



Short Communication

Study of Sickle cell Disease Phenotypes and Sickle Cell Gene Frequency in Some Tribals belonging to Tipeswar Forest Region, Yavatmal District, Maharashtra, India

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Abstract

Sickle cell disease (SCD) is a major gene disorder among the tribal population. Hence the objective of the present study was to determine prevalence and frequency of sickle cell gene in some selected tribal population of the Tipeswar forest region in Yavatmal District (Central India). A total of 1365 tribal individuals were screened for SCD from 11 tribal villages constituting 3 tribal castes (Gond, Kolam, Pardhan). Using electrophoresis on cellulose acetate membrane 13 individuals was found heterozygous and 15 individuals were found to be homozygous for sickle cell gene. The sickle cell allele frequency was found to be 0.009045 in Gond, 0.01505 in Kolam and 0.0296 in Pardhans.

Keywords: Sickle cell anemia, Tribals, Gond, Kolam, Pardhan, Tipeswar.

Introduction

Sickle cell disease (SCD) is an autosomal recessive genetically transmitted hemoglobinopathy responsible for considerable morbidity and mortality. This is a hereditary disorder caused due to defective hemoglobin structure. Sickle cell disorder is caused by 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 increases¹. Prior to 1952, no information was available about the existence of sickle cell disease in India. In 1952 it was recorded for first time simultaneously amongst the tribal population group of Nilgiri hill and laborers in the tea garden of Assam². Now it is firmly established that these genes harbor amongst different caste groups but with very high prevalence amongst scheduled caste, scheduled tribes and other backward communities^{3,4}.

The prevalence of sickle cell gene has been reported in many parts of India including central India, where the prevalence in the different communities ranges from 9.4% to 22.2 %⁵. According to studies carried out by Kate (2001), 10% of total population of the state of Maharashtra belongs to tribal population groups. Kate⁶ also reported SCD prevalence of 10% among the korku tribes of Amravati district and a very high prevalence amongst the tribal population groups of Nandurbar and Gadchiroli districts of the state. In the present work an effort has been made to screen few tribal communities of Tipeswar forest region, Yavatmal district and find out the magnitude of prevalence of SCD in the tribal groups residing in this region.

Material and Methods

Screening of SCD was conducted in 11 tribal villages from Tipeswar forest region of Yavatmal district from July 2011 to March 2012. A total of 1365 blood samples from individuals belonging to 3 different tribal caste were collected by organizing screening camps in co-ordination with the officials from Primary Health Centers. Few drops of blood was collected by bold finger prick for performing the solubility test⁷ for preliminary diagnosis of SCD. Blood samples of solubility test positive subjects were later subjected to electrophoresis on cellulose acetate membrane⁸ in the laboratory of Anthropological survey of India, Nagpur regional centre, as a confirmatory test for SCD.

Allele frequency was calculated using Hardy Weinberg Principle. A dendrogram was drawn as per UPGMA clustering method using phylip (v 3.69)⁹ and MEGA (5)¹⁰.

Results and Discussion

In the present work 3 tribal caste individuals i.e. Gond, Kolam and Pardhan suffering from SCD were found to be predominant in the study area. Zade *et al*¹¹ recorded the presence of SCD in 5 tribal castes (Korku, Bhil Gaoli Gowari and Nihal) of Melghat region in Amravati district. A total of 438 tribal's were screened for SCD from 6 tribal villages of Melghat region in Amravati district and 43 heterozygotes and 12 homozygotes were documented¹¹. In the present work a total of 1365 tribals from 11 tribal villages of Ghatanji and Kelapur taluka of Yavatmal district were screened for SCD and 13 heterozygotes and 15 homozygotes were recorded. Similarly 983 non tribal

individuals belonging to Navboudha and kunbi community were screened and 5 heterozygote and 8 homozygotes for SCD were recorded.

