Prevalence of haemoglobin E among Assamese Sikh community

The northeastern region of India is considered as a mosaic of people with diverse ethnicity and cultural entity. Streams of human waves had migrated to this part of the country centuries ago and settled in different parts of the region, maintaining their socio-cultural solidarity[1]. One of the unique ethnic groups of Assam, mostly confined to Nagaon district, is the Assamese Sikhs or Asomya Sikhs[2].

History records that the connection of Assam with Sikhs dates back to Guru Nanak's visit to the state. After Guru Nanak, the Ninth Guru, Tegh Bahadur, was the next to visit Assam in 1670 along with the Mughal forces commended by the General Raja Ram Singh[2,3]. Further, about 500 Sikh soldiers from Punjab, led by Ranjit Singh, migrated to Assam on the eve of the Battle of Hadirachaki (1820–22) on the invitation of Ahom King Chandrakanta Singh for protecting Assam against Burmese aggression. Nearly all the Sikh soldiers died on battlefield. Some of the survivors, migrated upstream of River Brahmaputra by boat and reached the Titamora rivulet. They disembarked in the western bank, the Chaparmukh, and settled in the area and finally married locals and raised families. Thus, the first settlement of the Assamese Sikhs is considered to be the Chaparmukh of Nagaon district in Assam. Gradually, they migrated to different parts of Assam. However, the major concentration of Assamese Sikhs is in Chaparmukh, Barkola, Lanka and Hatipara villages of Nagaon district[3]. In Chaparmukh, the Mataji Gurdwara was established as early as 1820 and the Central Gurudwara located at Barkola village was established in 1825.

In the northeastern region of India, haemoglobin E (Hb E) is the common monogenic disorder of the autochthonous inhabitants with variable gene frequencies[4,5]. Sickle cell haemoglobin was introduced to this part of the country by the British, particularly to Assam, by inducting a group of people from central, eastern and parts of southern India, during early 19th century, to work in the tea gardens[6]. Haemoglobin D (Hb D), in both heterozygous and double heterozygous state with Hb E, was also reported in an Ahom family, a mongoloid non-tribal ethnic group, of Assam[7]. Keeping this in view, a preliminary study was planned to find out the prevalence of haemoglobinopathy among the Assamese Sikh community.

Barkola village of Nagaon district was selected for the study. The village is represented by about 150 households of Assamese Sikh community. Camps were organized at the village for two days to create awareness among the people about haemoglobinopathy and thalassaemia. Leaflets on haemoglobinopathy and thalassaemia were also distributed among the villagers. Finally, 107 unrelated individuals (male 63 and female 44) volunteered to participate in the screening programme. Intravenous blood samples (about 2 ml) were collected in aseptic conditions in K_3EDTA-coated vials (AcCuvet) after obtaining informed consent. The samples were transported to the field laboratory and hematological indices were determined using an automated haematology cell counter (Celltac α, MEK-6420K, Nihon Kohden) within 12 h of sample collection. Aliquots of 5 µl of blood from individual samples were transferred to 1 ml haemolysis solution of BioRad in 2 ml press cap vials and stored in a refrigerator. Finally, samples were transported to the central laboratory maintaining suitable temperature in an ice box. Prevalence of haemoglobinopathy in the study subjects was determined by high performance liquid chromatography (HPLC)-based Variant Haemoglobin Testing System(™), using Beta thalassaemia short programme kit (BioRad). Standard protocol provided by the manufacturer was adopted for determination of the haemoglobinopathy and thalassaemia.

The HPLC data indicate that Hb E ($\beta^{\text{E Glu} \rightarrow \text{Lys}}$) is the only haemoglobin variant among the Assamese Sikh community. Figure 1 represents the prevalence of different haemoglobin patterns observed. The gene frequency for β^{E}-globin gene in the present study was 0.209. Mean (±SD) Hb E level was 29.64 ± 2.47% and 93.55 ± 2.40% among

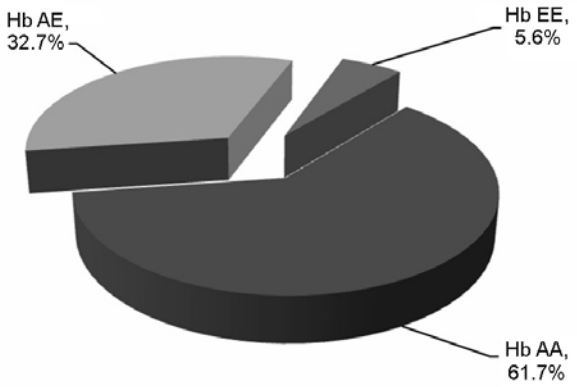

Figure 1. Prevalence of different haemoglobin variants observed in the present study.

Table 1. Mean (± SD) of some haematological parameters observed according to haemoglobin types

	Hb AA (Male 39 and female 27)	Hb AE (Male 19 and female 16)	Hb EE (Male 3 and female 3)
Hg (g/dl)			
Male	11.88 ± 1.63	10.99 ± 1.58	8.1 ± 1.75
Female	10.77 ± 1.23	10.28 ± 0.81	8.93 ± 0.55
MCV			
Male	95.75 ± 6.0	81.25 ± 4.53	69.2 ± 6.05
Female	93.88 ± 5.22	83.47 ± 3.51	63.5 ± 1.73
MCH			
Male	31.48 ± 4.78	25.79 ± 1.93	21.20 ± 2.27
Female	30.37 ± 1.86	26.53 ± 1.19	19.43 ± 0.91

subjects carrying heterozygous and homozygous state of β^E-globin gene respectively.

