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

Sanjenbam Yaiphaba Meitei
University of Delhi, yaipha_meitei@yahoo.co.in

Mohammad Asghar
University of Delhi, asghar2108@gmail.com

Nongthombam Devi Achoubi
University of Delhi, achoubi@gmail.com

Benrithung Murry
University of Delhi, benrithungmurry@yahoo.co.in

Kallur Nava Saraswathy
University of Delhi, knsaraswathy@yahoo.com

Mohinder Pal Sachdeva
University of Delhi, mpsachdeva@rediffmail.com

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

ANTHROPOLOGICAL NOTEBOOKS 16 (2): 19–28.
ISSN 1408-032X

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 (Parratt, 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.e-pao.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).

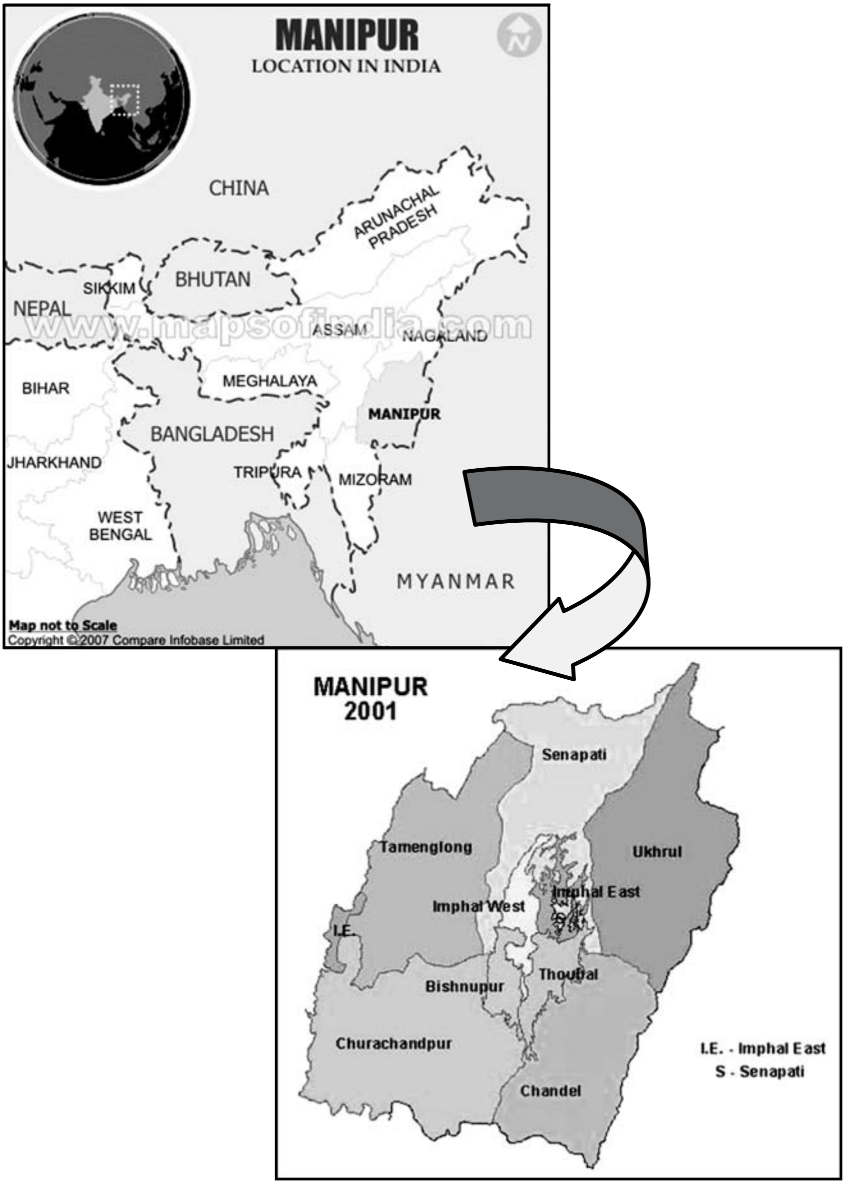

Figure 1: Manipur map

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/σ 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.

