Jr. Anth. Survey of India, 61 : 1 (211-221), 2012

Marital Distance and Genetic Structure among the Mullukuruman of Kerala

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ABSTRACT

The tribal populations with primitive technological attainment inhabiting varied environments in peninsular India, with peculiar socio-cultural feature having distinctive biological make up provides excellent opportunity for the anthropologists in investigating their genetic structure. The present study attempts to report a comprehensive genetic structure of the Mullukuruman of Wynad, one of the primitive tribal groups of Kerala. The data from 148 Mullukuruman couples have been collected through couple information schedule. The blood samples were drawn by finger prick method with disposable needles from 102 Mullukuruman individuals residing in 7 villages namely, Tirunelly, Kottanede, (Pootadi) Kolikka, Pullakkudi, Punchavayal, Mukkam and Makhtti in Sultan Battery taluka of Wynad district in Kerala. The blood samples were analyzed for the A1A2BO, the MNs, the Rh system and sickle cell trait following standard techniques. Out of 148 studied spouses only two couples, one couple of first-cousin ie., mother's brother's daughter (MBD) and another couple of third-cousin were found consanguineous. Thus, the consanguinity among the Mullukuruman was very low (1.35 per cent) compared to other ethnic groups of Kerala. The mean inbreeding coefficient for autosomal gene is 0.000457 ± 0.0004263 with a coefficient of variance of 1134.73 ± 65.95. The Mullukuruman follows village exogamy and strictly prohibited kulam endogamy. The mean marital distance among them is only 18.52 ± 0.84 Kms. The findings of A1A2BO blood groups show the preponderance of O blood group corresponding to a very high frequency of O gene (0.7819) followed by B and A along with their gene frequencies of 0.1365 and 0.0816 respectively. The Rh system shows a very distinctive feature in Mullukuruman with a relatively high frequency (8.82%) of haplotype cDe (R0). The highest frequency of haplotype is the CDe (R1) with 49.02 per cent among the Mullukuruman and the lowest is Cde haplotype (rI) with 0.98 per cent. The presence of Rz haplotype (4.90 per cent) among the Mullukuruman is of special interest as it is rare in Indian populations. The

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gene frequency of N is higher (0.5792) than that of m (0.4208). The Mullukuruman show an interesting situation where the gene 'n' shows dominant over gene 'm' which is a typical feature of the people living in Pacific area including Australia. . Only one person was found to be having the colour vision deficit with very low frequency of 0.98 per cent of Deutan type (green). About 10.78 per cent of the total 102 sample comprising 5 males and 6 females were found to have the gene HbS in the Mullukuruman.

INTRODUCTION

Indian tribal population constitutes 8.2 per cent of the total population in the country offers unique opportunity for genetic and anthropological studies because of the diversity that exist within and between populations. The study of genetic structure of a human population is important to understand human biology of the population. The genetic structure of a population is determined by the nature of gene of gene flow within a geographical area though it's breeding structure and marital movement, in addition to the biological make of the group. Mating patterns, inbreeding, gene flow, geographical isolation are some of the factors which act on the gene pool of a population in addition to the evolutionary forces which brings upon the changes in allelic frequency of a population.

The earliest studies on ABO blood groups were reported among the Cochin castes (Mcfarlane, 1937) and Pre-Dravidians of Wynad plateau (Aiyappan, 1936). Few more studies have been carried out on ABO blood groups system on Kerala populations by Mcfarlane et al., (1940). In recent years Sastry (1970; 1990) conducted serological studies on the Kurichian and Mullukuruman of Wynad and a few tribal groups of Nilgiri and Kodagu. Sickle cell trait was reported in several tribal groups inhabiting the Nilgiri – Wynad region by Buchi (1955, 1961), Das et al., (1967), Negi (1975), among Kurumba, Kurichian, Irula, Paniyan, Adiyan, Yerava and Soliga.