The sickle cell allelic frequency in the Melghat region of Amaravati District was reported to be 0.3294 in Korku, 0.4934 in Bhil, 0.4071 in Gaoli, 0.2871 in Gowari and 0.2898 in Nihal¹¹. In the present work, the sickle cell allelic frequency was found

to be highest in the Pardhans followed by Kolams and Gonds (table 1). Haematological data showed the expected degree of anemia and hemolysis. The average Hb Concentration was found to be 10.15 gm/dl. The hematological indices i.e. RBC count, mean corpuscular haemoglobin (MCH) and hematocrit (HCT) showed considerable deviation from Normal values. The Platelet count (PLT) and WBC counts were found to vary depending upon the degree of infection suffered (table 2).

Table -1

Showing the computed genotypic and allelic frequency of Normal and affected allele of the study Population

Tribal casts	Genotypic frequency	Allelic frequency
Gond (n=663)	AA =0.9879 AS =0.00603 SS =0.00603	p(A) = 0.9830 q(S) = 0.009045
Kolam (n=365)	AA =0.09808 AS =0.0008219 SS =0.01009	p(A) = 0.9863 q(S) = 0.0136
Pardhan (n=337)	AA =0.9614 AS =0.01780 SS =0.0207	p(A) = 0.9703 q(S) = 0.0296
Navboudha (n=435)	AA=0.9770 AS=0.0091 SS=0.0137	p(A)= 0.9815 q(S)= 0.0182
Kunbi (n=548)	AA=0.9945 AS=0.0018 SS=0.0036	p(A)=0.9954 q(S)=0.0045

Table 2

Data showing the values of Hematological parameters of the Sickle cell Positive Tribal Population as Compared with the Control

Parameter	Sickle cell patient (n=30)		Control (n=6)	
	mean±S.E.	Range	mean±S.E.	Range
WBC	8.01±9.41 ^{ns}	4.2-19.6	6.65±7.31	6.5-8.1
RBC	3.81±4.15***	2.41-5.66	5.12±5.54	4.8-6.1
Hb	9.6±10.7***	6.2-17.4	13.89±14.33	13.4-15.0
HCT	30.71±33.61***	21.3-50.2	46.97±49.13	42.6-52.2
MCV	78.36±82.1 ^{ns}	68.60-99.1	81.18±86.32	75.4-90.2
MCH	24.44±26***	16.9-33.6	28.38±29.64	26.9-31.2
MCHC	30.64±31.6*	26.8-34.8	32.28±33.38	30.9-34.3
PLT	277.81±320.99 ^{ns}	165-785	253.45±318.87	169-395
LY	44.44±47.12***	29.3-60.6	30.94±38.96	21.9-44.8
MO	17.96±19.6***	12.0-27.8	4.58±7.08	2.3-9.8
GR	33.57±38.33***	19.0-65.8	52.58±62.72	42.4-72.3
LY#	3.78±4.5***	2.2-9.7	1.79±2.63	0.9-3.6
MO#	1.47±1.77***	0.4-4.8	0.52±0.78	0.2-1.0
GR#	3.14±4.00 ^{ns}	0.8-11.3	3.53±4.13	2.8-5.0
RDW	16.7±17.98***	13.2-25.5	12.67±13.49	14.6-11.7
MPV	9.53±9.97**	7.5-12.0	8.43±9.09	7.9-10.1

(Level of significance - * P<0.05 , ** P<0.01, *** P< 0.001).

(WBC-White Blood Cell Count, RBC-Red blood Cell Count, Hb- Haemoglobin Count, HCT- Hematocrit Count, MCV- Mean Corpuscular volume, MCH-Mean Corpuscular Hemoglobin, MCHC-Mean Corpuscular Hemoglobin Concentration, PLT-Platelet Count, LY-Lymphocytes Count, MO- Monocytes Count, GR-Granulocytes Count, LY#- Lymphocyte number, MO#- Monocyte number, GR#- Granulocyte number, RDW-Red Blood Cell Distribution Width, MPV-Mean Platelet Volume)

The dendrogram constructed using the genetic distance obtained from the sickle cell allele frequencies using UPGMA method. Pardhan, Gond and Kolams represent the indigenous, aboriginal, dark-sarkinned, Dravidian-speaking population of the Deccan, of which the gonds are the most primitive tribe¹²⁻¹⁴. Hence the kolams, pardhans and gonds form three different embranchments of which the gonds occupy the basal position in the dendrogram. However the navbuddha and Kunbi represent the Aryan population thus forming a single clade (figure 1).