Blood group	Phenotype	Meitei		Brahmin (Bamon)		Muslim		Kabui		Gene frequency				
		Obs no. (%)	Exp. no.	Obs. no. (%)	Exp. no.	Obs. no. (%)	Exp. no.	Obs. no. (%)	Exp. no.	Allele	Meitei	Bamon	Muslim	Kabui
ABO	A	66 (31.58)	69.10	106 (35.10)	113.462	68 (22.44)	67.05	36 (28.35)	37.11	*ABO*A*	0.2468	0.2667	0.1424	0.2007
	B	53 (25.36)	56.18	56 (18.54)	63.903	73 (24.10)	71.99	30 (23.62)	31.11	*ABO*B*	0.2068	0.1623	0.1520	0.1717
	O	65 (31.10)	62.41	105 (34.77)	98.452	150 (49.50)	150.86	51 (50.03)	50.03	*ABO*O*	0.5464	0.5710	0.7056	0.6276
	AB	25 (11.96)	21.31	35 (11.59)	6.183	12 (03.96)	13.10	10 (07.87)	8.75					
	Total	209		302		303		127						
	χ^2	1.065		4.872		0.125		0.270						
	D/σ	1.014		2.154		0.343		0.528						
Rh	Rh +ve	208 (99.52)	207.9	296 (98.01)	295.99	297 (98.02)	297.00	127 (100)	127	*RH*D*	0.9307	0.8589	0.8593	1.0000
	Rh –ve	1 (00.48)	1.0	6 (01.99)	6.01	6 (01.98)	5.99	0 (000)	0	*RH*d*	0.0693	0.1411	0.1407	0.0000
	Total	209		302		303		127						

Table 1: Distribution of ABO and Rh blood groups among the Meitei, Brahmin (Bamon), Muslim and Kabui tribes of Manipur

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.

Group combination	ABO	Rh	MN	Genetic difference G2
Meitei X Brahmin	1.45	0.93	0.20	0.43
Meitei X Muslim	9.80	0.93	9.16	3.32
Meitei X Kabui	2.23	0.48	4.96	1.28
Brahmin X Muslim	9.83	0.00	9.83	3.28
Brahmin X Kabui	2.43	2.01	6.97	1.90
Muslim X Kabui	2.96	2.00	12.48	2.91

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

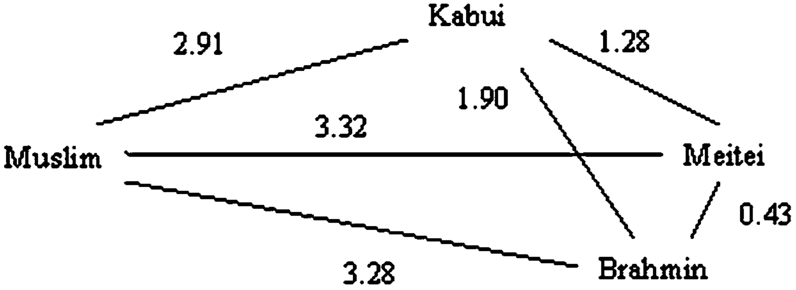

Figure 2: Diagrammatical representation of genetic difference among the four endogamous populations based on chi-square, calculated on the observed populations and the co-efficient of genetic difference between the studied populations

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.

