

# INBREEDING EFFECTS IN A COASTAL VILLAGE AND OTHER PARTS OF ANDHRA PRADESH

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*A survey was carried out among fisher-women in Pallepalam, in Nellore District of Andhra Pradesh, to determine the prevalence and pattern of consanguinity and its effects on fertility, mortality, and morbidity. Of the 106 marriages investigated, 54.72% were consanguineous with predominant proportions of first cousin (36.79%) and uncle-niece (13.21%) marriages. The average inbreeding coefficients for autosomal and sex-linked genes were found to be 0.0405 and 0.0448 respectively. The differences between consanguineous and nonconsanguineous marriages were studied with respect to fertility, mortality and morbidity.*

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## INTRODUCTION

Investigations in several countries, such as Brazil, U.S.A., Italy, France, Japan, Belgium, and Sweden, have demonstrated a significant decrease in consanguineous matings due to urbanization, breakdown of isolates, preference for small-sized families and higher socio-economic status of the population. But the situation is entirely different in India where there are a large number of endogamous castes, tribes and religious groups practising various types of mating patterns. In the populations of Southern States of India the frequencies of consanguineous matings in various subcastes are higher than in their Northern Indian counterparts. Unlike many highly inbred populations studied elsewhere in the world, in Southern India we are not dealing with either small island populations or religious isolates but with a collection of continental populations many of which are quite large.

The South Indian populations characterised by high levels of inbreeding have attracted the attention of many a human geneticist since several decades as they provide an excellent source for understanding the detrimental effects of inbreeding and also for estimating the genetic load. Several such empirical studies have shown higher rates of mortality and morbidity in offspring of consanguineous matings (e.g., Kumar et al. 1967, Murty and Jamil 1972, Papa Rao and Mukherjee 1975, Papa Rao and Rami Reddy 1977, Puri and Verma 1977, Rami Reddy and Papa Rao 1978, etc.). The present study therefore aims to evaluate consanguinity and its effects on fertility, mortality and morbidity, in a fishing community of Pallepalam, a hamlet of the Annagaripalem village situated on the shore of the Bay of Bengal in Kavali taluk of Nellore district.

## MATERIAL AND METHOD

The total population of fishermen was estimated in 440 persons, all of the same socioeconomic level. They are a Telugu-speaking people, practise the Hindu religion, and are locally known as *Pallevandlu*. None of them has received any formal education. Women assist their husbands in selling fish in the adjoining villages. With the cooperation of village leaders, we could interview all of the 106 married fisher-women and collect socioeconomic and demographic data. Information on consanguinity and on past reproductive performance including the outcome of each pregnancy was also recorded. Pedigrees were drawn to determine the type of consanguinity. Women absent at the first visit were revisited; thus, the response rate was 100%. The mean coefficients of inbreeding have been calculated for the present village (autosomal and sex-linked) according to Wright (1922). The results of the study are compared with the findings of other workers.

## RESULTS

As shown in Table 1, 54.72% of the marriages are consanguineous, mostly of the first-cousin type (36.79%), while uncle-niece marriages represent 13.21%. The mean inbreeding coefficients ( $\alpha$ ) for autosomal and sex-linked genes were found to be 0.0405 and 0.0448 respectively. Fertility, as measured by total pregnancies and livebirths, is higher in consanguineous than nonconsanguineous mothers (Table 2). The mean number of surviving offspring (net fertility) is slightly lower in consanguineous mothers than in controls, but the difference is statistically insignificant.

Prenatal mortality (abortions and stillbirths), as well as postnatal mortality are higher in consanguineous mothers than in controls. Two cases of apparent birth defects — one of cleft lip and palate and the other of webbed toes — have been observed in the male offspring of an uncle-niece marriage.