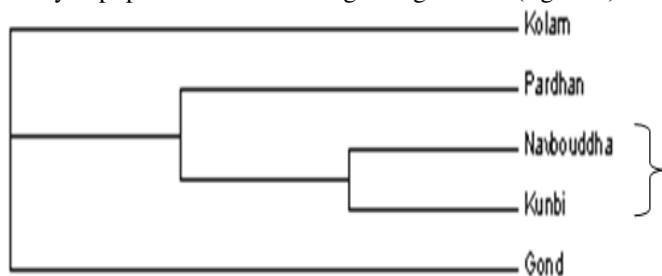


Figure 1

Dendrogram Showing genetic relationship among five communities of Tipeswar Forest Region of Yavatmal District

In the dendrogram study on the tribal groups of Melghat region of Amravati District, Maharashtra it was reported that Bhil and Gaoli tribals formed one clade and Gowari and Nihal formed the second clade whereas the korku tribe was forming the outgroup¹¹.

Conclusion

In the present study sickle cell disease was found to be highly prevalent in the tribal population of Gond, Kolam and Pardhans residing in Tipeswar forest regions of Yavatmal district. The sickle cell allele frequency was found to be 0.009045 in Gond, 0.01505 in Kolam and 0.0296 in Pardhans.

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References

1. Ingram V.M., A specific chemical difference between the globins of normal human and sickle- cell anemia hemoglobin, *Nature*, **178**,792- 794 (1956)

2. Lehman H. and Catbrush M., Sickle cell trait in Southern India. *British medical journal*, 404- 405 (1952)

3. Bhatia H.M, Rao V.R., Genetic Atlas of the Indian Tribes, *Institute of Immunohaematology, (ICMR), Bombay, India, (1987)*

4. Sharma A, Hemoglobinopathies in India. *Peoples of India, XV International Congress of genetics, New Delhi India, Dec 12-21, (1983)*

5. Shukla R. M. and Solanki B. R., Sickle trait in central India, *Lancet*, **1**, 297-298 (1985)

6. Kate S.L., Health problems of tribal population groups from the state of Maharashtra, *Indian J Med Sci.*, **55**, 99-108 (2001)

7. Huntsman R.G., Barclay G.P., Canning D.M., Yawson G.I., A rapid whole blood solubility test to differentiate the sickle-cell trait from sickle-cell anaemia, *J Clin Pathol.* **23**(9), 781- 783 (1970)

8. Dacie J.V. and Lewis S.M., Practical Hematology, 7th ed. *Edinburg, Scotland, Churchill Livingstone (1991)*

9. Felsenstein, J., PHYLIP: Phylogeny inference package, version 3.5. University of Washington, Seattle. (1993)

10. Tamura K., Peterson D., Peterson N., Stecher G., Nei M., Kumar S., MEGA5: Molecular Evolutionary Genetics Analysis Using Maximum Likelihood, Evolutionary Distance, and Maximum Parsimony Methods, *Mol. Biol. Evol.*, **28**(10), 2731–2739 (2011)

11. Zade V.S., Chede S., Thakare V.G., Warghat N.W., The prevalence of sickle cell disease phenotypes and sickle cell gene frequency in some tribals of Melghat forest region of Amravati, Maharashtra (India), *Bioscience Biotech Res Comm.*, **4**(1), 70- 73 (2011)

12. Christopher von Fürer- Haimendor., *The tribes of India: struggle for survival, (1982)*

13. Dunlop K.J. and Muzumdar U.K., The occurrence of sickle cell anemia among a group of tea garden labourers in upper Assam, *Indian Medical Gazette*, **87**, 387- 391 (1952)

14. Kate S.L., Health problems of tribal population groups of Maharashtra, *Immunohematal Bull.*, **31**, 1-10 (2000)