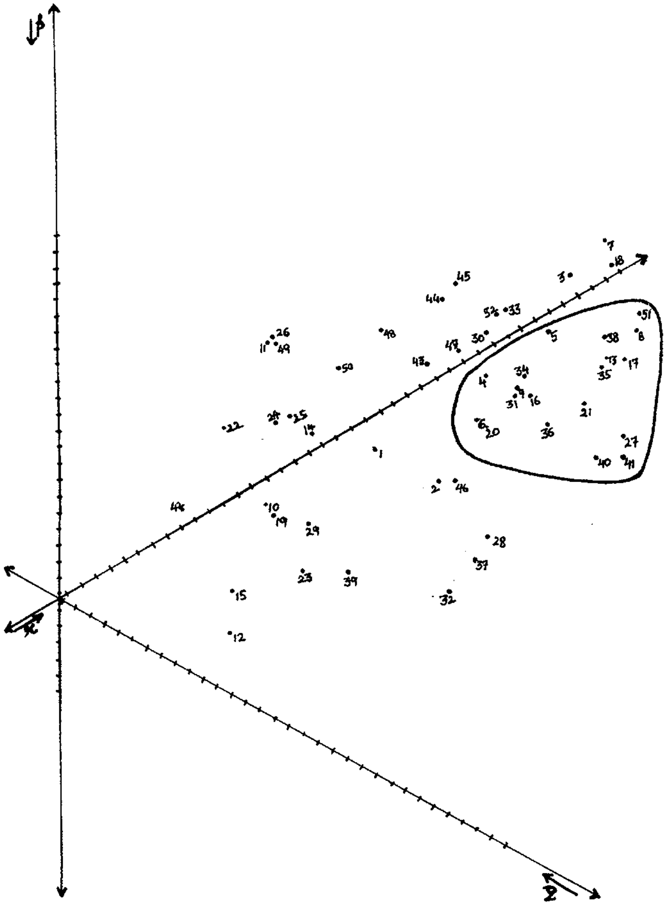

Figure 3: Three co-ordinate graph based on the ABO allele frequency of north-east populations that belong to Assam, Nagaland, Manipur, Sikkim, Meghalaya, Arunachal Pradesh, Tripura, etc.

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.

Acknowledgements

We are very thankful to all the lab colleagues of the Biochemical and Molecular Anthropology Laboratory, Department of Anthropology, University of Delhi. We are also grateful to all the individuals who volunteered to participate in this study.

References

Bhasin, Mohinder Kumar and S.M.S. Chahal. 1996. A Laboratory *Manual for Human Blood Analysis*. Delhi: Kamla Raj Enterprises.

Bhasin, Mohinder Kumar, Hubert Walter , S.M.S. Chahal, V. Bhardwaj, Sudhakar, et al. 1986. Biology of the people of Sikkim: Studies on the variability of genetic markers. *Zeitschrift für Morphologie und Anthropologie* 77 (1), 49–86.

Bhasin, Mohinder Kumar and Hubert Walter. 2001. *Genetics of Castes and Tribes of India.* Delhi: Kamla Raj Enterprises.

Bhattacharjee, PN. 1954. Blood group investigation in the Abor tribe. Bulletin of the *Department of Anthropology* 3: 51–54.

Bhattacharjee, P.N. 1957. A-B-O blood groups of the Angami Naga. *Eastern Anthropologist* 11 (1): 42–46.

Bhattacharjee, P.N., D. Choudhury and S. Chatterjee. 1974. Genetic variation among the Sikkimese Lepchas (A1A-2BO, MN, Rh blood groups, PTC taste and C.B.) and their affinity. *The Anthropologist* 21 (1–2): 41–48.

Bhattacharjee, P.N. and D.K. Nanda. 1980. Blood groups of the Paite of Manipur. *Journal of the Indian Anthropological Society* 15: 207–210.

Bittles, Alan Holland. 2002. The Impact of Consanguinity on the *Indian Population. Indian Journal of Human Genetics* 8 (2): 45–51.

British Research Association Committee. 1939. Blood groups among the primitive peoples. *Nature* 144: 714.

Buzarbarua, P.M. 1978. *A study on the effects of birth orders and mother age on reproductive wastage of the Mishing of Disangmukh Sibsagar.* Assam: Department of Anthropology (unpublished).

Chakraborty, M. 1965. ABO blood groups of the Zeliang Naga. *Man in India* 45: 311–315.

Chakraborty, R., Hubert Walter, P. Sauber, B.N. Mukherjee, K.C. Malhotra, et al. 1987. Immunoglobin (Gm and Km) allotypes in nine endogamous Groups of West Bengal, India. *Annals of Human Bioogy.* 14 (2): 155–157.

Chakravartti, Rama. 1986. People of Manipur: *Anthropologenetic study of Four Manipur Groups.* Delhi: B.R. Publishing Corporation.

Cordaux, Richard, Gunter Weiss, Nilmani Saha and Mark Stoneking. 2004. The Northeast Indian Passageway: A barrier or corridor for human migrations? *Mollecular Biology and Evolution* 21(8): 1525–1533.

Cserti, Christine M. and Walter H. Dzik. 2007. The ABO blood group system and Plasmodium falciparum malaria. *Blood* 110 (7): 2250–2258.

Das, Bhuban M. 1969. ABO blood groups in the tribal populations of north east India with special reference to the Khasi. *The Anthropologist* (Special volume): 85–92.

Das, Bhuban M., Priyabala Das and Renuka Das. 1973. Genetic distances in respect of ABO blood groups among the four castes of Assam (India). *Human Genetics*. 12: 264–266.

