Distribution of ABO and Rh(D) blood groups among four populations in Manipur, North East India

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Abstract
Genetic studies on populations in north-east Indian have been performed less frequently than in the other parts of India, in spite of diversity among these populations. In the present study, an attempt was made to study the distribution of ABO and Rh (D) blood groups among Meitei, Brahmin, Muslim and Kabui tribes of Manipur, India in order to understand the population affinities in relation to each other. This is a preliminary study in which the blood groupings were done after collection from these populations and statistical analyses were made. Blood group A shows the highest frequency among the Brahmin (35.10%) followed by the Meitei (31.58%), whereas blood group O is highest among the Muslims (49.50%) followed by Kabui (40.16%). Allele RH*d was found to be less frequent in all the studied populations, with no occurrence among the Kabui tribe. The Brahmin showed significant deviation from the Hardy-Weinberg equilibrium with respect to ABO blood grouping. Muslims are separate from the other three populations, forming a cluster and maintaining their own gene pool. The Kabui tribe shows close resemblance with the neighbouring Naga populations in the distribution of ABO alleles. For a better understanding of these populations, a more elaborate and precise study is much needed.

KEYWORDS: Manipur, genetic differences, heterogeneity, Hardy Weinberg equilibrium
Introduction

Anthropological studies have generated huge amounts of biological data among Indian populations, which in turn can be used to understand the peopling of India. The north-eastern part of India is relatively less studied with very sparsely reported data related to serological and biochemical traits on a few population groups. To fill this gap, the present study focuses on the ABO and Rh(D) blood group distribution among four population groups of Manipur: the Meitei, the Meitei Brahmin (Bamon), the Manipuri Muslim (Pangan) and a tribal population, Kabui. The study attempts to understand the status of these four populations in India with respect to the selected serological markers.

Manipur is one of the small hilly states situated at the north-eastern extreme corner of India that connects the Indian sub-continent to east Asia and south-east Asia as a unique narrow passageway (Cardaux et al., 2004). This state has a total area of 22,327 sq km, in which the hilly area (92% of the land) surrounds the central of the valley area (8%) (Vedaja, 1998). Numerous and various ethnic groups inhabit both the hilly and valley areas, forming a diverse cultural and ethnic background.

The Meitei represent the major non-tribal population group of the state, with 60% of the total state population (Lalit, 2007). The history of the Meitei is still hazy, but it is a fact that they represent a mixture of many races (Zehol, 1998). Hodson (1908) suggested that the Meitei are presumably formed by the admixture of Koomal, Looang, Moirang and Meitei, all of whom came in different periods of time from different directions and now represent the clans of the community. The Meitei Brahmin comprise about 5% (Ibohal, 1986) of the total population of the state, and are claimed to be the descendents of Nabadwip, Vrindavan, Ujjain and Kanauj upper-caste Brahmins. They were brought to Manipur during the reign of King Kyamba (1467–1508), and afterwards (Singh, 2001) for performing the ritual practices of Hinduism; later, they were allowed to marry the Meitei women.

In the same situation, Muslims (190,939; 2001 census), who account for 8% of the total population of the state, were brought as war captives from Sylhet of Assam (now in Bangladesh) in 1606 (Paratt, 2005), and were made to settle in the state by allowing them to marry Meitei women. Kabui (62,216; 2001 census) has been one of the indigenous tribes of Manipur and its neighbouring states Assam and Nagaland since earlier times. Kabui along with another minor tribe Puimei represent 9.84% of the total tribal population of the state. According to Kamei (2004), they migrated southward across the Himalayas in the prehistoric period to north-east India and south-east Asia from south-west China.

Mythologically, they are also claimed to be brothers of the Meitei (Singh, www.epao.net/). Even though all the populations speak the same Tibeto-Burman language (Grierson, 1903; Hodson, 1908; Paratt, 1980), the Meitei and Kabui belong to the Mongloid racial stock; while the Muslims are a Caucasoid group (Shah, 1990), and the Brahmin represent the admixture of Caucasoid and Mongloid features (Chakraborty et al., 1987).

Materials and Methods

A total of 941 random blood samples were collected from both sexes with prior informed consent from four endogamous populations of Manipur inhabiting in the valley area of the state (Meitei:
209, Meitei Brahmin: 302, Manipuri Muslim: 303 and Kabui; 127), with the finger-prick method, using disposable lancets. ABO and Rh(D) blood groupings were done on the spot, with a slide test as described by Bhasin and Chahal (1996) using anti-A, anti-B and anti-D monoclonal antibodies. Gene frequencies were calculated according to Mourant et al. (1976).
The test of goodness of fit (chi-square test) based on the observed and expected frequencies of ABO blood grouping were calculated in order to discover any significant deviation from the Hardy-Weinberg equilibrium. The overall genetic difference between any two endogamous groups was calculated, as described by Sanghvi and Khanolkar (1949), and Sanghvi (1953), using the presently studied markers and the secondary data available for these populations (Chakravartti, 1986; Singh et al., 1986). To have an overall regional variation of ABO allele-frequency distribution in North east India, a three coordinate graph was drawn up with the available data (Singh and Bhasin, 2004).