## DISCUSSION

A comparative picture of consanguinity in various fishermen populations of Andhra Pradesh is given in Table 3. Sanghvi's study (1966) on the fishermen of the entire coastal Andhra Pradesh has shown 56.82% of marriages to be consanguineous — a slightly higher proportion than the one found by us. It is interesting to note that the proportion of first cousin marriages

Table 1. *Consanguineous marriages and inbreeding coefficients ( $\alpha$ ) among the fishermen of Annagaripalem*

Type of marriage	N	%	Mean inbreeding coefficient	
			Autosomal	Sex-linked
I. Nonconsanguineous	48	45.28		
II. Consanguineous	58	54.72		
(a) Uncle-niece	14	13.21	0.0165	0.0165
(b) First cousins				
1. Matrilateral	24	22.64	0.0142	0.0283
2. Patrilateral	15	14.15	0.0008	0.0000
(c) First cousins once removed	2	1.89	0.0006	0.0000
(d) Second cousins	3	2.83	0.0004	0.0000
Total	106	100.00	0.0405	0.0448

Table 2. *Fertility, mortality and morbidity among the fishermen of Annagaripalam*

	Mean values		<i>t</i>	<i>p</i>
	Consanguineous (N = 58)	Controls (N = 48)		
<i>Fertility</i>				
1. Pregnancies	5.43 ± 0.3978	3.48 ± 0.3497	3.68	0.05
2. Liveborn children	5.05 ± 0.4017	3.43 ± 0.3494	3.04	0.05
3. Living children*	3.00 ± 0.2678	3.33 ± 0.2908	0.83	
<i>Prenatal mortality</i>				
1. Abortions	0.07 ± 0.0333	0.00 ± 0.0000	2.10	0.05
2. Stillbirths	0.12 ± 0.0423	0.00 ± 0.0000	2.84	0.05
<i>Postnatal mortality</i>				
1. Newborn to 1 year	1.16 ± 0.2166	0.52 ± 0.1102	2.78	0.05
2. 1 to 6 years	0.29 ± 0.0843	0.13 ± 0.0634	1.60	0.05
<i>Morbidity</i>				
1. Cleft lip and palate	0.03 ± 0.0342	0.00 ± 0.0000	0.88	
2. Webbed toes				

\* Total livebirths minus nonaccidental deaths prior to age 21.

Table 3. *A comparative picture of the incidence of consanguinity among the fishermen of Andhra Pradesh*

Population	Total marriages	Consanguineous marriages		Uncle-niece	First cousin		1½ cousin	2nd cousin	Mean inbreeding coefficient		Source
		N	%		Patrilateral cross-cousin	Matrilateral cross-cousin			Auto-somal	Sex-linked	
Fishermen of rural areas of Andhra Pradesh	308	175	56.82	55	5	115*			0.0470	0.0690	Sanghvi (1966)
Jalari of Vadapalem	102	48	47.06	14	8	26			0.0380	0.0540	Veerraju (1973)

\* Includes one marriage of two sisters' children.

(36.79%) is quite predominant of all consanguineous marriages. Parallel first-cousin marriages are absent unlike in Muslim and like in other Hindu populations of the country, due to the existence of exogamous lineages. The marked preference for certain types of first-cousin marriages (matrilateral) also stresses the nonrandom nature of these marriages. Reid (1973) offered reasons for the marked preference of marriages with mother's brother's daughter over the father's sister's daughter in southern India. The work of Schull and Neel (1965) in Japan has shown that most of the first-cousin marriages take place between a woman's son and her sister's or brother's daughter, the former being more common than the latter.

The latter type of consanguineous marriages is preferred in South India, while the former appears to be rather rare. Next to this comes the incidence of uncle-niece marriages (13.21%). The preference of South Indian Hindus for the matrilineal cross-cousin and uncle-niece marriages, previously reported by Sanghvi (1966), Reid (1973) and Sundar Rao (1976), holds good for our population too.