A significant difference in Hb F level was also observed in subjects carrying homozygous state of Hb E ($t = 6.31$; $P = 0.000$) when compared with Hb F levels of subjects with normal haemoglobin pattern ($0.19 \pm 0.24\%$). The Hb F level was $0.81 \pm 0.73\%$ and $3.32 \pm 1.15\%$ in subjects with heterozygous and homozygous state of Hb E respectively.

A trend towards lower level of haemoglobin, mean corpuscular volume (MCV) and mean cell haemoglobin (MCH) was observed in subjects carrying β^E-globin gene (Table 1). However, with limited sample size of the present study, statistically significant difference could not be found.

The present study revealed that Hb E is prevalent among the Assamese Sikh community with a gene frequency of 0.209. Prevalence of Hb E has not been reported earlier among the Sikhs and it is considered to be a rare haemoglobin variant in this community[8,9]. However, a case of Hb E–thalassaemia was reported from Ludhina[9]. The gene frequency for Hb E among autochthonous population of Assam is as high as 0.6 (ref. 5). The present observation of Hb E among Assamese Sikhs may be due to the gene flow from autochthonous inhabitants of Assam because of the intermingling of migrant Sikh community with various ethnic groups since their initial settlement in Assam.

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SANTANU K. SHARMA*
JAGADISH MAHANTA

Regional Medical Research Centre, NE Region (ICMR), Post Box No. 105, Dibrugarh 786 001, India
**For correspondence.*
e-mail: sksharma@icmr.org.in

Magnesite in the Palaeoproterozoic metasedimentary carbonate sequence of Aravalli Supergroup in Gujarat, western India

Carbonate rocks form a substantial part of the Palaeoproterozoic Aravalli Supergroup in western India. They are good repositories of stromatolitic rock phosphate at Jhamarkotra[1] and Sallopat areas (S. K. Trivedi, unpublished), Cu–Au–Fe mineralization in Banswara[2] and Zn–Pb–Ag in Zawar area[3] in southern Rajasthan. During large-scale mapping and sampling of a phosphate prospect in Champaner Group at Chalvad–Ranjitpura area in Panchmahals district, Gujarat[4], chemical analyses of a few samples yielded high MgO content beyond the compositional limit of pure dolomite (< 21.7 wt% MgO). In the absence of any significant amount of serpentine and talc, the high magnesia content was suspected to be periclase-brucite and/or magnesite. XRD analyses performed on high-MgO samples confirmed the presence of magnesite as a major carbonate phase. Here we report the discovery of magnesite in the Precambrian metasedimentary sequence of northern Gujarat.

The E–W trending metasedimentary sequence in Chalvad–Ranjitpura area forms a part of the Champaner Group of the Palaeoproterozoic Aravalli sequence that occupies about 1200 sq. km area in Vadodara and Panchmahals districts in Gujarat. The Champaner Group comprises mainly of an interbedded sequence of argillaceous, arenaceous and impure calcareous rocks that rest unconformably over the pre-Champaner Gneissic Complex. Gupta *et al*.[5] divided Champaner Group into six formations, viz. Lambia, Khandia, Narukot, Jaban, Mn-bearing Shivrajpur and Rajgarh. The Chalvad–Ranjitpura area exposes almost the entire section of the Champaner Group. The metasedimentary sequence is intruded by granitoids representing 955 ± 20 Ma-old Godhra magmatism[6] in the southern part of the Chalvad–Ranjitpura area (Figure 1).

Dolomite marble is an important member in the Khandia Formation that contains phosphorite-bearing stromatolites. The stromatolitic structures occur as discontinuous bands between Chalvad and Ranjitpura. The phosphatic stromatolite-bearing dolomite marble forms a large-scale antiformal fold that plunges moderately to WNW. Dwivedi (unpublished) carried out close-spaced grid sampling in stromatolitic carbonates in Ranjitpura area. The Directorate of Mining and Geology, Gujarat, followed up with a detailed exploration that involved 1600 m of drilling (N. V. Shah, unpublished). They reported sporadic low-grade phosphorite that analysed generally below 10% P_2O_5. Magnesite occurs at higher structural levels in the antiformal structure in the carbonate sequence.

In magnesite-poor samples, carbonates are represented by calcite and dolomite. There is size-bimodality in carbonate grains. Large idioblastic dolomite grains show features in support of late stage development in the milieu of fine-grained carbonates. The idioblastic dolomites contain smaller carbonate inclusions that together with the matrix define parallel *Si* and *Se* relationship. The other important minerals in carbonate rocks include calcite, talc, tremolite, serpentine and diopside. Apatite in non-phosphatic magnesite-bearing carbonates is always a minor phase that occurs as discrete micron-size particles in carbonates.

In the field, magnesite appears as a dark brown-coloured coarse-grained rock