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Role of Marital Migration in the Expression of Inbreeding Load in Different Castes of Andhra Pradesh

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ABSTRACT Role of maritial migration in influencing inbreeding local has been examined. A positive interaction between marital distance and inbreeding load has been observed. The Scheduled Caste groups (Madiga, Mala) with low marital migration showed low inbreeding load or absence of it, whereas the forward caste groups (Reddy, Vysya) with high marital migration exhibted high inbreeding load. This may possibly be due to the introduction of new genes from distant populations into a local population where they are maladapted.

Marital migration helps sub-divided populations exchange their gene pool thereby causing genetic convergence of these populations and maintaining heterozygosity within them. Inbreeding increases homozygosity of the genes so exchanged. Thus marital migration and inbreeding act in opposite directions one causing heterozygosity and another increasing homozygosity.

Inbreeding load, defined as reduction in average fitness of a population as a result of enhanced homozygosity of rare deleterious recessive genes under inbreeding would therefore depend on the extent and type of genes introduced into it by marital migration. If the genes so introduced are less adaptable or non-adaptable in the local environment, their homozygosity manifests as morbidity or mortality under inbreeding.

Studies carried out earlier on the relationship between marital distance and inbreeding understandably reported a negative correlation (Cavalli Sforza et al., 1966; Mortan et al., 1971; Malhotra; 1978; Ramesh, 1979) but there were no attempts to examine effect of marital migration on the inbreeding load. This study examines such an effect in caste groups living under different socio-cultural environments.

MATERIALS AND METHODS

Sample populations of Scheduled Castes (Madiga, Mala) and forward castes (Reddy and Vysya) of rural villages of Mahabubnagar District along with a sample of urban Vysya from Nagarkurnool town were chosen for the present study. In addition an urban population in which there was no inbreeding, namely, the Maheshwaris an immigrant population of Hyderabad city, also was considered for comparison. These caste groups differ in economic background, profession, food and nutritional intake (Rao and Murty, 1984). The Scheduled Castes are poor and hard working involved in agricultural labour, masonry etc., Reddis are farming community holding agricultural lands whereas Vysyas and Maheshwaris are generally well-to-do businessmen. Madiga, Mala and Reddy are non-vegetarians of varying sophistication in their food habits, but Vysya and Maheshwaris are pure vegetarians.

In the caste groups Madiga, Mala, Reddy and rural Vysya, information on reproductive patterns, marital distance (distance between birth places of spouses measured in km. as crow flies) and inbreeding was collected from families

belonging to 7 villages of Nagarkurnool Taluk of Mahabubnagar District. The families of urban Vysya belonged to Nagarkurnool town itself. The families of Maheshwaris were contacted from Hyderabad city. The number of couples who cooperated in the study and provided complete information on all aspects were 821 (Table 1).

Table 1: Percentage distribution of marital distance in different caste groups

Marital distance (km)	*Caste*				
	Madiga	*Mala*	*Reddy*	*Vysya rural*	*Vysya urban*
0 (Endogamy)	8.33	11.37	9.35	6.18	2.45
0-5	24.76	18.18	18.98	15.97	9.21
5-10	38.33	27.27	14.95	18.52	19.02
10-20	16.67	28.40	28.35	19.75	20.85
20-30	6.56	7.96	13.08	17.28	6.75
30-40	2.38	3.41	5.64	9.87	12.27
40+	2.97	3.41	9.65	12.43	29.45
Total (N)	168	88	321	81	163

Statistical Analysis

The parameters A and B of the exponential regression model of MCM namely 1-L = exp [-(A+BF)] were estimated by the weighted least squares technique of Smith (1967). The estimate 'A' indicates the amount of mortality load expected under random mating and due to non-genetic causes of mortality and 'B' indicates inbreeding load purely due to homozygosity of recessive genes. Total mortality (abortions, still births, infant mortality and adolescent mortality) is considered for the present analysis.

RESULTS

a) *Inbreeding Levels:* Scheduled Castes Madiga and Mala are characterised by high levels of inbreeding (F_A=0.025, F_X=0.028) where as Reddy and Vysya exhibit some what lower levels of inbreeding (F_A=0.014, F_X=0.010).

b) *Village Endogamy:* If both spouses belong to the same village, the distance is taken to be zero and it is defined as village endogamy. Percentages of such marriages are not differing largely; however all rural populations are showing higher endogamies (6.18% to 11.37%) in contrast to urban Vysya where it is the lowest (2.45%).

c) *Marital Distance:* The distributions of marital distance are presented in Table 1. These distributions exhibit considerable differences between the populations especially in their dispersion, skewness and kurtosis and estimates of these statistics are given in Table 2.

