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Polymorphismic Changes in Blood Groups of the Naga Tribes of Nagaland

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Northern India is one of the oldest geophysical regions of human evolution and migration in the world. Genetic and anthropological studies have shown that the peopling the subcontinent is characterized by a complex history,contributed from different ancestral populations. Genetic level studies of polymorphisms always associated with health and diseases of population becoming the need of hours. The present study was aimed to explore the relationship of ABO blood groups association of populations and to assess the prevalence of blood groups in different categories of Northern India and to compare our results with other studies conducted in India. Blood samples from 155 unrelated individuals was collected from Naga tribal settlements Blood groups of individuals were evaluated with the presence of antigen using monoclonal antibody by a standard blood typing are protocol, Gene frequencies was calculated by Hardy-Weinberg method. The blood group O 67 (43.23%) was the commonest group prevalent in donors followed by group B 45 (29.03%), A 33(21.29%) and AB 10 (6.45%). The Rh negative was not observed in female donors, whereas in male it was found to be 1.3%. Data among tribal suggest their common origin as well as a drift from an original population due to the possible founder effect among tribal Naga Ten Tribal

Keywords: ABO blood groups, Rhesus factor, Diversity, Diphupar-B, , Nagaland.

The ABO blood group system was the first human blood group system to be discovered by Landsteiner in 1900[1]. The ABO blood group system is the only system in which antibodies are consistently and predictably present in the serum of normal individuals whose red cells lack the antigens . Apart from differences amongst species, differences between the individuals of the same species have also been demonstrated. During the world wars, it was discovered for the first time that the frequency of ABO and Rhesus blood groups was different in persons native to different parts of the world[2-3]. ABO and Rh gene phenotypes vary widely across races and geographical boundaries despite the fact that the antigens involved are stable throughout life. The resultant polymorphism remains important in population genetic studies, estimating the availability of compatible blood, evaluating the probability of hemolytic disease in the new born, resolving disputes in paternity/

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maternity and for forensic purposes[4]. The frequency of ABO and Rh phenotypes in different populations hasve been extensively studied. Rh system emerged as second most important blood group system due to hemolytic disease of newborn and its importance in RhD negative individuals in subsequent transfusions once they develop Rh antibodies. The D antigen, after A and B, is the most important red cell antigen in transfusion practice[5]. Unlike the situation with A and B, persons whose red cell lacks the D antigen do not regularly have anti D in their serum. Blood bank usually has a problem of ever-changing stock position and it being very difficult to predict the prevalence of a particular blood group at a particular time. The present study was done to assess the prevalence of blood groups in different categories of Northern India and to compare our results with other studies conducted in India and elsewhere in the world and its multipurpose future utilities for the health planners[6-8].

MATERIALS AND METHODS

The study of ABO and Rhesus Blood Group was carried out on 155blood donors (male and female) during a period of two months from 1stseptember to 31st October 2018 in Diphupar-B area Dimapur, Nagaland. The blood donors were selected after taking a detailed history and a complete examination regarding their eligibility criteria for blood donation. Donor's name, age, sex, occupation, caste, complete postal address and contact number was recorded. Blood samples were obtained by standard procedures of venupuncture and subjected to determination of ABO and Rhesus blood group using "antisera" by combined slide and test tube method. Each sample of donors was tested for ABO and Rhesus status.

Laboratory analysis

ABO and Rh blood group tests are carried out by a standard protocol using AB D Antisera typing Kit.(Fig. 1.)

