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Consanguinity and Inbreeding Effects on Fertility and Mortality Among Malas of Chittoor District, Andhra Pradesh

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ABSTRACT A sample of 190 households of Malas of Chittoor district was studied for evaluating the consanguinity and its effects on fertility and mortality. The proportion of consanguineous marriage (60.53%) was found to be higher than that of non-consanguineous (39.47%) marriages. The autosomal and sex-linked inbreeding coefficients are 0.04112 and 0.03948, respectively. The pregnancy wastages and mortality are high and total conceptions, livebirths, surviving offspring are low among consanguineous matings than in non-consanguineous matings. The results were discussed in comparison with other populations of Chittoor district.

INTRODUCTION

Marriage of individuals who are related through one or more common ancestors is known as consanguineous and their offspring as inbred. Consanguineous marriages are more prevalent in the Southern states than in Northern states of India. The different consanguineous levels like uncle- niece, aunt-nephew, first cousin, first cousin-once-removed, second cousin, second cousin-once-removed and third cousin etc. lead to inbreeding, thereby increasing the frequency of homozygotes and affecting the genetic structure of a population. Two of the four kinds of first cousin marriages, mother's brother's daughter (MBD) and father's sister's daughter (FSD), are practised by the Hindus, while the other two, mother's sister's daughter (MSD), and father's brother's daughter (FBD), by the Muslims.

The vital processes of life like fertility and mortality are fundamental determinants of population growth and they represent an essential feature of our approach to the understanding of the human biology. A number of investigations on consanguinity have been conducted in the Indian sub-continent by different investigators (Dronamraju and Khan, 1960; Sanghvi, 1966; Kumar et al., 1967; Basu and Roy, 1972; Ghosh, 1972; Veerraju, 1973; Sundar Rao, 1971,1972; Huq, 1976; Rami Reddy and Papa Rao, 1978; Rami Reddy and Naidu, 1978; Krishna Sharma, 1978; Rami Reddy and Chandrasekhar Reddy, 1979; Roychoudhury, 1980; Mohan Reddy, 1983; Govinda Reddy, 1984, 1985, 1987; Rami Reddy and Subhashini, 1985.

PRESENT STUDY

The present study reports on the consanguinity and inbreeding effects on fertility and mortality of Malas of Chittoor district, Andhra Pradesh. The only work carried out on this population was about a decade ago (Chengal Reddy, 1979). Ever since, the Malas have been strongly exposed to the influence of modern science and technology as also urbanisation, and many of them exhibit tendencies of change in their customs and lifestyles. Their counterpart in the area of the present study, who are also under the influence of similar forces, have not been investigated earlier. In view of this, and in order to add to the existing knowledge, this work was undertaken.

THE PEOPLE AND THE AREA

The Telugu-speaking Malas are a Scheduled Caste population found not only in the area of our study and other parts of Chittoor district but they also inhabit the other regions of the state. They occupy the lowest position in the Hindu caste system alongside of the Madigas, another Scheduled Caste population. They still stay outside the main part of the village and live mainly by agricultural labour. In recent years, however, most of the welfare programmes implemented by the State and Central Governments have benefitted a large number of Mala families and individuals, including those of the present study. They prefer consanguineous marriages (60.53%), as revealed by the present investigation. Widow remarriage is prohibited. Polygamy is rarely practised. The dowry system is prevalent.

The study area of the 'Mala' population is covered by the villages of Vallivedu (lattitude 13°30' north and 79° 05' west), Ramanappagari palle (13° 30' north and 79° 05' west) and Reddivaripalle (13°36' north and 79°03' west). The climatic conditions of the area generally conform to those of the district. It receives an annual average rainfall of 514.1 mm and experiences 34° C to 42° C temperature. Agriculture is the mainstay of the economy. The crops usually grown are sugarcane (*Saccharum afficinarum*), groundnut (*Arachis hypogea*) and Paddy (*Orisa sative*). Tamarind (*Tamarindus indica*) and mango (*Mangifera indica*) are also known in the area.

MATERIAL AND METHODS

The information on marriages, fertility and mortality was collected using a pretested proforma devised for the purpose by direct interview from 190 couples drawn from the villages of Vallivedu (75), Ramanappagari palle (50) and Reddivaripalle (65), by surveying the villages completely. All couples of different ages were visited and interviewed at their houses. In the interview, the degree of consanguinity in each family was checked and complete information by the numbers of generations and sex of the persons along with connecting paths of relationship between husband and wife was obtained. The pedigrees were drawn wherever necessary. The reproductive history noted consisted of total number of pregnancies, live births, abortions, still births and postnatal mortality (deaths upto 1 year, 1-6 years and 7-20 years). Reproductive wastage from 5th week of pregnancy upto 7th month was noted as abortion and cases between 7th month to birth was recorded as still births.