It may be seen that the Scheduled Castes show low mean marital distance (10.75 km, 12.95 km) compared to other castes (18.66 km-30.27 km). Variances exhibit large differences among these castes, reflecting the differential extents of migrations; Scheduled Castes show low variances (Madiga 127.53, Mala 104.96) and other castes with high variances (Reddy 345.76; Vysya rural 315.19 Vysya urban 642.38), though, all other distributions are positively skewed and leptokurtic.

When we consider the proportions of marriages beyond 30 km which is about thrice standard deviation of the marital distance in the Scheduled Castes, to know the differences in large distance migration, it is found to be very low in Scheduled Caste (only 5.35% and 6.82% in Madiga and Mala respectively), but fairly high in other well-to-do castes (Reddy 15.25%, Vysya rural 22.21%, Vysya urban 41.72%).

d) *Mortality Loads:* Caste groups with low marital migration show low or negative inbreeding load and caste groups with high marital migration exhibit high inbreeding loads. Madiga has the least mean marital distance (10.745 km) and migration beyond 30 km is only 5.35%, it exhibits a negative inbreeding load (-0.403). On the other hand Vysya, a forward caste group with the highest mean marital distance (30.269 km) and the highest migration beyond 30 km (41.72%) exhibits the highest inbreeding load (3.410).

Table 2: Inbreeding levels, statistics marital migration and mortality loads in different castes studied

S. No	Particulars	Caste				
		Madiga	*Mala*	*Reddy*	*Vysya rural*	*Vysya urban*
1.	Number of families	168	88	321	81	163
2.	Average Inbreeding coefficient	0.0247	0.276	0.0137	0.0102	0.0222
	(Standard error)	(.0029)	(.0037)	(.0017)	(.0031)	(.0027)
3.	Village endogamy (%)	8.33	11.37	9.35	6.18	2.45
4.	Mean marital distance	10.76	12.95	18.66	20.70	30.27
	(Variance)	(127.53)	(104.96)	(345.74)	(315.19)	(642.38)
5.	Skewness	6.46	2.14	6.21	1.83	0.89
6.	Deviation kurtosis	7.69	2.01	8.46	1.81	0.16
7.	Large distance migration	5.35	6.82	15.25	22.21	41.72
8.	Inbreeding load (B)	- 0.403	0.062	1.869	2.375	3.410
	(Standard error)	(.925)	.083)	(.0603)	(1.378)	(.761)
9.	Random load (A)	0.596	0.460	0.256	0.299	0.181
	(Standard error)	(.041)	(.055)	(.018)	(.035)	(.024)
10.	Total load	0.193	0.522	2.125	2.674	3.591

DISCUSSION

The essential effect of marital migration is to introduce new genes into a population and cause hetorozygosity in it, but subsequent inbreeding uncovers these hidden new genes and brings them into homozygous state thereby causing expression of the hidden (genetic) load.

In the present study the caste groups with low marital distance (the Madiga and Mala) exhibit negative or low inbreeding effect. Apparently no new genes are introduced by marital migration into these groups which may become disadvantageous under the local environment. These caste groups maintain homozygosity for original genes adapted to local environment.

In contrast the castes with larger distance marital migration (Reddy and Vysya) are exhibiting higher inbreeding loads. This may indicate that the genes introduced into them from different geographical areas are less adaptable in the local environment, and express as mortality under inbreeding.

Maheshwaris a totally outbred urban group (of the Hyderabad city) has the highest mean marital distance (501.82 $\pm$ 30.18) but inbreeding load could not be estimated as inbreeding was totally absent. However the estimate of A, the random mating load was 0.1405 $\pm$ .0114 for total mortality. For such populations we can theoretically expect a significant level of inbreeding load, if inbreeding is practised.

Another possible reason for difference in inbreeding loads is the history and level of inbreeding. The long standing and high level of inbreeding must be highly efficient in causing the homozygosity of the deleterious genes whichever are existing in the Scheduled Caste group and therefore eliminating them soon whereas the low level of inbreeding in the forward castes is not efficient enough in eliminating the new deleterious genes introduced by marital migration (Rao & Murty, 1986).

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