The present study attempts to report a comprehensive genetic structure of the Mullukuruman of Wynad, one of the primitive tribal groups of Kerala, who were hunters, food gatherers and shifting cultivators. The principal occupation of the Kuruman was wood cutting and collection of forest produce (Thurston, 1909). According to Luiz (1962) they were Vedas of south India. They have their own dialect which is an admixture of Tamil, Malayalam and Kannada words. They have four exogamous kulams (clan) namely Kathiya, Vangade, Villippa and Vandaka. Marriage within the kulam is prohibited.

Material and Methods

The data from 148 Mullukuruman couples have been collected through couple information schedule comprising information on couples age, sex, clan, couples birth places, distance between the birth places of couple, residence prior to marriage, type of consanguineous marriage etc. The data were analyzed following standard procedures and statistical constants were calculated following standard formulae. The mean inbreeding coefficient and other derivatives were calculated in accordance with the procedure laid down in Li (1961), Cavali-Sforza and Bodmer (1971) and Bala Krishnana (1988).

The blood samples were drawn by finger prick method with disposable needles from 102 Mullukuruman individuals residing in 7 villages namely, Tirunelly, Kottanede, (Pootadi) Kolikka, Pullakkudi, Punchavayal, Mukkam and Makhtti in Sultan Battery taluka of Wynad district in Kerala. Care was taken to exclude nearest blood relatives. The data was collected in the month of October 1996. The blood samples were analyzed for the A1A2BO, the MNs, the Rh system and sickle cell trait following standard techniques. The gene frequencies were calculated following Mourant (1954) and also the maximum likelihood method as illustrated by Bala Krishnan (1988). The gene frequencies for different blood group systems were rechecked following Mourant (1954) and Race and Sanger (1954).

Results and Discussion

Mating patterns

The frequency distribution of the different types of marriages among the Mullukuruman have been presented in Table-1. Out of 148 studied spouses only two couples, one couple of first-cousin ie., mother's brother's daughter (MBD) and another couple of third-cousin were found consanguineous. Thus, the consanguinity among the Mullukuruman was very low (1.35 per cent) compared to other ethnic groups of Kerala. The mean inbreeding coefficient for autosomal gene is 0.000457 ± 0.0004263 with a coefficient of variance of 1134.73 ± 65.95, which is very less compared to other Kerala castes and tribes reported by Ali (1968). Although the mean inbreeding coefficient values are very high among the Indian tribes particularly in southern India, the Mullukuruman are an exception to this phenomenon. The occurrence of first cousin marriages are more prevalent among the castes and tribes of southern India but marriages with 1 _ cousin, 2nd cousin, 2 _ cousin and beyond 3rd cousin are very few (Ali, 1968). Even in the occurrence of different forms of consanguineous marriages, the Mullukuruman show contrasting picture with their neighbouring tribes inhabiting the same region and opt for non-consanguineous marriages. The most frequently occurred marriages among the villages surveyed are in between Vadaka kulam versus Villippa followed by Kathiya versus Villippa.

Table – 1. Matting patterns among the Mullukuruman

Type of marriage		N	%
Uncle - Niece		–	0
First cousins	FSD	–	0
	MBD	1	0.68
First cousins once removed			
	i) Matrilateral	–	0
	ii) Patrilateral	–	0
Second cousins		–	0
Third cousins		1	0.68
Total consanguineous marriages		2	1.35
Non-consanguineous marriages		146	98.65
Total marriages		148	100

Table – 2. Mean Inbreeding coefficients among the Mullukuruman

I ± SE	SD ± SECV ± SE	
0.000457 ± 0.0004263	0.0051857 ± 0.0003014	1134.73 ± 65.95

Marital distance

The marital distance is measured in terms of the actual road distance between permanent residences of the spouses before marriage in kilometers. The frequency distribution of marriage distance among the Mullukuruman of Wynad is shown in Table-3. The Mullukuruman follows village exogamy and strictly prohibited kulam endogamy. About 68.24 per cent of the marriages among the Mullukuruman were held within the distance of 20 Kms. while 12.84 per cent of marriages took place beyond the distance of 32 Kms. from their actual birth places. The mean marital distance among them is only 18.52 ± 0.84 Kms. which is lesser than that of the Kurichian ie., 21.07 (Saheb, 1999). It means the Mullukuruman tribe preferred short distance for selection of spouse than that of their Kurichian counterpart though they share the same habitats and region.