**Results**

Among the Meitei and Brahmin, blood group A shows the highest frequency (31.58% and 35.10%, respectively); while blood group O is the most preponderant (49.5% and 40.16%, respectively) among the Muslim and Kabui communities. As expected, AB is the least frequent blood group among all the studied populations (Table 1). The test of goodness of fit indicates a significant deviation from the Hardy-Weinberg equilibrium only among the Brahmin ($\chi^2 = 4.875$). The value of $D/\sigma$ is also high among the Brahmin, which is also reflected in the wide difference in the observed and expected AB frequencies (Table 1). Among all the studied populations, $ABO^*O$ has the highest allele frequency (Meitei: 0.5464, Brahmin: 0.5710, Muslim: 0.7056 and Kabui: 0.6276, respectively). It is followed by $ABO^*A$ among the Meitei, Brahmin and Kabui each with 0.2468, 0.2667 and 0.2007, respectively; while in Muslims, it is followed by $ABO^*B$ with 0.1520.

A very low percentage of Rh-ve individual was found in the present study: Meitei (0.48%), Brahmin (1.99%) and Muslim (1.98%), and 0% among the Kabui. The corresponding $RH^D$ allele frequencies are 0.9307, 0.8589, 0.8593 and 1.0000 among the Meitei, Brahmin, Muslim and Kabui, respective.

**Discussion**

The high occurrence of blood group O among the Muslims and Kabui may be due to the practice of consanguinity among the Muslims (Bittles, 2002) and the smaller population size among the Kabui tribe, leading to the founder effect. Another possible explanation of this occurrence could also be because of the selection of the Blood group O in a *Plasmodium falciparum*-affected malarial region through the process of reduced rosetting (Cserti and Dzik, 2007; Rowe et al., 2007) as the Manipur state is prone to *Plasmodium falciparum* malaria (Dev et al., 2003; Lal
et al., 2000). A similar incidence of high levels of blood group O has also been reported earlier among the Purum (Chothe) tribe of Manipur (Singh and Singh, 2007).

The significant deviation from Hardy-Weinberg equilibrium among the Brahmin indicates that the population is not stable yet. The plausible reason for this significant deviation may be the smaller size of the Brahmin population.

The relatively high incidence of the $ABO^*A$ allele among Meitei, Brahmin and Kabui populations is in accordance with the distribution pattern of ABO alleles among the Indian populations. $ABO^*A$ allele has been reported highest among the Tibeto-Burman speaking people (more than 20%) of north-east India (Bhasin et al., 2001). However, among the presently studied populations, all the three allelic frequencies are within the reported range of eastern Himalayan region in which the state is situated.

In general, the frequency of allele $RH^*D$ varies from 0.532 to 0.100 among Indians. The $RH^*D$ frequency was found to be higher among the tribes in comparison to other communities (Bhasin and Walter, 2001). In the present study, the Kabui tribal population also has higher allele frequency of $RH^*D$ than the other studied non-tribal population, which shows that the distribution of Rh blood group among these population follows the generally expected pattern of distribution in Indian population groups.

<table>
<thead>
<tr>
<th>Group combination</th>
<th>ABO</th>
<th>Rh</th>
<th>MN</th>
<th>Genetic difference G2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meitei X Brahmin</td>
<td>1.45</td>
<td>0.93</td>
<td>0.20</td>
<td>0.43</td>
</tr>
<tr>
<td>Meitei X Muslim</td>
<td>9.80</td>
<td>0.93</td>
<td>9.16</td>
<td>3.32</td>
</tr>
<tr>
<td>Meitei X Kabui</td>
<td>2.23</td>
<td>0.48</td>
<td>4.96</td>
<td>1.28</td>
</tr>
<tr>
<td>Brahmin X Muslim</td>
<td>9.83</td>
<td>0.00</td>
<td>9.83</td>
<td>3.28</td>
</tr>
<tr>
<td>Brahmin X Kabui</td>
<td>2.43</td>
<td>2.01</td>
<td>6.97</td>
<td>1.90</td>
</tr>
<tr>
<td>Muslim X Kabui</td>
<td>2.96</td>
<td>2.00</td>
<td>12.48</td>
<td>2.91</td>
</tr>
</tbody>
</table>