Table 1. Hardy-Weinberg model for ABO blood group

Phenotype (blood group)	Genotype	Phenotype frequency	Genotypic frequency	Expected frequency
A	AA+AO	ηA	ηAA + ηAO	$p2 + 2pr$
B	BB+BO	ηB	ηBB + ηBO	$q2 + 2qr$
O	AB	ηAB	ηAB	$2pq$
AB	OO	ηO	ηOO	$r2$

Table 2. Overall allele frequencies for the ABO and Rh antigens in the Ten studied populations

Group	Gene frequency			Hardy-Weinberg loglikelihood	Genotypic frequency	χ2	Pvalue	Rh+(D)	Rh-(d)
	p[A]	*q*[B]	*r*[O]						
Total	0.16	0.2	0.64	-179.3	O>B>A	0.11	0.73	0.99	0.01
Chekhesang	0.13	0.30	0.57	-57.48	O>B>A	0.95	0.32	1.00	0.00
Sumi	0.27	0.03	0.70	-15.20	O>A>B	0.39	0.52	1.00	0.00
Angami	0.10	0.10	0.8	-15.09	O>A =B	0.39	0.53	1.00	0.00
Ao	0.20	0.27	0.51	-40.03	O>B>A	1.45	0.22	0.97	0.03
Mao	0.2	0.16	0.64	-16.40	O>A>B	1.34	0.25	1.00	0.00
Lotha	0.13	0.07	0.8	-07.30	O>A>B	0.17	0.68	1.00	0.00
Konyak	0.23	0.44	0.32	-09.17	B>O>A	0.47	0.50	1.00	0.00
Zeliang	0.15	0.15	0.70	-08.07	O>A =B	1.59	0.20	1.00	0.00
Sangtam	0.28	0.28	0.44	-05.75	O>A =B	0.42	0.51	0.63	0.33
Phom	0.42	0.18	0.40	-07.62	A>O>B	0.02	0.90	1.00	0.00

The study populations used in blood groupings occurred in the order O> B >A > AB .The allele frequency of blood group O was the highest ABO allele p (A), q (B), r (O) as 0.16, 0.2 , 0.64, respectively. This occurred in the order O> B >A. The allele frequency of blood group O is the highest χ2. The goodness of fit test was resulted in value was = 0.11 and p value was 0.73. The genotype frequencies are reached (D) = 99.0% and (d) = 1%, genotype frequencies are (D) = 0.99 and (d) = 0.01. There is the high proportion of Rh (D) +ve individuals than the Rh - vein the study populations

Statistical analysis

The gene and allele frequencies of blood group, are calculated by Hardy-Weinberg model using S2 ABO estimator software[7]. Allele frequencies are calculated under the assumption of Hardy–Weinberg equilibrium and expressed as percentages. The chi - square test is used to compare observed allelic and genotypic frequency distributions of the blood group and Rh antigens to that of under the Hardy–Weinberg[9]. ABO blood was aligned according to their respective frequencies in populations using PAST software : PCA and Phylogenetic trees were constructed, using Neighbor-Joining (NJ) method

RESULTS

The ABO and Rhesus blood Group in Diphupar-B showsed various typical results. The frequency of ABO and Rh blood groups in a total of 155 (male and female)donor population was compared. Amongst Rh positive female donors blood group O was found to be most prevalentin group 34(45.95%), followed by group B 23(31.08%), A 14(18.92%) and AB 3(4.05%). Amongst Rh positive male donors blood group O was the most prevalent group 33(41.77%), followed by group B 21(26.58%), group A 18(22.78%) and group AB 7(8.86%). The Rh negative does not exist in any female donors. The Rh negative appears only in male donors in blood group A-ve(1) and B-ve(1)with 1.3%..

DISCUSSION

The Neighbour Joining Analyses

Population relationships can be easily represented by Neighbor Joining (NJ) trees. To study the genomic affinities of the tribal populations of Nagalnd, NJ trees was constructed