Das, Bhuban M., Ranjan Deka and Renuka Das. 1980. ABO blood groups and Rh–factor in six populations in Assam. *Bulletin of the Anthropological Survey of India* 29: 1–3.

Das, Bhuban M., Hubert Walter, K. Gilberg, P. Lindenberg, K.C. Malhotra, et al. 1987. Genetic variation of five blood group polymorphisms in ten populations of Assam, India. *International Journal of Anthropology* 2 (4): 325–340.

Das, Bhuban M., Priyabala Das, Renuka Das, Hubert Walter and Heidi Danker-Hopfe. 1985. Anthropological studies in Assam, India. 1. Observations on five mongoloid populations. *Anthropologischer Anzeiger* 43 (3): 193–204.

Deka, Ranjan. 1984. A genetic survey of four Mongoloid populations in Garo Hills. In: I.J.S. Jaswal, I.J.S. (ed.), *Bioanthropology of Garo Hills.* New Delhi, India: Omson Publishers.

Dev, V., P.C. Bhattacharyya and Rupjyoti Talukdar. 2003. Transmission of Malaria and its Control in the Northeastern Region of India. *Journal of Association of Physicians of India* 51: 1073–1076.

Flatz, G, M.R. Chakravartti, B.M. Das, H. Delbrück. 1972. Genetic survey in the population of Assam. 1. ABO blood groups, glucose-6-phosphate dehydrogenase and haemoglobin type. *Human Heredity* 22 (4): 323–330.

Gupta, S.P. 1958. ABO blood groups in Tripura (North East India). *The Journal of the Royal Anthropological Institute of Great Britain and Ireland* 88 (1): 109–111.

Grierson, George Abraham. 1903. *The Linguistic Survey of India.* Vol (iii) Part (ii). Delhi: Motilal Banarsidass.

Hodson, T.C. 1908. *The Meiteis.* Delhi: Low Price Publications.

Ibohal, W. Singh. 1986. *The History of Manipur (An early period)*. Thangal Bazar, Imphal: Manipur Commercial Private Limited.

Jaswal, I.J.S. and P.B.S.V. Padmanabham. 1983. Sero anthropology of Apatanis of Arunachal Pradesh. *Human Science* 32 (2): 120–124.

Kamei, Gangmumei. 2004. *The History of Zeliangrong Naga.* Guwahati: Spectrum Publications.

Kapaiwo, Th. 1995. *ABO and Rh-Blood Group Distribution among the Tangkhuls of Manipur.* Unpublished M.A. Dissertation. Canchipur: Department of Anthropology, Manipur University.

Kar, R.K. and M. Bhattacharjee. 1981. A1A2BO, MN, and Rh blood groups among the Ao of Nagaland. *Bulletin of Department of Anthropology of Dibrugarh University* 10: 94–108.

Krithika, S, Suvendu Maji and T.S. Vasulu. 2006. Genetic Heterogeneity Among Three Adi Tribes of Arunachal Pradesh, India. *Human Biology* 78 (2): 221–227.

Lal, Shiv, G.S. Sonal and P.K. Phukan. 2000. Status of Malaria in India. *Journal of Indian Academy of Clinical Medicine* 5 (1): 19–23.

Lalit, P. 2007. *A brief history (Puwari) of the Meiteis of Manipur.* http://themanipurpage.tripod.com/history/puwarimeitei.html. Accessed on 15 November 2009.

Majumdar, D. Nath. 1950. ABO blood group among the Garos of East Pakistan. *Man in India* 30: 32–35.

Mitra, P.N. 1935. Blood groups and heredity (Assamese-plains). *Indian Journal of Medical Research* 22: 496.

Mitra, P.N. 1936. Blood groups of the Angami Naga and the Lushai tribes. *Indian Journal of Medical Research* 23: 685–686.

Mourant, A. Ernest, Ada C. Kopec and Kazimiera Domaniewska-Sobezak. 1976. *The Distribution of the Human Blood Groups and Other Polymorphisms.* London: Oxford University Press.

Parrat, Saroj Nalini. 1980. *The Religion of Manipur: A Brief Historical Development.* Calcutta: Firma KLM Private Ltd.

Parrat, Saroj Nalini Arambam. 2005. *The Court Chronicle of the Kings of Manipur (the Chaitharon Kumpapa English translation).* New York: Routledge Taylor and Francis Group.

