Gene diversity among some endogamous population of Amravati District, Maharashtra, India.

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Abstract:

The present work deals with the distribution of ABO, Rh and sickling alleles as a marker to study the genetic structure and micro-demarcation among castes and tribal population from Amravati district of Maharashtra. Three loci namely, ABO, Rh and sickling were selected to measure the relative frequency of respective alleles in ten (10) endogamous population inhabiting Amravati District. The ABO locus was found to be less polymorphic when compared with other loci. On the other hand Rh and sickling loci were found to be more polymorphic. Construction of dendrogram using allele frequency data reveals interesting relationship among the caste and tribe. An analysis show three major clade comprising A, B and C. The clade A comprises of Islamic Dawoodi Bohra and Hindu Gujrati. Clade B comprising upper caste as Brahmin, Jain, Kashmiris and Kunbis, while Clade C shows Gonds and Katchhi. This study is a first attempt to provide genetic landscape of caste and tribes inhabiting Vidarbha region. The findings are discussed in the light of historical, anthropological and genetical data available for the studied group.

Key words: Diversity, Caste, Tribe, Endogamous, Vidarbha.
Introduction:

India is known for its enormous genetic diversity and rank second in the world after Africa. The Indian population provides excellent opportunity to study socio-culture and genetic variability. Due to its geographical location India has served as major corridor for the dispersal of modern humans out of Africa ~2,000000 years ago (Cann, 2001). The contemporary Indian population is classified as tribal and non-tribal. There are 5000 endogamous groups in India which are known for their endogamous units and diversity (Sing, 1999). Many population groups migrated to India from northwest and northeast. It is believed that the ancestor of some of the existing tribes in southern India entered the country from the northwest, in pre-historic times. Non-tribes also came from this direction. Tribal are the aboriginal groups who have not been absorbed in the caste system (Vidyarthi, 1985) and are mainly ancestor worshipper. Linguistically population of India is classified into four major classes’ viz. Indo-Aryan, Dravidian and Austro-Asiatic and Tibeto-Burman. The Indo-Aryan forms the largest group and comprises much of the north and northwest region of the subcontinent. Great deal of literature exists on classical genetic studies carried out among Indian population (Cavalli-Sforza et al.1964; Papiha, 1996) demonstrating high degree of heterogeneity among different caste and tribal groups. Social restrictions in marriages have apparently hampered the gene flow between different castes thereby resulting into isolated endogamous groups. Many studies on Indian population put forwarded to explain their genetic origin and genetic relationship (Bamshad, 1998; Roychaudhary, 2001; Baig, et al. 2004). The genetic relationship among different caste groups are not uniform. Polymorphism are now considered useful tool for studying differentiation in human population. This is generally done by using gene frequency data of number of genetic loci. Twenty two blood group loci are found to be polymorphic in human population, out of which ABO and Rh where two such polymorphic loci. Sickle cell anemia was the first polymorphism observed in
protein coding gene by electrophoresis (Pauling et al. 1949; Ingram, 1957). The variation in
the frequency of Rh negative gene i.e. Rh (d) reported in majority of Indian population is 15-
30%. The gene frequency of Rh (d) gene is lower in the tribes of Maharashtra while the
Sickle-cell trait is found mainly in the tribes. The frequency of the Sickle-cell trait varies
between 5 to 30 percent in many tribes of Gujarat, Maharashtra, Madhya Pradesh and Andhra
Pradesh (Kate, 2002).

The Amravati city in Maharashtra is situated between latitude 20°56’ and 20°93’ North and
77°45’ and 77°75’ east longitude and its total area is 12,626 km². It has an average elevation
of 343 meters and lies 156 km west of Nagpur. Amravati has tropical wet and dry climate
with hot, dry summer from March to June. The population of district is 2,607,160 (census of
India 2001) comprising Hindus, Buddhist, Muslims and various tribal populations. The
present study was conducted during June 2007 to April 2008, sampling was done at random
and healthy unrelated individuals of different endogamous group’s viz. Brahmin, Hindu
Gujrati, Kunbis, Nav-Buddhist, Gonds, Korkus, Dawoodi Bohras, Muslim Katchhi, Jain and
Kashmiris inhabiting Amravati district of Maharashtra were sampled. In the current study,
we screened 10 endogamous populations for three important loci to infer the origin and
relationship amongst them.