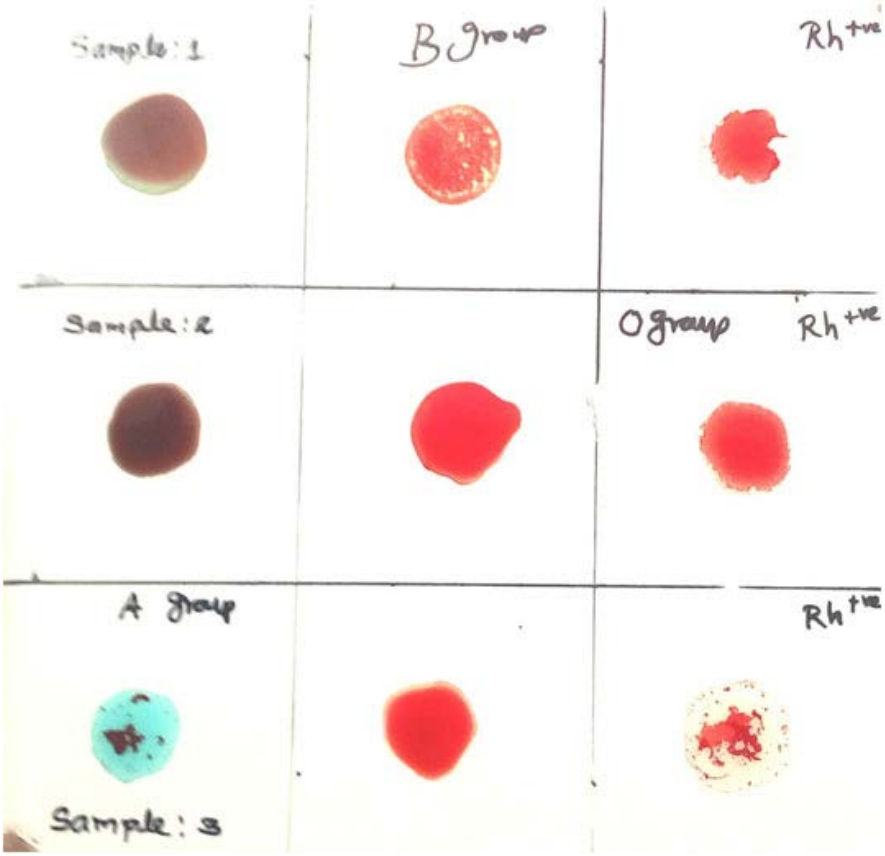

Fig.1. The Plate Showing the the result of A B O blood groups

by using various reported investigations in the tribes of India and globally by means of same set of loci/alleles. In the first NJ tree analysis, given in Fig.2. ABO blood polymorphic loci alleles are used to construct the tree to find the genomic affinities among the tribal populations of Nagaland under study Interestingly, this tree showed that *Mao* are clustered with Sumi who are geographically distant from *Mao* instead of *Zeliang*, who are thought as same to *Sumi,Angami* and *Lotha.* Another surprising genetic relation was established between Ao and Chekesang, though both are geographically

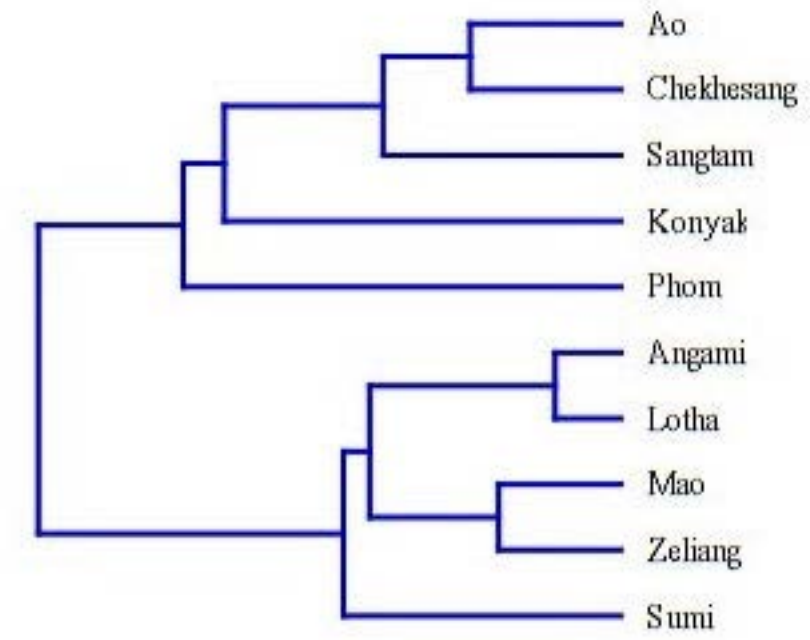

Fig. 2. Dendrogram of Ten Naga Tribal populations on diversity for ABO polymorphic loci