Considerable difficulty was experienced in obtaining the reproductive history of various women because of the very low rate of literacy in the population. It was found hard to get data pertaining to abortions, still births etc., especially from most of the illiterate aged ladies. All these problems were estimated but the number and the exact age of living children helped in assessing the nearly correct age, of the dead children and also the information on the abortions and still births. We have also cross checked the reproductive histories of various women with the local mid-wives (*Mantrasani*) who attended on the deliveries. In this connection, it is of significance to mention that the other numbers of the concerned families are also helped in the correct assessment of the information sought from their families. Further more, our close associations with the informents helped us in making our data as accurate as possible.

The co-efficient of inbreeding, has been calculated from the pedigrees by path co-efficient method (Wright, 1922) and for comparison of the mean co-efficient of inbreeding, following formula,

$F = \Sigma \frac{Fc.n}{N}$ has been used

F = Inbreeding co-efficient

Σ= the sum for different categories of consanguineous marriage observed.

Fc= Inbreeding co-efficient (autosomal/sex-linked) of the particular category of consanguineous marriages.

n = number of marriages in the particular category ex., uncle-niece, first cousin etc.

N = Total number of marriages enquired into concerning a certain group.

The data has been treated with descriptive statistics and '*t*' test is implemented to know the difference between various measures of consanguineous and non-consanguineous marriage.

RESULTS AND DISCUSSION

The percentages and frequencies of various types of consanguineous marriages along with inbreeding co-efficients, both autosomal and sex-linked, are presented in table 1. The consanguineous marriages (60.53%) occur in much higher proportion than the non-consanguineous marriages (39.47%). Of the four types of consanguineous marriages found, the proportion of uncle-niece marriages (10.53%) is four times less than the first cousin type (42.11%). The first cousin once removed type (2.63%) constitutes about one-half of the second cousin type (5.26%). The autosomal and sex-linked mean inbreeding co-efficients of the population are 0.04112 and 0.03948, respectively.

Table 1 : Patterns of consanguinity and inbreeding co-efficients

Marriage Type	*N*	*Per cent*	*Mean inbreeding co-efficient*	
			Auto-somal	*Sex-linked*
Non-consanguineous	75	39.47	—	—
Consanguineous	115	60.53	—	—
(i) Uncle-niece	20	10.53	0.01316	0.01316
(ii) First cousin	80	42.11	0.02632	0.02632
(iii) First cousin once removed	5	2.63	0.00082	0.00000
(iv) Second cousin	10	5.26	0.00082	0.00000
Total	190	100.00	0.04112	0.03948

In table 2, the fertility and mortality measures are given for consanguineous and non-consanguineous matings. The mean values of total pregnancies, live births and surviving offspring are relatively less in consanguineous than in non-consanguineous marriages. But the difference is significant ($P < .05$) in survival offspring between consanguineous and non-consanguineous marriages, where as the total pregnancies and live births show insignificance as is revealed by the '*t*' value. The pregnancy wastages like abortions, still births and post-natal deaths, *i.e.*, new born to one year, 1 year to 6 years, are higher in consanguineous than in non-consanguineous matings. The deaths between 7 years to 20 years is present only in consanguineous group than in non-consanguineous group. The difference in abortions and still births is insignificant and significant difference is observed in the deaths between new born to 1 year ($p < .05$) and the deaths between 1 years to 6 years ($P < .01$).

Age-specific consanguinity effects on fertility and offspring mortality (Table 3) show lower fertility and mortality values in consanguineous mothers in the age range of 25 years and below as reflected in their pregnancies, live- births, surviving offspring and mortality than in non-consanguineous mothers, while no still births are found in both non-consanguineous as well as consanguineous mothers. Abortions (0.333 ± 0.126) have been reported in the latter. In the age group of 26 - 50 years, consanguineous mothers reported higher fertility and mortality rates than the non-consanguineous mothers, except the surviving offspring and abortions which present higher mean values in non-consanguineous mothers than in consanguineous mothers. In the age group of 51 years and above, there are higher mean values of pregnancies, livebirths and surviving offspring in non-consanguineous than consanguineous mothers, whereas the mortality rate is much higher in the latter than in the former type of mothers. While both types of mothers in this age range reported no still births, abortions have been noticed in the consanguineous mothers.

