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QUANTIFICATION OF SICKLE CELL GENE FREQUENCY AND THE PREVALENCE OF SICKLE CELL DISEASE AMONG THE TRIBALS OF FOUR TALUKAS OF YAVATMAL DISTRICT

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ABSTRACT

Indian tribal population suffers from various genetic and non-genetic diseases. Sickle cell disease (SCD) is the second most common hemoglobinopathy after thalssemia. The prevalence of SCD is more in Central India. The present study is a small attempt to find out the sickle cell allele frequency and prevalence of SCD in tribals of four talukas of Yavatmal district i.e. Kelapur, Ghatanji, Wani and Zari-jamani. A total of 129 individuals were screened for SCD from five different tribal castes, among them 28 were found homozygous and 67 were heterozygous for SCD. The allelic frequency was found to be 0.009045 in Gond, 0.0136 in Kolam, 0.0296 in Pardhan, 0.50 in Govari, 0.50 in Madgi, 0.20 in Banjara, 0.0182 in Navbuddha, 0.00 in Shimpi and 0.0045 in Kunbi.

KEY WORDS

Allele frequency, Heamoglobinopathy, Indian tribals, Sickle cell disease, Tribals of Yavatmal District.

1. INTRODUCTION

It is well documented that the gene for sickle cell gene is located on the short arm of chromosome 11 and has an autosomal recessive inheritance. Hence, it can manifest in two forms viz. heterozygous (carrier) and homozygous (sufferer). When two carriers marry, the chance of having a homozygous child is 25% with every pregnancy [1]. This hereditary disorder caused due to defective hemoglobin structure because of a point mutation at sixth position in β globin chain, valine substituting glutamic acid, due to which in deoxygenated state the shape of erythrocytes change to sickle shape and also the fragility of cell membrane increases[2].

Sickle cell anaemia is the most common disease among tribals of Indian population. It arose in populations originating from Sub-Sahara Africa, the Middle East and Mediterranean and spread worldwide through migrations of populations. India did not get rid of it and this hemoglobinopathy started spreading through heredity and most affected population of India are castes and sub-castes of schedule tribes [3]. This hemoglobinopathy is the most common genetic disorder in tribal belt of central and southern India [4].

As per the census of India, 2001, there are about 635 biological isolates (tribes and sub tribes) that constituted 8.08 % (about 84.3 million) of the total populations of India who are considered to be original inhabitants of this ancient country. Maharashtra harbours the largest tribal population in India which is about 1/4th of the total tribal population of the country. Since 1952 the presence of sickle cell disease is known when Lehman et al reported it for the first time among the tribals of Nilgiri Hills [5]. At the same time, Dunlop reported the presence of the disease in Assam [6]. In Maharashtra, Banker et al reported prevalence of the disease from 1.9% to 33.3% in different communities [7]. Prevalence of 5.5% SCD population from few villages of Wardha District has

been reported by Ankushe[8]. Whereas Kate indicated that the overall prevalence of sickle cell disorder in different tribals of Maharashtra is 10% for carrier and 0.5% for the sufferer[9]. The present study is a small attempt to find out the magnitude of sickle cell disorders in rural population of Kelapur, Ghatanji, Wani and Zari-Jamani talukas of Yavatmal District, Maharashtra (Central India).

2. MATERIAL AND METHODS

Screening of SCD was conducted in some tribal villages of Yavatmal district from February 2013 to June 2013. A total of 129 blood samples from individuals belonging to different tribal castes from 30 villages along with written consent forms were collected by organizing screening camps in co-ordination with the officials from Primary Health Centers as well as Sub-district and Rural Hospitals. For performing preliminary diagnosis of SCD few drops of blood was collected by bold finger prick for performing the solubility test [10]. Solubility test positive subjects were later subjected to electrophoresis on cellulose acetate membrane (Dacie and Lewis) in the laboratory of Anthropological survey of India, Nagpur regional centre, as a confirmatory test for SCD [11].

Allele frequency was calculated using Hardy Weinberg Principle. A dendrogram was drawn as per UPGMA clustering method using phylip (v 3.69) [12] and MEGA (5)[13].

3. RESULTS AND DISCUSSION

In the present work individuals of 6 tribal castes i.e. Gond, Kolam, Pardhan, Banjara, Govari and Madgi were found to be suffering from SCD in the study area. Zade et al recorded the presence of SCD in 5 tribal castes (Korku, Bhil Gaoli Gowari and Nihal) of Melghat region in Amravati district [14]. Whereas Patki et al reported the prevalence and frequency of the sickle cell gene in some selected tribal population of the Ghatanji and Kelapur talukas of Yavatmal District (Central India) wherein they screened individuals for SCD from 17 tribal villages constituting 3 tribal castes (Gond, Kolam, Pardhan) and found 25 individuals to be heterozygous and 19 individuals to be homozygous for sickle cell gene[15]. In the present study, a total of 129 blood samples from tribals were screened for SCD out of which 28 were found homozygous and 67 were heterozygous for sickle cell disease. Out of the 14 samples of non tribal individuals 1 was homozygous and 6 were heterozygous for SCD. Whereas 115 samples were of tribals, among those 27 were found to be homozygous and 61 heterozygous for SCD.