Materials and methods:

Five ml of blood was collected from following endogamous groups using appropriate
informed consent. The blood was collected in EDTA vials at random from a total 250 healthy
and unrelated individuals. Twenty five (25) samples were collected and transported to the
laboratory quickly in cold storage for screening. The details of endogamous group are as
follows.

Brahmin: Brahmin is a class of priests and preachers of ‘Dharma’ and considered as the
torch bearer of Hinduism. Majority of Brahmin in Maharashtra speak Marathi, one of the
major languages of Indo-Aryan linguistic group. The population of Brahmins in Amravati district is 21,500 or 3 percent of the population. We collected 25 samples of Brahmins living in Amravati district.

**Hindu Gujrati:** The Gujarati people live in the northwestern part of the Indian subcontinent, in the state of Gujarat many Gujarati also inhabit Rajasthan, Maharashtra and Madhya Pradesh of India. Additionally, the Gujarati language has been adopted by communities such as the Kachhi and Parasi. Gujarati is an umbrella term used to describe an Indo-Aryan ethnic group that is traditionally Gujarati speaking.

**Kunbi:** Kunbi was claimed to have been warriors and land lord having their roots in Maharashtra. They belong to the Hindu caste and are considered as close to the upper class Brahmin from the same geographical location. Other than Maharashtra Kunbi are also found in Karnataka, Gujarat, Goa and Madhya Pradesh. They speak Marathi Language (a branch of Indo-Aryan linguistic family) and make more than 30% population of Maharashtra.

**Nav Buddhist:** Nav-Buddhist is those who have adapted Buddhism some 50 years ago and hence called as Nav-Buddha (New-Buddhist). These are widely spread throughout India and make up 16% of Indian population. Buddhist also speaks Marathi language.

**Gonds:** This tribe fall under primitive tribes category and spread much over the central India. Gond generally speaks ‘Gondi’ dialect which belong to Dravidian linguistic family and is consider being closer to Tamil.

**The Korkus:** The Korkus are typical tribal population from Amravati district and found only in the Satpuda mountain ranges spanning Maharashtra and Madhya Pradesh. They are mainly concentrated in Melghat a scheduled area of Korku comprising 89% of the tribal population. The Korkus speak Korku dialect belonging to Austro-Asiatic linguistic group. The Austro-Asiatic speakers are considered as the first settler of Indian subcontinent (Roychaudhary, 2001).
The Dawoodi Bohras: Dawoodi Bohras are the main branch of Bohras community in India. Today there approximately are one million Dawoodi Bohras resides in Mumbai, Surat and Madhya Pradesh. Some Bohras ancestors were converted from Hinduism to Islam. Bohras have their own language called Lisanu-I-Dawat written in Arabic script but is derived from Urdu and Gujrati.

Muslim Kachhi: Muslim Kachhi are Sunni Muslim who migrated from Sindh to Kutch in Gujarat state of India. After their conversion of Islam in 1422 C.E. Kachhi speaks non-written dialect called Memoni, a mixture of Sindhi and Kachhi which belongs of Indic family. The collected samples of Kachhi population are native of Amravati district.

Jain: Jainism present in Maharashtra since ancient times. The emigrant Jains has a large population in Maharashtra. Majority of them are from Rajasthan and Gujarat. Jains speak non-written dialect’ Marwari’ originated from Indo-European language group.

The Kashmiris: From the time of the beginning of formation of the present Asian continent, Kashmir has remained an anseparable part of Indian peninsula. The population of Jammu and Kashmir has highest proportion of Muslim (96%) and only (4%) of Hindus consisting of small minorities of Sikhs and Buddhist. The Kashmir people belong to the Aryan race and widely spoken language belonging to the Indo-Aryan branch of Indo-European language family. Some Kashmiris migrated in Maharashtra by the cause of terrorism.

