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Incidence of Sickle Cell Haemoglobin Among the Kolams of District Adilabad, Andhra Pradesh

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INTRODUCTION

Kolam is a primitive tribe and is mainly distributed in Andhra Pradesh, Maharashtra and Madhya Pradesh. The total population of Kolams in Andhra Pradesh according to 1991 census is 41,254 individuals of whom 92.4 % belong to the rural areas and the rest 7.6% belong to the urban areas. Kolams in Andhra Pradesh are primarily confined to Adilabad district constituting 97.7% of the Kolam population of the state.

Sickle cell anaemia and sickle cell trait are observed to occur in varying frequencies amongst the endogamous tribal groups through out India. It has been estimated, based on the prevalence rate of HbAS persons in various affected populations, that a staggering over 5 million persons among tribals alone are carriers of this genetic disorder (Malhotra, 1994) and over .2 million are homozygous. Many other kinds of haemoglobinopathies and thalassaemias have been detected in various population groups (Bhasin et al., 1994). The present genetic study has been conducted to know the -

1. Incidence of sickle cell haemoglobin among the Kolams
2. Generational variation among the Kolams with respect to the incidence of sickle cell haemoglobin, if any.
3. Effect of consanguinity on the distribution of sickle cell haemoglobin.

MATERIALS AND METHODS

Collection of Blood Samples: One day before going to the field the sterile sample collecting tubes were rinsed with the anticoagulant, EDTA solution of 0.5% concentration. In the field, 2 to 3 drops of blood were collected from each individual by pricking the middle finger using a disposable sterilized lancet. The properly labelled blood samples were then placed in an icebox and transported to the field laboratory at Utnoor for analysis. At the field laboratory, minimum 20 ml of blood was transferred to Whatman 3MM filter paper strips from the sample collection tubes and air dried for approximately 6 to 7 hours. After the complete drying the samples were transferred to sterile and labelled poly bags and stored at room temperature. The remaining blood in the sample collection tubes was analysed for the screening of haemoglobin S.

Samples for Screening: A total of 485 blood samples were collected at random from individuals of all ages and either sex avoiding the closely related individuals to serve as the representative sample of the Kolam population.

Sample for Generational Variation: Later the blood samples were categorised in to the parental and the offspring generations. For this, 135 families were selected and 3 samples from each family were tested, which included that of wife, husband and their first child; thus the total sample size of parental generation came to be 270 (between 15 to 45 years) and that of the offspring generation was 135 (< 15 years).

Samples to Study the Effect of Consanguinity on the Genetic Parameter: For this, 154 blood samples of offsprings below the age of 15 years were selected. As the marriage type of parents of these children was definitely known, they

were categorised in to two groups, i.e., consanguineous and nonconsanguineous, with the sample sizes of 89 and 65, respectively. Slide test for sickle cell haemoglobin was performed on 80 children of consanguineous marriages and 65 of non-consanguineous marriages.

Test for Sickle Cell Haemoglobin: The slide method of Daland and Casetle (1948) using 2% sodium metabisulphite solution was used to detect the presence of sickle cell haemoglobin in the collected blood samples. For further analysis the blood was transported to the base laboratory at the Department of Anthropology, University of Delhi, where the sickle cell positives cases by the slide test were confirmed for their heterozygote or homozygote status by a modified electrophoresis technique standardized by the author and her colleagues (Sachdeva et al., 1999).

RESULTS AND DISCUSSION

The results respectively are set out in the tables numbering 1 to 4.

The incidence of haemoglobin S in heterozygous condition among the tribal populations of Andhra Pradesh ranges from 0% in Yerakulas (Blake et al., 1981) and Nayakpods (Saraswathy, 1991) to as high as 34.65 in Pradhans of Adilabad (Blake et al., 1981). Prior to the study of Blake et al, a study on Pradhans revealed an incidence of 31.99 % of HbAS, which was also quite high (Goud and Rao, 1979). On the whole the incidence of haemoglobin S in heterozygous condition is found to be higher among the tribes of Telangana region than that of the Coastal region, with the exception of KoyaDora tribe of East Godavari district where the frequency of HbAS phenotype is found to be 24.24%. (Sudhakar Babu et al., 1980). Sickle cell haemoglobin in homozygous condition seems to be completely absent among the tribes of Coastal region where as its frequency among the tribes of Telangana region varies from 0% among the Pradhans, Raj gonds, KoyaDoras (Goud and Rao, 1979) to 2% among the Kolams (Ramesh et al., 1979).