Table 2: Chi-square, calculated on the observed frequencies and the co-efficient of genetic difference between the studied populations

![Diagram](image)

Figure 2: Diagrammatical representation of genetic difference among the four endogamous populations based on chi-square, calculated on the observed populations and the co-efficient of genetic difference between the studied populations
The two-dimensional representation of the multidimensional genetic relationship between the studied groups, based on the value of the genetic difference (G2) (Fig. 2), reveals that the Manipuri Muslims (a Caucasoid group) is separate, far from the other three Mongloid populations that share a common cluster. It supports the strict endogamous pattern of Muslims and as well the status of being of Caucasoid racial stock. The high genetic difference between the Muslim and Brahmin reveals their different waves of migration from different places. The lower genetic difference between the Meitei and Brahmin indicates the low of reproductive isolation between these populations, resulting in the increase of genetic similarities. The lower genetic difference between the Meitei and Kabui supports the mythologically claimed hypothesis of their being brothers, probably sharing a common ancestor.

Figure 3: Three co-ordinate graph based on the ABO allele frequency of north-east populations that belong to Assam, Nagaland, Manipur, Sikkim, Meghalaya, Arunachal Pradesh, Tripura, etc.
The three co-ordinate graph (Figure 3), based on the gene frequency of $ABO^*A$ (p), $ABO^*B$ (q) and $ABO^*O$ (r) of the presently studied populations and the available data for the surrounding populations, indicates that different populations of the region have a lower degree of similarities. A few populations tend to cluster, indicating similar distribution of ABO alleles. The Naga tribes along with the other tribal populations of the neighbouring states were found share the similar pattern of allele distribution, indicating the possibility of common origin. Another group of populations, mainly those of Assam, were found to cluster together, showing a similar pattern of allele distribution.

Among the presently studied populations, the Kabui tribe, a Naga tribe, are very close to the Tangkhul Naga tribe of Manipur and the Angami Naga tribe, and also forms a part of the cluster of Naga tribes. The Meitei and Brahmin are close to each other, while the Muslims are separate from the other present studied populations. Overall, the graph shows the high degree of variation in the distribution of ABO alleles among the north-eastern populations, even though these populations share the same geographical region and climatic conditions.

The results of this study illustrate that there is high degree of genetic variation among the studied populations, in terms of distribution of ABO and Rh(D) blood groups. All the studied populations are in genetic equilibrium, maintaining their own gene pools, except the Brahmin, in which the gene inflow from the neighbouring Meitei population is presently occurring. Muslims, being Caucasoid, maintain a separate gene pool and, in their overall genetic difference, lie far from the other populations studied. The Kabui, the only tribal community in the present study, show close genetic proximity with the Meitei and share similar ABO allele frequencies with neighbouring Naga tribal communities. However, for a better understanding of the genetic differences and affinities of these population groups of this state, a more precise and detailed study on different genetic markers and at the genome level is much needed.

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References


**POVZETEK**

Genetske študije populacij severovzhodne Indije so precej redkejše kot podobne študije v drugih delih eIndije, čeprav so ravno te populacije zelo raznolike. V pričujoči študiji smo želeli proučiti razširjenost ABO in Rh (D) krvnih skupin med manipurskimi plemeni Meitei, Brahmin, Muslimani in Kabui, da bi bolje razumeli populacijske sorodnosti med njimi. Predstavljena je preliminarna študija, ki temelji na statistični analizi krvnih skupin iz vzorcev, odvzetih omenjenim populacijam. Krvna skupina A je najbolj pogosta med Brahmini (35.10%), ki jim sledijo Meiteiji (31.58%), krvna skupina O pa je najpogostejša med Muslimani (49.50%), ki jim sledijo Kabuiji (40.16%). Alel RH*d je bil med proučevalnimi populacijami redek, v plemenu Kabui pa se ni pojavil. Pri Brahminih se je pokazal statistično značilen odklon od Hardy-Weinbergovega ravnoveseja glede na ABO krvne skupine. Muslimani so ločeni od ostalih treh populacij in oblikujejo skupino, ki ohranja lasten genski bazen. Kabuiji so v razširjenosti ABO alelov zelo podobni sosednjim populacijam plemena Naga. trije co-ordinate diagram prikaže se heterogeneity med Severen vzhodnim populacijam s spoštovanje k razširjenost od ABO aleli. Za boljše razumevanje teh populacij, temeljitejši in natančen študij je potreben veliko. Za boljše razumevanje teh populacij so potrebne nadaljne, bolj razvite in natančne raziskave.

**KLIJUČNE BESEDJE:** Manipur, genske razlike, heterogenost, Hardy-Weinbergovo ravnoveseje

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