Laboratory Analysis

ABO and Rh (D) Group Typing: Slide agglutination method was followed for ABO and Rh (D) group typing. All samples are tested for the ABO and Rh blood groups using anti – A, anti – B and anti – D sera.

Sickling Test: Sickling test was carried out by method as described by Scott and Castro (1998). Late positive sickling samples were subjected to cellulose acetate membrane electrophoresis by using method of Marengo-Rowe (1965).
Statistical Analysis

Measurement of Genetic variation:

Allele frequency was calculated using Hardy-Weinberg principle. Coefficients of gene differentiation ($G_{ST}$) and ($D_{ST}$) were calculated following Nei (1973). The genetic relationship among the present endogamous population group were assessed using the measure of genetic distance (D) proposed by Nei (1972). A dendrogram was drawn as per UPGMA clustering method using Phylip (v 3.69), Felsensteins (1993).

Result and Discussion

In ABO blood group, the phenotype frequency of B was found to be higher in Buddhist, Bohras, Gonds and Katchhi than the other population. The frequency of AB was higher only in the Korkus population as compare to other groups. Among total population, the frequency of B was highest (38.4) as compared to blood group O (28.0). The frequency of blood group A and AB was found to be 26.04 and 07.20 respectively (Table. 1).

Rh (D) phenotype frequency (08.00) was observed high among Bohras, Kashmiris and Gujrati population (Table. 2). The phenotype and gene frequency of Sickling was high only in the Navbuddhist population (0.40). Sickling gene was virtually absent in other population (Table. 3).

The Chi-square differences was non-significant of group Katchhi in case of ABO blood groups($X^2=0.116$; df 3; p-value=0.989) and remaining population shows significant differences. In case of Rh (D) and Sickling all populations have significant value of $X^2$. The $X^2$ differences in allelic frequency for majority of markers for various population was significant ($X^2=0.461$, df=18, p<1.00 for ABO; $X^2=0.052$; df=9; p<1.00 for Rh (D) and $X^2=0.058$; df=9; p-value=0.999 non-significant for Sickling). The $X2$ values further point towards stratification of Hindu caste system into caste and sub-caste where social forces are acting as the main deterrent in the free gene flow among them.
Genetic diversity:

The gene diversity indices for the total population $H_T$ and intra populational gene diversity $H_S$ were quite high i.e. $0.926$ and $0.853$ (Table.4). The inter-populational gene diversity $D_{ST}$ was high i.e.$1.00$, and the coefficient of genetic differentiation ($G_{ST}$) was $0.079$. The pooled $H_T$, $D_{ST}$ and $G_{ST}$ were found to be highest for Sickling and lowest for ABO; while pooled $H_S$ was highest for ABO and lowest for Sickling. Previous study on Indian caste and tribe also reveal higher intra-population diversity (Bamshad et al. 1998).

Genetic distance:

Using the allele frequency data for the five markers, Nei’s measure of genetic distance was calculated between the ten (10) endogamous groups. It was found highest between Navbudhist and Kunbis ($0.5792$) and lowest between Gonds and Katchhi ($0.0007$) (Table.5). Using distance matrix a dendrogram was constructed as per UPGMA method (figure. I). The dendrogram constructed using UPGMA method clearly shows Korkus and Navbuddhist as outlier. The dendrogram shows three distinct clades designated as A, B and C. The clade A comprises of Islamic Dawoodi Bohra and Hindu Gujarati. Both Bohra and Gujrati speaks are linguistically related. The Bohra has known history of migration from Middle East and were first settle down in Gujarat (Muthukrishnan, et al. 2010). Another monophyletic clade B includes Brahmin, Jain, Kashmiris and Kunbi. Of note, the entire ethnic group in this cluster belongs to higher rank of the caste. The Kunbis are considered as sub-caste within the warrior class the “Shatriyas”, more frequently referred as Maratha. The genetic similarity of Maratha with the Brahmin is well established (Cavalli-Sforza et al. 1994). Also Maratha are considered as the migrant group from north of India (Sahoo, et al. 2005). Interestingly, Clade C shows clustering of tribal Gond and Katchhi, an Islamic group. This clustering might be due to limitation of markers employed or might be due ancient link of them. Interestingly, in the past Gonds has rule the central India (Bhasin, 1992). and Katchhi, basically a trading
group might have established some linkages. Taking into account the sample size, we should not read too much but some pattern are clear that signature of social force still persist in the genome of cast and tribes of India. In coming years sampling of more endogamous group and typing using DNA marker will provide better insight into the genetic landscape of Indian population.
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Table 1. ABO blood group frequency among different endogamous population of Amravati district.