Table 1 shows the phenotypic and gene frequencies of sickle cell haemoglobin among the Kolams .Of the 485 individuals screened for sickle cell haemoglobin, 93.2% were found to be normal and 6.8% had sickle cell trait. The gene frequencies of normal haemoglobin (A) and sickle cell haemoglobin (S) were found to be 0.9659 and 0.0341, respectively.

270 Kolams (135 couples) were screened for sickle cell haemoglobin in the parental population. In the offspring generation, 135 children (one child from each couple) were tested for the same. 7.04% in the parental generation and 4.44% in the offspring generation were found to have the sickle cell trait. Sickle cell anaemia was completely absent in both the generations. The percentile frequency of HbAS in the offspring generation is comparatively lower than that of the parental generation, leading to a lower frequency of Hb S gene (0.0223) in the offspring generation compared to that of the parental generation (0.03). The low Chi square value (1.0484) indicates a statistically non-significant difference between the two generations of the Kolams with respect to sickle cell haemoglobin (Table 2). Hb S gene is lethal, and hence in the present population where there is a long history of consanguinity, this lower frequency of an autosomal

Table 1: Distribution of Sickle Cell Haemoglobin among the Kolams

Total No.	-	*Phenotypic Frequencies*			*Gene Frequencies*	
-	-	*AA*	*AS*	*SS*	*A*	*S*
485	N	452	33	0	0.9659	0.0341
-	%	93.2	6.8	0.0	-	-

Table 2: The Distribution of sickle cell haemoglobin among the parental and the offspring generations of Kolams

Generation	*No.*	*Phenotypic Frequencies*						*Gene Frequencies*		χ^2	*Df*	*p*
-	-	*AA*		*AS*		*SS*				-	-	-
-	-	*N*	*%*	*N*	*%*	*N*	*%*	*A*	*S*	-	-	-
P	270	251	92.96	19	7.04	0	0.0	0.9648	0.0352	1.05	1	.5>p>.3
O	135	129	95.56	06	4.44	0	0.0	0.9777	0.0223	-	-	-

P- Parental; O- Offspring

Table 3: Distribution of Sickle cell haemoglobin among the children of consanguineous and non-consanguineous marriages

MT		*Number*	*Phenotypic frequencies*			*Gene frequencies*		χ^2	*Df*	*p*
			AA	*AS*	*SS*	*A*	*S*			
C	N	89	84	5	0	.9719	.0281	1.669	1	.2>p>.1
	%	-	94.38	5.62	0					
NC	N	65	64	1	0	.9923	.0077			
	%		98.46	1.54	0					

C - Consanguineous, N - Non consanguineous, MT – Marriage Type

recessive allele can be expected (Sanghvi, 1966).

A total of 89 children from consanguineous marriages and 65 from nonconsanguineous marriages were screened for sickle cell haemoglobin, of which 0.06% and 0.02% respectively were found to have the abnormality in heterozygous condition. Sickle cell haemoglobin in homozygous condition is found to be completely absent in both the groups. Though the Chi square value (1.6693 at .05% p with 1df) reveals a non-significant difference between the two groups, despite is an increase in sickle cell haemoglobin gene frequency (0.0281) among the children of consanguineous matings when compared to that of the nonconsanguineous matings (0.007) (Table 3).

The incidence of haemoglobin S in heterozygous condition among the tribal populations of Andhra Pradesh ranges from 0% in Yerakulas (Blake et al., 1981) and Nayakpod (Saraswathy, 1991) to as high as 34.65 % in Pradhans of Adilabad (Blake et al, 1981). Prior to the study of Blake et al; a study on Pradhans revealed an incidence of 31.99 % of HbAS that was also quite high (Goud and Rao, 1979). On the whole the incidence of haemoglobin S in heterozygous condition is found to be higher among the tribes of Telangana region than that of the Coastal region, with the exception of Koya Dora tribe of East Godavari district where the frequency of

Table 4: The Distribution of Sickle Cell Haemoglobin among the Tribal Populations of Andhra Pradesh