A_1A_2BO blood groups

Table-4 portrays the findings of A1A2BO blood groups which shows the preponderance of O blood group corresponding to a very high frequency of O gene (0.7819) followed by B and A along with their gene frequencies of 0.1365 and 0.0816 respectively. The

frequency of blood group A is very low among the Mullukuruman while that of frequency of O gene is above 75 per cent.

It is in general agreement that the Indo-Aryan affiliations are characterized by 'A' gene with its preponderance over 'B' gene whereas the Mongoloid populations exhibit high proportion of 'B' gene and lower frequency of 'A' gene. On the other hand the Proto-Australoid groups possess moderate value of both A and B gene. It is noteworthy that 'O' gene is universally high in all the populations except the Paniyan, Adiyan (Sarkar, 1954), Toda (Kirk, et al., 1962), Ulladhan, Malavadan, Muthua and Vettuvan (Buchi, 1958; Roy, 1955) of south India.

Rh blood groups

The frequency of Rh blood groups (tested with 5 anti-sera) for 102 Mullukuruman individuals are shown in Table-5. The Rh system shows a very distinctive feature in Mullukuruman with a relatively high frequency (8.82%) of haplotype cDe (R0) but Bhasin et al., (1994) reported the absence of this haplotype in Indian populations. The highest frequency of haplotype is the CDe (R1) with 49.02 per cent among the Mullukuruman and the lowest is Cde haplotype (rI) with 0.98 per cent. The presence of Rz haplotype (4.90 per cent) among the Mullukuruman is of special interest as it is rare in Indian populations. The occurrence of 'r' chromosome in Mullukuruman might be due to isolation which leads to genetic drift and lesser interaction with the neighbouring tribes of wynad and Nilgiri hills though living in the same ecological niche.

Table – 3 Frequency distribution of marital distance among the Mullukuruman

	Total	
Marital distance (in Km)	**N**	**%**
0 (Village endogamy)	0	0
0 - 4	11	7.43
5 - 10	22	14.86
11 - 15	20	13.51
16 - 20	48	32.43
21 - 25	4	2.70
26 - 30	22	14.86
31 - 35	5	3.38
36 - 40	15	10.14
41+	1	0.68
Total	**148**	**100.00**

Mean ± S.E. = 18.52 ± 0.84 Km

Table-4 Frequency distribution of A1A2BO blood groups among the Mullukuruman

Blood group	Observed absolute No.	Frequency %	Expected frequency	Gene frequency
O	63	61.76	61.14	p1 = 0.0658
A1	11	10.78	10.92	p2 = 0.0158
A2	2	1.96	2.5	q = 0.1365
B	23	22.55	23.21	r = 0.7819
A1B	2	1.96	1.8	
A2B	1	0.98	0.43	
Total	**102**	**99.99**	**100**	**1**

MN blood groups

The distribution of MN blood groups phenotype and genotype frequencies among the Mullukuruman are given in Table-6. The result shows higher frequency of MN (46.53 per cent) than that of N and M phenotypes ie., 34.65 per cent and 18.81 per cent respectively. The gene frequency of N is higher (0.5792) than that of m (0.4208). Some of the south Indian tribes eg. The Chenchu, Kadar, Irula, Kota, Kurumba, Toda and Kanikkar show more 'm' gene frequency than 'n' gene. But the Mullukuruman, the Kurichian, the Malapantaram (Buchi, 1955)of Kerala and the Dhodia of Gujarat show an interesting situation where the gene 'n' shows dominant over gene 'm' which is a typical feature of the people living in Pacific area including Australia. This variation may be due to their genetic composition and relative isolation where genetic drift has vital role on such a small gene pool.

