)	13.31	31.27	36.52	10.15	99.97	0.03
	Jharkhand (Pandey *et al*., 2012)	23.81	23.81	44.76	7.62	100	0
Western India	Southern Rajasthan (Shekhar 2014)	22.3	34.4	35.7	7.6	94.2	5.8
North India	Himachal Pradesh (Pathania, 2011)	27.0	24.0	31.0	18.0	89.3	10.7
	Kashmir Valley (Handoo 2014)	23.88	34.72	33.34	8.06	91.17	8.83
	Uttaranchal (Gauniyal, 2006)	40.69	23.72	22.03	11.86	89.27	10.73
	Uttar Pradesh (Rai and Kumar, 2011)	23.66	32.68	36.81	6.85	95.59	4.41
Central India	Chattisgarh (Shrivastava *et al*., 2015)	22.17	33.55	35.42	8.17	96.85	3.15
	Indore (Gupta and Dadwal, 2012)	24.2	31.5	35.2	9.1	95.4	4.6
South India	Karnataka (Rao and Shetty, 2014)	25.8	42.0	27.3	4.8	94.64	5.35
	Bangalore (Periyavan *et al*., 2010)	23.85	39.81	29.95	6.37	94.20	5.79
	Devangere (Periyavan *et al*., 2010)	26.15	36.72	29.85	7.25	94.8	5.52
	Chittoor (Das *et al*., 2001)	18.95	47.37	25.79	7.89	90.6	8.42
	Pondicherry (Subhashini, 2007)	20.5	34.0	39.5	6.0	93.5	6.5
	Telangana (Sukumaran *et al*., 2016)	18.31	41.20	35.86	4.58	96.18	3.82
	Karnataka (Rao and Shetty, 2014)	25.8	42.0	27.3	4.8	94.64	5.35
Outside India	Nepal (Pramanik and Pramanik, 2000)	34.0	32.5	29.0	4.0	96.66	3.33
	West Iran (Zahara *et al*., 2014)	34.2	33.7	16.2	7.0	91.1	8.9
	Macedonia (Kostovski *et al*., 2014)	34.45	28.85	15.66	10.29	89.26	10.74

significant difference in the frequency of blood group A and O among Rai, Subba, Chettri, Gurung, Sharma, Kami, and Tamang (Table 3). This may be attributed to different races to which they belong such as Chettri, Sharma and Kami belong to Indo-Aryan group whereas Rai, Subba, Gurung, Tamang belong to Mongoloid group.

Most of the samples included in the present study were from West and East Sikkim and samples that were not included from South and North Sikkim, which is the limitation of present study. Taking this limitation into consideration, the present study still provides preliminary information about ABO and Rh frequency among the population of Sikkim. The results of this study may be of immense help in providing background information for transfusion services.

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Conflict of Interest

The authors declare no conflict of interest.

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