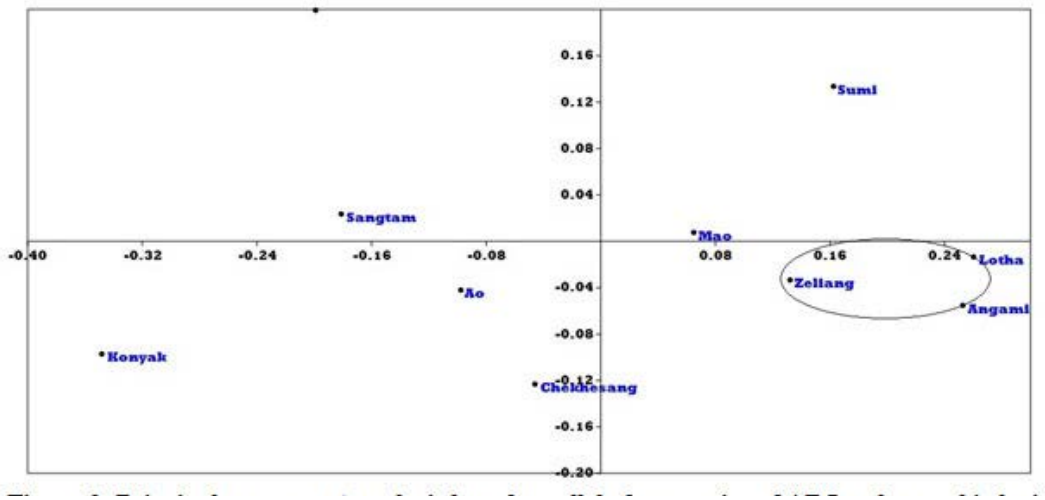

Fig.3. Principal component analysis based on allele frequencies of ABO polymorphic loci

Table 3. Detailed list of all donors and their corresponding bio-data

Sl No.	Name	Age	Sex	Blood Group	Tribe
1	Medou	22	F	O+	Chakhesang
2	Awistoli	22	F	O+	Sumi
3	Asenuo	22	F	O+	Angami
4	Supenro	19	F	B+	Lotha
5	Nyemang	21	F	O+	Konyak
6	kilingna	20	F	O+	Zeliang
7	Amy	19	F	A+	Sumi
8	Woben	21	F	O+	Lotha
9	Savinu	21	F	A+	Angami
10	Wesly	21	F	O+	Chakhesang
11	Kenlingunuuo	19	F	O+	Sumi
12	Pelevituo-u	24	F	O+	Angami
13	Mhasilenuo	45	F	O+	Angami
14	paziini	22	F	B+	Mao
15	A.moses	22	M	B+	Mao
16	Amenla	23	F	A+	Mao
17	Bethibra	33	F	B+	Mao
18	Sentiro	22	F	A+	Mao
19	Leshini	30	F	A+	Mao
20	Kokhrolu	24	M	O+	Mao
21	Eliveyi	24	M	O+	Mao
22	Rokositi	23	M	O+	Mao
23	Benlo	24	M	A+	Mao
24	Savio	45	M	A+	Angami
25	Itevika	22	M	O+	Sumi
26	Manato	21	M	O+	Sumi
27	S.sanmei	23	M	B+	Angami
28	Khrilazo	22	M	O+	Sumi
29	Savito	22	M	O+	Sumi
30	Nyewe-u	21	F	O+	Chakhesang
31	Julie	19	F	B+	Chakhesang
32	Krecheni	22	F	O+	Mao
33	Aniphro	22	F	A+	Mao
34	Marini	21	F	O+	Mao
35	Tsukhum	22	M	B+	Mao
36	Fuchumlo	22	F	O+	Lotha
37	Lutsu	22	F	O+	Pochury
38	Asen	22	F	A+	Ao
39	Atsu	21	F	O+	Yimchunger
40	Hukai	24	M	O+	Sumi
41	Asang	49	F	B+	Ao
42	Kehosedel	54	M	O+	Angami
43	Roko	22	M	B+	Angami
44	Nieketouzo	22	M	O+	Angami
45	Kenli	23	F	O+	Angami
46	Alokeu	24	F	O+	Lotha
47	Lanu	25	F	O+	Sumi
48	Mhalevino	22	F	A+	Sumi
49	Rencham0	22	F	O+	Ao
50	Vilasilie	22	M	B+	Angami
51	Vileto	24	M	A+	Angami
52	Nchumbeni	21	F	O+	Angami