The different degrees of consanguinity and their effects on fertility and mortality rates are portrayed in table 4. Both pregnancies and infant mortality show higher means in first cousin-once-removed type of consanguinity

Table 2: Measures of fertility and mortality in consanguineous and non-consanguineous parents

S.No.	Results of conception	No.	Consanguineous			No.	Non-consanguineous			't' value
			Mean±S.E.	S.D±S.E.	C.V±S.E.		Mean ±S.E.	S.D.±S.E.	C.V.±S.E.	
1.	Total pregnancies	445	3.870±0.161	1.727±0.114	44.626± 2.942	300	4.000±0.266	2.300±0.189	57.725± 4.713	0.4181
2.	Pregnancy wastages	45				20				
	(a) Abortions	30	0.261±0.049	0.529±0.035	202.681±13.360	15	0.200±0.046	0.400±0.033	200.000±16.330	0.9075
	(b) Still births	15	0.130±0.031	0.337±0.022	259.000±17.078	5	0.066±0.029	0.249±0.020	377.272±30.804	1.5077
3.	Live births	400	3.478±0.216	2.319±0.153	66.676± 4.396	280	3.733±0.200	1.731±0.141	46.370± 3.786	0.8662
4.	Surviving offspring	290	2.522±0.137	1.471±0.097	58.326± 3.846	245	3.266±0.268	2.323±0.190	71.127± 5.807	2.4719[2]
5.	Post-natal deaths	110				35				
	(a) New born to 1 year	65	0.565±0.066	0.712±0.047	126.018± 8.309	25	0.333±0.069	0.596±0.049	178.979±14.614	2.4298[2]
	(b) 1 year to 6 years	35	0.304±0.051	0.547±0.036	179.934±11.864	10	0.133±0.039	0.339±0.028	254.887±20.810	2.6634[1]
	(c) 7 years to 20 years	10	0.087±0.026	0.282±0.019	324.138±21.373	0	—	—	—	—

1 = P < 0.01 2 = P < .05

Table 3: Means of fertility and mortality among consanguineous and non-consanguineous mothers of different age groups (in years)

Age group	Relationship	N	Pregnancies	Live births	Surviving offspring	Mortality	Still births	Abortions
0-25	C	15	2.000±0.436	1.666±0.333	1.000±0.218	0.666±0.252	—	0.333±0.126
	NC	10	3.000±0.333	3.500±0.166	3.500±0.166	1.000±0.000	—	—
26-50	C	95	4.211±0.191	3.769±0.188	2.789±0.148	0.947±0.118	0.158±0.050	0.211±0.063
	NC	50	3.800±0.377	3.700±0.356	3.200±0.305	0.300±0.091	0.100±0.043	0.300±0.129
51+	C	5	3.000±0.000	3.000±0.000	2.000±0.000	2.000±0.000	—	1.000±0.000
	NC	15	5.333±0.333	4.000±0.787	3.333±0.666	0.666±0.126	—	—

Table 4: Distribution of means and mortality attributes in different levels of consanguinity

Mating type	*No.*	*Pregnancies*	*Live births*	*Surviving offspring*	*Infant mortality upto 1 year*	*Infant mortality 1-6 years*	*Still births*	*Abortions*
Uncle-niece 1/8	20	4.500±0.344	4.500±0.344	2.750±0.190	1.000±0.162	0.750±00.190	—	0.250±0.099
First cousin 1/16	80	3.500±0.182	3.125±0.221	2.438±0.178	0.375±0.088	0.125± 0.027	—	0.250±0.063
First cousin once removed 1/32	5	9.000±0.000	6.000±0.000	3.000±0.000	2.000±0.000	1.000± 0.000	3.000±0.000	1.000±0.000
Second cousin 1/64	10	3.000±0.333	3.000±0.333	2.500±0.499	—	—	—	—

Table 5: Comparison of the fertility and mortality values with other populations of Chittoor District by 't' values