| Population | Observed | Phenotypes | Allele frequency |
|------------|----------|------------|------------------|
|            |          | A          | B               | AB             | O     | A     | B     | O     |
| Navbudhist | No %     | 7 28.00    | 11 44.00       | 3 12.00        | 4 16.00 | 0.2373 | 0.3441 | 0.4185 |
| Kunbi      | No %     | 6 24.00    | 7 28.00        | 1 04.00        | 11 44.00 | 0.1623 | 0.1838 | 0.6539 |
| Bohras     | No %     | 5 20.00    | 12 48.00       | 1 04.00        | 7 28.00  | 0.1442 | 0.3146 | 0.5413 |
| Korku      | No %     | 11 44.00   | 9 36.00        | 2 08.00        | 3 12.00  | 0.3262 | 0.2656 | 0.4042 |
| Kashmiris  | No %     | 8 32.00    | 5 20.00        | 2 08.00        | 10 40.00 | 0.2301 | 0.1614 | 0.6085 |
| Brahmin    | No %     | 9 36.00    | 8 32.00        | 1 04.00        | 7 28.00  | 0.2411 | 0.2125 | 0.5464 |
| Gond       | No %     | 7 28.00    | 13 52.00       | 1 04.00        | 4 16.00  | 0.1867 | 0.3575 | 0.4545 |
| Jain       | No %     | 6 24.00    | 8 32.00        | 2 08.00        | 9 36.00  | 0.1854 | 0.2338 | 0.5808 |
| Gujrati    | No %     | 3 12.00    | 10 40.00       | 3 12.0         | 9 36.00  | 0.1368 | 0.3095 | 0.5536 |
| Kachhi     | No %     | 4 16.00    | 13 52.00       | 2 08.00        | 6 24.00  | 0.1372 | 0.3704 | 0.4845 |
| Total (n=250) | No % | 66 26.04    | 96 38.40       | 18 07.20       | 70 28.00 | 0.1368 | 0.1614 | 0.4042 |

Table 2. Allele frequency of Gene Rh (D) factor among different endogamous population of Amravati district.

| Population | Observed | Phenotype | Allele frequency |
|------------|----------|-----------|------------------|
|            |          | Rh + (D)  | Rh - (d)         | D    | d    |
| Navbudhist | No %     | 24 96.00  | 1 04.00         | 0.7774 | 0.2226 |
| Kunbi      | No %     | 24 96.00  | 1 04.00         | 0.7774 | 0.2226 |
| Bohras     | No %     | 23 92.00  | 2 08.00         | 0.7097 | 0.2903 |
| Korku      | No %     | 24 96.00  | 1 04.00         | 0.7774 | 0.2226 |
| Kashmiris  | No %     | 23 92.00  | 2 08.00         | 0.7097 | 0.2903 |
| Brahmin    | No %     | 24 96.00  | 1 04.00         | 0.7774 | 0.2226 |
| Gond       | No %     | 24 96.00  | 1 04.00         | 0.7774 | 0.2226 |
| Jain       | No %     | 24 96.00  | 1 04.00         | 0.7774 | 0.2226 |
| Gujrati    | No %     | 23 92.00  | 2 08.00         | 0.7097 | 0.2903 |
| Kachhi     | No %     | 24 96.00  | 1 04.00         | 0.7774 | 0.2226 |
| Total (n=250) | No % | 237 94.80 | 13 05.20 | 0.7097 | 0.2226 |
Table 3. Sickling test, allele frequency among different endogamous population of Amravati district.