53	Adino	25	F	O+	Muslim
54	Jabeda	25	F	A+	Muslim
55	Yantsuntung	26	M	A+	Lotha
56	Sai	23	M	O+	Zeliang
57	Merlin	2	F	B+	Pochury
58	Sentilemla	24	F	A+	Ao
59	Akato	25	M	O+	Suni
60	Kewe	26	M	O+	Sumi
61	Mercy	4	F	O+	Sumi
62	Manen	22	F	O+	Sumi
63	Nally	23	M	A+	Phom
64	Seyiesu	24	F	B+	Zeliang
65	Waltrina	25	M	AB+	Angami
66	Alona	26	F	A+	Garo
67	Kivisu	21	M	O+	Angami
68	Binlozu	30	F	B+	Rengma
69	Keyiening	32	F	O+	Zeliang
70	Vikeithozo	23	M	O+	Angami
71	Vinoka	22	M	B+	Sumi
72	Temjen	22	M	A+	Ao
73	Wapang	22	M	AB+	Ao
74	Yapani	23	F	B+	Loyha
75	Nungsen	23	M	O+	Ao
76	Sianglu	23	F	A+	Zeliang
77	Esther	23	F	B+	Konyak
78	Levilu	22	F	AB+	Chakhesang
79	Lipok	21	M	AB+	Ao
80	Lijingba	30	M	A-	Sangtam
81	Bishoka	24	F	O+	Dimasa
82	Alemla	23	F	O+	Ao
83	Aloto	24	M	A+	Sumi
84	Vihuka	23	M	A+	Sumi
85	Anoka	21	M	A+	Sumi
86	Bokato	25	M	A+	Sumi
87	Mercy	23	F	B+	Konyak
88	Akok	21	M	A+	Ao
89	Anengla	22	F	B+	Ao
90	Sunglu	22	F	B+	Ao
91	Mabeni	24	F	O+	Lotha
92	Menibeni	21	F	A+	Lotha
93	Alisong	23	M	O+	Ao
94	Aka	22	M	B-	Ao
95	Easter	24	F	O+	Sangtam
96	Kese	23	M	O+	Angami
97	Even	23	M	B+	Konyak
98	Juniya	24	F	B+	Dimasa
99	Lily	24	F	O+	Konyak
100	Hemsu	23	F	B+	Khiamniungun
101	Asen	22	F	AB+	Ao
102	Vili	21	M	A+	Sumi
103	Velu	21	F	O+	Chakhesang
104	Imti	21	M	A+	Ao
105	Wati	23	M	B+	Ao
106	Lanu	23	M	AB+	Ao
107	Amsong	23	M	O+	Ao