Rowe, J. Alexandra, Ian G. Handel, Mahamadou A. Thera, Anne-Marie Deans, Kirsten E. Lyke , et al. 2007. Blood group O protects against severe Plasmodium falciparum malaria through the mechanism of reduced resetting. *Proceedings of the National Academy of Sciences* 104(44): 17471–17476.

Sanghvi, L.D. and Vasant Ramji Khanolkar. 1949. Data relating to seven genetical characters in six endogamous groups in Bombay. *Annals of Eugenics* 15: 52–76.

Sanghvi, L.D. 1953. *Comparison of genetical and morphological methods for a study of biological differences. American Journal of Physical Anthropology* 11: 385–404.

Sengupta, Sarthak. 1982. ABO blood groups among Brahmins of India with special reference to Assam. *Indian Journal of Physical Anthropology and Human Genetics* 8: 143–149.

Seth, Praveen Kumar and Swadesh Seth. 1973. Genetical study of Angami Nagas (Nagaland, India), A1A2BO, MN, Rh blood groups, ABO (H) secretion, PTC taste sensitivity, and color blindness. *Human Biology* 45: 457–468.

Shah, Latif. 1990. Bio-anthropology of the Muslims of Manipur. Unpublished Ph.D. Thesis, Canchipur: Department of Anthropology, Manipur University.

Shah, Md Latif. 2001. ABO Blood Groups among the Koirengs of Manipur. *Journal of Anthropological Society of Manipur* 3: 47–51.

Shreela, Devi, Ng. Singh and T. Shyamacharan. 1998. Gene differentiation at two loci between the Muslims of Manipur and Assam. *Journal of Indian Anthropological Society* 25: 35–38.

Singh, K.S., B.N. Mukherjee, H.Walter, P. Lindenberg, K. Gilbert, et al. 1986. Genetic Markers among Meiteis and Brahmins of Manipur, India. *Human Heredity* 36: 177–187.

Singh, L.R. 1986. Physical Variation Between the Two sections of Kabuis of Manipur and Their Ethnic Position. Unpublished Ph.D. Thesis. Gauhati: Gauhati University.

Singh, T. Shyamacharan and M.N. Phookan. 1990. A note on the frequency distribution of ABO and Rhesus blood group in four Thai population in Assam (India) and their position among the Mongloids of this region. *Anthropologischer Anzeiger* 48: 29–35.

Singh, R.K. Ranjit and Latif Shah. 1997. The Chiru Tribe of Manipur: A Bio-anthropological Study. A Project report submitted to the Directorate for Development of Tribals and Backward Classes. Government of Manipur.

Singh, Longjam Nobinchandra. 2001. Ethnographic history of the Brahmins in Manipur. In: Saratchandra Konsam (ed.), *Glimpses on the Culture and Biology of the people of North East India.* New Delhi: Har Anand Publications.

Singh, Indera P. and Mohinder Kumar Bhasin. 2004. *A Manual of Biological Anthropology.* Delhi: Kamla Raj Enterprises.

Singh, S. Jibonkumar and Vokendro H. Singh. 2007. A Genetic Study on the Purum (Chothe) Tribe of Manipur. *Anthropologist* 9 (2): 161–162.

Singh, Pukhrambam Lalitkumar. *The People of Manipur, Ethnic Races of Manipur*, http://www.e-pao.net/epSubPageExtractor.asp?src=manipur. Ethnic_Races_Manipur.The_People_of_Manipur. Accessedd on 1 July 2010.

Vedaja, Sanjenbam. 1998. *Manipur Geography and Regional Development.* New Delhi: Rajesh Publication.

Zehol, Lucy. 1998. *Ethnicity in Manipur: experiences, issues and perspectives.* New Delhi: Regency Publication.

POVZETEK

Genetske študije populacij severovzhodne Indije so precej redkejše kot podobne študije v drugih delih eIndija, 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 proučevanimi populacijami redek, v plemenu Kabui pa se ni pojavil. Pri Brahminih se je pokazal statistično značilen odklon od Hardy-Weinbergovega ravnovesja 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 vzhoden populacija 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.

KLJUČNE BESEDE: Manipur, genske razlike, heterogenost, Hardy-Weinbergovo ravnovesje

CORRSPONDENCE: MOHINDER PAL SACHDEVA, Biochemical and Molecular Laboratory, Department of Anthropology, University of Delhi, Delhi-110007, India. E-mail: mpsachdeva@rediffmail.com.