The sickle cell allelic frequency in the Ghatanji and Kelapur talukas of Yavatmal District was found to be 0.009045 in Gond, 0.0136 in Kolam, 0.0296 in Pardhan, 0.0182 in Navbuddha and 0.0045 in Kunbi[15]. Whereas, in the present study, sickle cell allele frequency was found to be highest in the Pardhans (0.575), followed by Gonds (0.4243), Kolams (0.350) and the Govaris (0.50) and Madgis (0.50) who have same allelic frequency. Least prevalence was seen in the Banjaras (0.20). In the non tribals allele frequency was found to be Kunbi (0.333), Navbudhha (0.125) and Shimpi (0.00). (Table1).

The dendrogram was constructed using the genetic distance obtained from the sickle cell allele frequencies using UPGMA method (Figure: 1). The dendrogram shows the non-tribal castes i.e. Navbbudha, Shimpi and Kunbi forming a single clade. The tribal castes i.e. Govari, Madgi, Pardhan and Banjara also form a single clade. Kolams and Gonds are forming separate embranchments of which the Gonds occupy the basal position in the dendrogram. Pardhan, Gond, Kolam, Govari, Madgi and Banjara represent the indigenous, aboriginal, dark-skinned, Dravidian-speaking population of the Deccan, of which the Gonds are the most primitive tribe[16]-[17].

4. CONCLUSION

In the present study sickle cell disease was found to be highly prevalent in the tribal population of Gond, Kolam, Pardhans, Govaris and Madgis and less prevalent in Banjaras and non-tribals i.e. Navbuddhas, Kunbis and absent in Shimpis of Yavatmal district. The sickle cell allele frequency was found to be 0.4243 in Gond, 0.350 in Kolam and 0.5750 in Pardhans, 0.50 in both Govaris and Madgis and only 0.20 in Banjaras. In the non-tribals i.e. Navbuddhas and Kunbis have 0.125 and 0.333 respectively and Shmpis shows 0.00 allelic frequency for SCD. The prevalence of SCD was found to be

21.70% for homozygous and 51.93% for heterozygous in the study area.

Table 1: Showing the computed genotypic and allelic frequency of Normal and affected allele of the study Population.

Tribal castes	Genotypic frequency	Allelic frequency
Gond (n=33)	AA=0.333 AS=0.4848 SS=0.1818	P(A)=0.5757 Q(S)=0.4243
Kolam (n=10)	AA=0.50 AS=0.30 SS=0.20	P(A)=0.650 Q(S)=0.350
Pardhan (n=60)	AA=0.150 AS=0.550 SS=0.30	P(A)=0.425 Q(S)=0.575
Govari (n=3)	AA=0.00 AS=1.00 SS=0.00	P(A)=0.50 Q(S)=0.50
Madgi (n=4)	AA=0.00 AS=0.10 SS=0.00	P(A)=0.50 Q(S)=0.50
Banjara (n=5)	AA=0.60 AS=0.40 SS=0.00	P(A)=0.80 Q(S)=0.20
Navbbudha (n=8)	AA=0.125 AS=0.750 SS=0.125	P(A)=0.50 Q(S)=0.50
Kunbi (n=3)	AA=0.666 AS=0.00 SS=0.333	P(A)=0.666 Q(S)=0.333
Shimpi (n=2)	AA=1.0 AS=0.0 SS=0.0	P(A)=1.0 Q(S)=0.0

Where, n–no. Of individuals, SS-Genotypic Frequency of Sickle Cell Disease Individuals, AS- Genotypic Frequency of Sickle Cell Gene Carrier Individuals and AA-Genotypic Frequency of Normal Individuals; P (A) - Allele Frequency of gene 'A' Q(S)- Allele Frequency of gene 'A'

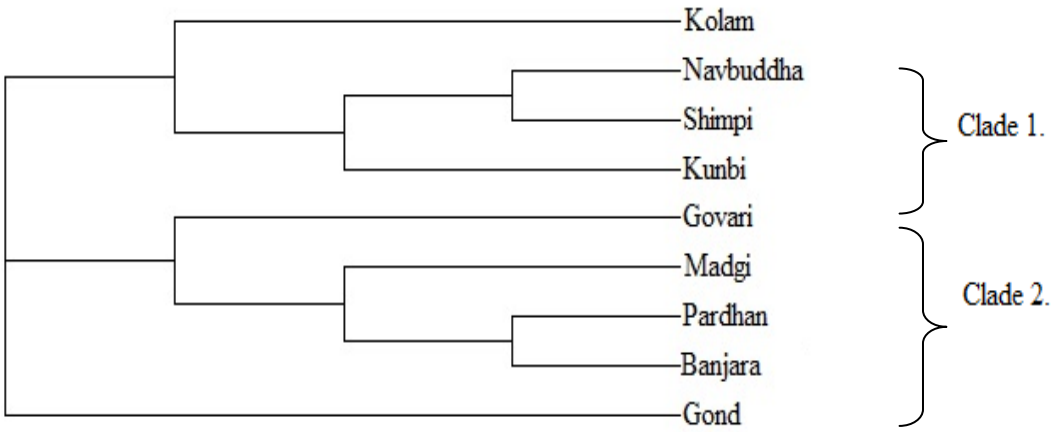

Figure 1: dendrogram showing genetic relationship among nine communities of Yavatmal district

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