Table-5 Frequency distribution of Rh system in the Mullukuruman

Phenotype	N	Observed frequency	Haplotype frequency
ccddee	2	1.96	r = 0.1409
ccDee	9	8.82	
ccddEe	2	1.96	R' = 0.0352
ccddEE	–	–	
ccDEe	1	0.98	R"= 0.0704
ccDEE	–	–	
Ccddee	1	0.98	R1 = 0.2818

Phenotype	N	Observed frequency	Haplotype frequency
CCddee	–	–	
CcDee	18	17.65	R0 = 0.1896
CCDee	32	31.37	
CcDDEe	–	–	Rz = 0.2821
CcddEE	–	–	
CCddEe	–	–	
CCddEE	–	–	
CcDEe	11	10.79	
CcDEE	3	2.94	
CCDEe	18	17.65	
CCDEE	5	4.9	
Total	**102**	**100**	**1**

Table-6 Distribution of MN blood group among the Mullukuruman

No.	Phenotype			Gene frequency	
	MM	Mn	NN	m	n
101	19	47	35	0.4208	0.5792

Colour blindness

Colour vision deficiency test using Ishihara (1977) chart comprising 38 plates was performed in day light on 102 Mullukuruman of both the sexes consisting of 57 males and 45 females from seven villages. Only one person was found to be having the colour vision deficit with very low frequency of 0.98 per cent of Deutan type (green). Contrary to this no female person was found for vision deficit. This low frequency of colour blindness in Mullukuruman justifies the hypothesis propounded by Post (1962) that the incidence of colour blindness will be negligible in the hunting and gathering communities due to relaxation of selection.

Sickle cell traits (HbS)

The sickle cell test was performed on 102 individuals belonging to 14 to 85 years of age is shown in Table-7. About 10.78 per cent of the total 102 sample comprising 5 males and 6 females were found to have the gene HbS in the Mullukuruman primitive tribal group of Kerala. The incidence of sickle cell trait varies from 0 to 40 per cent among the

tribes inhabiting the Western Ghats spread over three states. The genetic disorder caused by mutation is believed to have occurred first in south India as the high frequency of HbS is widely spread among the tribal groups of all southern states followed by central and western states of Indian subcontinent. Lehman and Cutbush (1952) first detected the gene HbS among the Irula boy of Nilgiri hills in Tamilnadu.

Table-7 Distribution os sickle cell trait among trib al groups of southern India Tribal group

Tribal group	N	AA	As	SS	%	Source
Adiyan	75	51	24		16	ICMR, 1986
Paniyan	61	40	21		17.21	ICMR, 1986
Irual	124	85	39		15.73	Lehman & Cutbush, 1952
Irual	254	168	81	5	17.91	Sastry, 1990
Irual	130	84	46		35.38	Undevia et al., 1981
Kurumba-Mullu	101	62	38	1	19.8	Sastry, 1990
Toda	98	–	–	–	1.02	Saha et al., 1976
Kurumba	43	–	–	–	20.93	Saha et al., 1976
Toda	60	–	–	–	3.33	kirk et al., 1962b
Irula	15	–	–	–	40	kirk et al., 1962b
Kurumba	43	–	–	–	23.25	kirk et al., 1962b
Kota	549	–	–	–	0	Ghosh et al., 1977
Irula	175	–	–	–	26.28	Saha et al., 1976
Kurichian	106	104	2	–	1.88	Saheb, 1999
Mullukuruman	102	91	11	–	10.78	Present study

The Mullukuruman of the present study exhibits moderate frequency of 10.78 per cent as compare to other tribal groups in southern India which is higher than the Kurichian but lower than the Adiyan, Paniyan, Irula and the Kurumba of the same area. The Allison (1954) hypothesis says that the sickle cell trait shows its presence among the population whose economy revolves around agriculture and settled populations which justifies the hypothesis for the Mullukuruman with the presence of moderate frequency of sickle cell trait.

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