Result of conceptions	*Population (N) Authors*	*Mala (115) Present Study*	*Mangali (85) Anuradha Devi, 1989*	*Ediga (190) Chandrasekhar, 1989*	*Palli Reddy (322) Rami Reddy et. al., 1985*	*Kamma (180) Chandrasekhar, 1989*	*Pokanati Reddis (85) Rami Reddy et al., 1979*	*Pedakanti Reddis (129) Rami Reddy et al.,1979*
Total conceptions		3.870±0.161	3.18±0.26[2]	3.505±0.154	3.44±0.14	3.333±0.144[2]	3.967± 0.210	3.378±0.093[1]
Live births		3.478±0.216	2.31±0.21[1]	3.174±0.146	3.41±0.09	2.872±0.132[2]	3.700± 0.209	3.202±0.091
Survival offspring		2.522±0.137	2.24±0.20	2.747±0.129	2.65±0.09	2.489±0.051	3.267±0.109	0.101±0.000
Abortions		0.261±0.049	0.56±0.16[1]	0.237±0.043	0.13±0.03[1]	0.317±0.051	0.200± 0.0742	0.067±0.007[1]
Still births		0.130±0.031	0.32±0.07[1]	0.089±0.027	0.07±0.02	0.111±0.31	0.067± 0.032	0.101±0.000
New born to 1 year		0.565±0.066	0.13±0.05[1]	—	0.18±0.05[1]	—	0.283± 0.075[1]	0.563±0.084
1 year to 6 years		0.304±0.051	—	—	0.24±0.03	—	0.087± 0.032[1]	0.101±0.000[1]
7 year to 20 years		0.087±0.026	0.04±0.02	—	0.06±0.02	—	—	—

1 = 1% 2 = 2%

than in uncle niece, first cousin and second cousin marriage types. Further, the second cousin marriages did not report any still births and abortions, while in the uncle-niece and first cousin types of mariages there were no still births. A similiar trend is observed in live births too, the order of their occurrence being: first cousin-once-removed >uncle-niece > first cousin > second cousin marriages. In the case of surviving offspring first cousin-once removed type of marriages show higher means than the uncle-niece, second cousin and first cousin types. In the case of abortions, first cousin-once-removed marriage type reported a much higher value than uncle-nicce and first cousin types.

The results of the present study are compared with those of other populations of the area earlier studied and are as shown in table 5. To understand the extent of intergroup difference between the Malas of our study with each of the other population groups, '*t*' test has ben employed. Accordingly, with respect to total conceptions, there is significant difference at 2 % level between our series and the populations of Mangali and Kamma and at 1% level with Pedakanti Reddis. In the case of livebirths, 1% and 2% levels of significance are found in Mangali and Kamma populations, respectively. With regard to abortions, Mangali, Palli Reddis and Pedakanti Reddis show significant difference at 1% and 2% levels with the Pokanati Reddy population. Only the Mangalis show 1% level of significance in still births. In mortality, Mangali, Palli Reddis and Pokanati Reddis show 1% level of significance taking into view the new borns to 1 year children put together whereas only Pokanati and Pedakanti Reddis show 1% level of significance for the children on 1 year to 6 years.

Table 6 shows the consanguinity and inbreeding co-efficient among some caste populations of Chittoor district, Andhra Pradesh. Of all the available studies on different populations of Chittoor district, Mala caste shows higher percentage of consanguineous marriages and lowest percentage is in Balija population as the order presented under: Mal > Ped.R > Edi > Pal.R > Kam > Ksht > Man > Pok.R > Bal.

In the case of autosomal inbreeding -co-efficients, Palli Reddis show the highest value, whereas Kshatriyas show the lowest: Pal.R > Ped.R > Pok.R > Mal > Man > Bal > Kam > Edi > Ksht.

The sex linked inbreeding co-efficients which occur in the following order show Pedakanti Reddis having the highest value and the Mala (present study) the lowest one: Ped. R > Pok.R > Kam > Ksht > Edi > Pal.R > Bal > Mal.

CONCLUSION

It is known from the results of our study that the increase in consanguinity leads to the

Table 6: Consanguinity and Inbreeding Co-efficients among the case populations of Chittoor District, Andhra Pradesh

Population	*Number of marriages*	*Consanguineous marriages(%)*	*Inbreeding co-efficient*		*Source*
			Autosomal	*Sex-linked*	
Mala	190	60.53	0.04112	0.03948	Present study
Mangali	200	42.50	0.0409	—	Anuradha Devi, 1989
Ediga	400	47.50	0.0325	0.0394	Chandrasekar, 1989
Palli Reddy	712	45.22	0.0565	0.0281	Rami Reddy et al., 1985
Kamma	400	45.00	0.0353	0.0422	Chandrasekar, 1989
Pokanati, Reddis	163	39.88	0.04126	0.0482	Rami Reddy et al., 1979
Pedakanti, Reddis	255	50.59	0.04926	0.05539	Rami Reddy et al., 1979
Balija	1138	36.03	0.0392	0.0266	Gunasundaramma, 1980
Kshatriya	1506	44.00	0.02791	0.0410	Subramanyam, 1984

increase in prenatal and post-natal deaths with the decrease in fertility, live-births and survival offspring when compared with non-consanguinity, a well known finding reported by earlier studies as well. The prevalence of a high frequency of consanguinity speaks of its importance in human societies.