108	Tatong	25	M	B+	Ao
109	Temjen	22	M	O+	Ao
110	Akaba	19	M	O+	Ao
111	Atubu	22	M	B+	Ao
112	Sama	21	M	AB+	Ao
113	Tia	18	M	O+	Ao
114	Moa	21	M	B+	Ao
115	Sunep	22	M	B+	Ao
116	Tako	23	M	A+	Ao
117	Sashi	27	M	O+	Ao
118	Toshi	45	M	O+	Ao
119	Yinu	43	M	B+	Ao
120	Melekho	22	M	O+	Chakhesang
121	Vekho	22	M	B+	Chakhesang
122	Veto	22	M	O+	Chakhesang
123	Vethi	22	M	A+	Chakhesang
124	Achi	22	M	A+	Chakhesang
125	Akho	21	M	A+	Chakhesang
126	Ato	21	M	B+	Chakhesang
127	Khoto	24	M	B+	Chakhesang
128	Khrupu	25	M	O+	Chakhesang
129	Khruhu	25	M	B+	Chakhesang
130	Shehu	23	M	B+	Chakhesang
131	Michivo	24	M	A+	Chakhesang
132	Vechipo	21	M	B+	Chakhesang
133	Kuvezo	24	M	AB+	Chakhesang
134	Vebuzo	42	M	AB+	Chakhesang
135	Vemucho	33	M	B+	Chakhesang
136	Khoshe	31	M	O+	Chakhesang
137	Zhosheku	31	M	O+	Chakhesang
138	Vepopu	31	M	O+	Chakhesang
139	Popo	34	M	O+	Chakhesang
140	Alepu	22	M	B+	Chakhesang
141	Aku	22	M	O+	Chakhesang
142	Khrope	22	M	B+	Chakhesang
143	Atalu	34	F	B+	Chakhesang
144	Asulu	32	F	O+	Chakhesang
145	Avelu	23	F	B+	Chakhesang
146	Shelu	21	F	B+	Chakhesang
147	Khrulu	22	F	O+	Chakhesang
148	Khotalu	22	F	B+	Chakhesang
149	Abi	23	F	O+	Chakhesang
150	Atho	32	F	B+	Chakhesang
151	Vebunielu	34	F	AB+	Chakhesang
152	Shetolu	24	F	A+	Chakhesang
153	Shekhrulu	43	F	A+	Chakhesang
154	Tsinolu	23	F	B+	Chakhesang
155	Vetholu	21	F	B+	Chakhesang

very far-off. Overall, this tree showed that the Naga tribes under consideration are interrelated and equally distant from each other in terms of ABO blood allele frequencies.

Principal Component Analysis

Principal component analyses (PCA) was performed to identify possible clustering among the populations. In the PCA (Figure.3.)

using ABO blood, the populations *Zeliang, Lotha*and*Angami*are observed to be falling under a single cluster among the populations.

Human shares the same blood group systems, differing only in the frequenciesof specific types. The incidence of ABO, Rh and MN groups varies in different parts of the world and in different races[10]. Geographical and ethnic groups and socioeconomic groups,[11-12]. Many studies have revealed possible associations of various diseases with the ABO blood group, but the reasons for such associations are remain controversial[13-14]. With Blood group O has a greater incidence of association with hypertension[15] and melanoma[12]. As far as abortion is concerned, it is found to be higher in between A type husband and O type wife and high in couples with combination of A type husband and B type wife. The frequencies of Rh positive and Rh-negative individuals are 96.5% and 3.5% respectively[16]. ABO blood groups are important in determining migration of races and in hereditary diseases[17]. Some diseases are more common to develop in certain blood groups; hence the relationship of different blood groups with diseases is important[18].

The genomic affinities among eleven study populations are represented in Fig2& 3, using allele frequency data of four loci by a standard NJ tree and Principal component analysis. It has been that all student groups are genetically related to each other, to asses genomic affinities of the ten study populations, the data from the results of presents study groups are assured together and represented in an others NJ tree andPrincipal component analysis (Fig.2& 3).

CONCLUSION

In conclusion, based on ABO blood group poylmpohsms the Naga tribes have geneticroots with others Indian population. Studieds association of ABO blood group polymorphismand disease prevalence in populations of India need to be established using molecular markers, such as nDNA, mtDNA etc. Whichright clear the picture in the human biography of the Indian subcontinent

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