| Population | Observed | Phenotype | Allele frequency |
|------------|----------|-----------|-----------------|
|            |          | Sickling test +ve | Sickling test -ve | S    | s    |
| Navbudhist | %        | 1          | 24              | 96.00 | 0.7774 | 0.2226 |
| Kunbi      | %        | 0          | 25              | 100   | 0.8862 | 0.1138 |
| Bohras     | %        | 0          | 25              | 100   | 0.8862 | 0.1138 |
| Korku      | %        | 0          | 25              | 100   | 0.8862 | 0.1138 |
| Kashmiris  | %        | 0          | 25              | 100   | 0.8862 | 0.1138 |
| Brahmin    | %        | 0          | 25              | 100   | 0.8862 | 0.1138 |
| Gond       | %        | 0          | 25              | 100   | 0.8862 | 0.1138 |
| Jain       | %        | 0          | 25              | 100   | 0.8862 | 0.1138 |
| Gujrati    | %        | 0          | 25              | 100   | 0.8862 | 0.1138 |
| Katchhi    | %        | 0          | 25              | 100   | 0.8862 | 0.1138 |
| Total      | (n=250)  | %          | 1               | 0.40  | 249    | 99.60  |

Table 4. Gene diversity analysis in Ten (10) endogamous population of Amravati district.

| Locus    | DST  | HT  | HS  | GST |
|----------|------|-----|-----|-----|
| ABO      | 1.000 | 0.957 | 0.914 | 0.045 |
| Rh (D)   | 1.000 | 0.922 | 0.845 | 0.084 |
| Sickling | 1.000 | 0.901 | 0.801 | 0.110 |
| Pooled   | 1.000 | 0.926 | 0.853 | 0.079 |

Table 5. Genetic distance matrix among different endogamous population of Amravati district.

| Population | Navbudhist | Kunbi | Bohras | Korku | Kashmiris | Brahmin | Gond | Jain | Gujrati | Katchhi |
|------------|------------|-------|--------|-------|-----------|---------|------|------|---------|---------|
| Navbudhist | 0.379215   | 0.349479 | 0.347934 | 0.357351 | 0.361301 | 0.354282 | 0.354282 | 0.366483 | 0.351254 | 0.358652 |
| Kunbi      | 0.007881   | 0.019998 | 0.003186 | 0.003725 | 0.014616 | 0.001659 | 0.001659 | 0.007154 | 0.013307 | 0.003289 |
| Bohras     | 0.013912   | 0.007629 | 0.006183 | 0.004399 | 0.003915 | 0.000049 | 0.000049 | 0.003289 | 0.006600 | 0.003289 |
| Korku      | 0.015411   | 0.006456 | 0.006595 | 0.011036 | 0.015161 | 0.011435 | 0.011435 | 0.003733 | 0.006401 | 0.003753 |
| Kashmiris  | 0.003357   | 0.015840 | 0.003608 | 0.007256 | 0.016530 | 0.008443 | 0.008443 | 0.000735 | 0.006401 | 0.003753 |
| Brahmin    | 0.006936   | 0.000989 | 0.006300 | 0.008443 | 0.003733 | 0.000735 | 0.000735 | 0.006401 | 0.003753 | 0.003753 |
| Gond       | 0.005144   | 0.006600 | 0.005144 | 0.000735 | 0.003733 | 0.006401 | 0.006401 | 0.003753 | 0.003753 | 0.003753 |
| Jain       | 0.003733   | 0.006401 | 0.003753 | 0.003753 | 0.000735 | 0.003733 | 0.003733 | 0.003753 | 0.003753 | 0.003753 |
| Gujrati    | 0.003733   | 0.006401 | 0.003753 | 0.003753 | 0.000735 | 0.003733 | 0.003733 | 0.003753 | 0.003753 | 0.003753 |
| Katchhi    | 0.003733   | 0.006401 | 0.003753 | 0.003753 | 0.000735 | 0.003733 | 0.003733 | 0.003753 | 0.003753 | 0.003753 |
Figure I. Dendrogram showing genetic relationship among ten (10) endogamous population of Amravati district, Maharashtra.