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REFERENCES

Anuradha Devi, D.C. : *Genetic Demography of the Mangalis of Tirupati, Chittoor District, Andhra Pradesh.* M. Sc. Dissertation. S.V. University, Tirupati (1989).

Basu, S.K. and Roy Sibani : Changes in the frequency of consanguineous marriages among the Delhi Muslims after partition. *East. Anthropol., 25:* 21-28 (1972).

Chandrasekar, A.: *Consanguinity and Its Effects on Reproduction and Adolescent Growth Among Three Endogamous Groups of Chittoor District, Andhra Pradesh.* Ph. D. Thesis, S.V. University, Tirupati (1989).

Dronamraju, K.R. and Meera Khan, P.: Inbreeding in Andhra Pradesh. *J. Hered., 51:* 239-242 (1960).

Ghosh, A.K.: Inbreeding in the Kota of Nilgiri Hills, Madras. *Soc. Biol., 19:* 289-291 (1972).

Govinda Reddy, P.: Preferential marriages: Native view point in three South Indian communities. *Anthropology, 18:* 45-57 (1984).

Govinda Reddy, P.: Effects of inbreeding on mortality: A study among three South Indian communities. *Hum. Biol., 57:* 47-59 (1985).

Govinda Reddy, P.: Effects of consanguineous marriages on fertility among three endogamous groups of Andhra Pradesh. *Soc. Biol., 34:* 68-77 (1987).

Gunasundaramma, K. and Rami Reddy, V.: Some aspects of population structure of the Balija's of Tirupati. *Comp.Physiol. Ecol., 9 (Suppl.):* 364-366 (1984).

Huq, F.: Consanguinity and inbreeding among the Muslims of Mushirabad and Birbhun districts of West Bengal. *J. Ind. Anthrop. Soc., 11:* 21-26 (1976).

Kumar, S., Pai, Raj and Swaminathan, M.S.: Consanguineous marriages and the genetic load due to lethal genes in Kerala. *Ann. Hum. Genet., 31:* 141-145 (1967).

Malhotra, K.C.: Inbreeding among Dhangar castes of Maharashtra. *J. Biosoc. Sci., 11:* 377-410 (1979).

Mohan Reddy, B.: Trends of inbreeding among the migrant groups of fishermen of the Puri Coast. *J. Ind. Anthrop. Soc., 18:* 61-65 (1982).

Rami Reddy, V. and Chandrasekhar, B.K.: Consanguinity effect on fertility and mortality among the Reddis of Chittoor district, Andhra Pradesh. *Ind. J. Hered., 11:* 77-88 (1979).

Rami Reddy, V. and Naidu, G.P.: Effects of consanguinity of fertility and mortality in the Gampasati Kammas of Chittoor district, Andhra Pradesh (India). *Medical Genetics, 2:* 151-156 (1978).

Rami Reddy, V. and Papa Rao, A.: Effects of parental consanguinity on fertility, mortality and morbidity among the Pattasalis of Tirupati, South India. *Hum. Hered., 28:* 226- 234 (1978).

Rami Reddy, V. and Subhashini, A.B.: Effects of consanguinity on fertility and mortality among Palli Reddis of Tirupati. *Comp. Physiol. Ecol., 10:* 141-144 (1985).

Rao, P.S.S.S.: Rural urban differentials in consanguinity. *J. Med. Genet., 9:* 174-178 (1972).

Rao, P.S.S.S.: An epidemiological study of consanguinity in a large South Indian Town. *Ind. J. Med. Res., 59:* 294-301 (1971).

Roychoudhury, A.K.: Consanguineous marriages in Tamilnadu. *J. Ind. Anthrop. Soc., 15:* 167-174 (1980).

Sanghvi, L.D.: Inbreeding in India. *Eugen. Quart., 13:* 291-301 (1966).

Subramanyam, K.N.: *Consanguinity and Inbreeding Effects Among Kshatriyas of Chittoor District, Andhra Pradesh.* Ph. D. Thesis, S.V. University, Tirupati (1984).

Veerraju, P.: Inbreeding in Coastal Andhra Pradesh. p. 309-348. *Proc. Int. Symp. of Hum. Genet.*, Andhra University, Waltair (1973).