Schull and Neel (1965) found that both pregnancies and livebirths in Japan increased significantly with parental consanguinity. But the net fertility (total livebirths minus nonaccidental deaths prior to the age of 21 years) is found in equal proportions in consanguineous and nonconsanguineous parents. Similar results have been observed with respect to the pregnancies and livebirths in the population under study as well as in other Indian populations. But in Indian populations hitherto studied, as well as in the present one, the values of offspring survival (net fertility) are found in unequal proportions (Basu 1975) (lower in related than in unrelated) due to high incidence of postnatal mortality among the offspring of consanguineous parents. Prenatal and postnatal mortality rates (newborn to one year and one to six years) are higher among the offspring of consanguineous mothers in the present study as in many other Indian populations (Sundar Rao and Inbaraj 1977). Similarly, congenital malformations (externally visible at the time of birth) are also higher among the offspring of consanguineous mothers in the present study as in many other Indian populations (Chakraborty and Chakravarti 1977). The higher rate of congenital defects, as well as of prenatal (abortions and stillbirths) and postnatal mortality (newborn to one year and one to six years) among the inbred children, suggests the action of deleterious genes. The higher number of pregnancies in consanguineous mothers appears to compensate the higher loss, although greater immunological compatibility in such matings and other genetic mechanisms might be behind these observations as held by Schull and Neel (1971). It is quite pertinent to observe that the population of the present study is best suited for fertility investigations as it presents uniform social conditions and almost complete absence of family welfare methods.

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#### REFERENCES

- Basu S.K. 1975. Effect of consanguinity among North Indian Muslims. *J. Pop. Res.*, 2: 57.
- Chakraborty R., Chakravarti A. 1977. On consanguineous marriages and the genetic load. *Hum. Genet.*, 36: 47.
- Kumar S., Pai R.A., Swaminathan M.S. 1967. Consanguineous marriages and the genetic load due to lethal genes in Kerala. *Ann. Hum. Genet.*, 31: 141.
- Murty J.S., Jamil T. 1972. Inbreeding load in the newborn of Hyderabad. *Acta Genet. Med. Gemellol.* 21: 327.
- Papa Rao A., Mukherjee D.P. 1975. Consanguinity and inbreeding effects on fertility, mortality and morbidity in a small population of Tirupati. *Proc. 2nd Conf. of Ind. Soc. Hum. Genet.*
- Papa Rao A., Rami Reddy V. 1977. Consanguineous marriages and their effects on fertility offspring mortality in a rural Yadava population of south-eastern Andhra Pradesh. *Abst. 4th Annu. Conf. Indi. Soc. Hum. Genet.*, Madras, Dec. 21-24.
- Puri R.K., Verma I.C. 1977. Effects of consanguinity and inbreeding on fetal outcome in Pondicherry. Paper presented at an International Workshop on Medical Genetics held at JIPMER, Pondicherry.
- Rami Reddy V., Papa Rao A. 1978. Effects of parental consanguinity on fertility, mortality and morbi-

- dity among the Pattusalis of Tirupati, South India. *Hum. Hered.*, 28: 226-234.
- Reid R.M. 1973. Social structure and inbreeding in a South Indian caste. In N.E. Morton (Ed.): *Genetic Structure of Populations* (p. 92). Univ. of Hawaii.
- Schull W.J., Neel J.V. 1965. *The Effects of Inbreeding on Japanese Children*. New York: Harper and Row.
- Sanghvi L.D. 1966. Inbreeding in rural areas of Andhra Pradesh. *Indian J. Genet* 26A: 351.
- Schull W.J., Neel J.V. 1971. The effects of parental consanguinity and inbreeding in Hirado, Japan. (See Summary and Interpretation). *Am J. Hum. Genet.*, 24: 425.
- Sundar Rao P.S.S. 1976. The effects of inbreeding on human reproduction. Doc. Diss. Columbia University, New York.
- Sundar Rao P.S.S., Inbaraj S.G. 1977. Inbreeding effects on human reproduction in Tamil Nadu of South India. *Ann. Hum. Genet* 41: 87.
- Veerraju P. 1973. Inbreeding in Coastal Andhra Pradesh. In: *Proc. Int. Symp. of Hum. Genet.*, (p. 309). Waltair: Andhra University Press.
- Wright S. 1922. Coefficients of inbreeding and relationship. *Am. Naturalist* 56: 330.