Tribe	*Area*	*No tested*	*Phenotypic Frequencies*			*Gene Frequencies*		*Reference*
			AA	*AS*	*SS*	*A*	*S*	
Kolams	Adilabad	485	93.2	6.80	00	.9659	.0341	Present study
Pradhans	Adilabad	122	68.91	31.09	00	.8264	.1736	Goud and Rao, 1979
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Nayakpods	Adilabad	90	95.30	4.7	00	.9767	.0233	Goud and Rao, 1979
Raj Gonds	Adilabad	197	88.66	11.34	00	.9416	.0584	Goud and Rao, 1979
Kolams* [U]	Adilabad	165	83.64	16.36	00	.9182	.0818	Ramesh et al., 1979
Kolams** [A]	Adilabad	50	90.00	8.00	2.0	.9400	.0166	Ramesh et al., 1979
Chenchu***[M]	Adilabad	139	99.28	0.72	00	.9964	.0036	Ramesh et al., 1980
Raj Gonds	Adilabad	133	84.97	14.25	0.76	.9201	.079	Blake et al., 1981
Pardhan S	Adilabad	101	64.36	34.65	00	.8168	.1832	Blake et al., 1981
Koya Dora	Adilabad	159	86.79	12.58	.64	.9308	.0692	Blake et al., 1981
Konda Reddy	Adilabad	92	95.66	4.34	00	.9783	.0217	Blake et al., 1981
Sugali	Adilabad	61	95.08	4.92	00	.9754	.0246	Blake et al., 1981
Yerakula	Adilabad	40	100	00	00	1.00		Blake et al., 1981
Lambada	Warangal	154	97.36	2.64	00	.9867	.0133	Blake et al., 1981
Konda Dora	Warangal	190	90.00	10.00	00	—	—	Naidu and SachiDevi, 1990[p.c]
Koya Dora	Warangal	548	92.15	7.67	00	—	—	Rao and Goud, 1979
Lora Dora	Khammam	132	95.45	4.55	00	—	—	Saraswathy, 1991
Nayakpod	Khammam	40	100	00	00	1.00	00	Saraswathy, 1991
Konda Kammara	East Godavari	110	69.09	30	.09	.805	.195	Jai Kishan et al., 1982
Koya Dora	East Godavari	99	75.76	24.24	00	.8704	.1296	Sudhakar Babu et al., 1980
Savaras	Srikakulam	132	98.48	1.52	00	.9924		Rao et al., 1978
Jatapus	Srikakulam	157	98.73	1.27	00	.9936		Rao et al., 1978

Note - *-Utnoor; ** – Asifabad; *** – Mehaboobnagar

HbAS phenotype is found to be 24.24%. [Sudhakar Babu et al., 1980]. Sickle cell heamoglobin in homozygous condititon seems to be completely absent among the tribes of Coastal region where as its frequency among the tribes of Telangana region varries from 0% among the Pradhans, Raj gonds, and Koya Doras (Goud and Rao 1979) to 2% among the Kolams (Ramesh et al., 1979). Ramesh et al in 1979 reported the frequency 0f HbAS phenotype as 16.36% and 8% among the Kolams of Utnoor and Asifabad respectively. On an average 12.18% of HbAS phenotype is found among the Kolams of Adilabad district. The frequency of sickle cell gene among the tribes of Andhra Pradesh varies from 0% among the Nayakpods (Saraswathy, 1991) to 18.32 among the Pradhans of Adilabad (Blake et al., 1981).Ramesh et al reported a give frequency of 0.0818 and 0.06 among the Kolams of Utnoor and Asifabad of Adilabad district of Andhra Pradesh. On an average again, the sickle cell gene frequency among the Kolams was found to be 0.0709.In the present study, the phenotypic frequency and the sickle cell gene frequency, 0.068 (heterozygous condition) and 0.0341 respectively seem to be quite lower, compared to that reported in of the previous studies. This can be attributed to the fact that the long-term inbreeding leads to the elimination of lethal genes. Since this population has a long history of high consanguinity, the sickle cell gene in this population, being lethal in homozygous condition would have been lost in homozygous condition. As the sample for the present study consists of mainly people above the age of 15 years with few exceptions, the lower frequency of sickle cell haemoglobin in heterozygous condition and the absence of sickle cell haemoglobin in homozygous condition can be justified.

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