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Genetic Load among Four Endogamous Populations of Coastal Andhra Pradesh

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ABSTRACT The present paper reports the inbreeding effects on the reproductive wastage in terms of genetic load among four endogamous populations, namely Kapu, Settibalija, Paki and Yerukala living in Coastal Andhra Pradesh. Estimates of genetic load were calculated from the data on the reproductive histories of randomly selected 400 couples belonged to above populations. The regression coefficient 'B' is positive in majority of cases and indicated a positive association between inbreeding and mortality. The genetic load is predominantly segregational in majority of cases. However, the load due to postnatal mortality among the Kapu is mutational. Relatively lower levels of coefficient 'A' revealed the changing public health status of these populations.

INTRODUCTION

The effect of inbreeding on reproductive wastage is well recognized as a principal driving force of evolution. Natural selection operates through differential mortality and fertility among human populations. The differential mortality acts on individuals prior to their reproductive age, and determines that group of individuals who survive and may potentially produce the offspring who will constitute the next generation of a population. According to Darwin, natural selection for the descent of the organisms, which refers to the evolution, operates through "survival of the fittest" referring differential mortality (prenatal and postnatal) of individuals within a species and the selection agent of differential fertility. It is probable that natural selection operating through differential mortality is less important among modern human populations where differential fertility appears to be more effective.

The concept of genetic load was first introduced by Muller (1950) as one of the approaches to explain the relationship between inbreeding and some of the presumed effects. Later, Crow (1958) defined genetic load as the relative decrease in the average fitness of a population, with respect to the fitness it would have if all individuals in the population had the genotype that has the maximum fitness. Thus genetic load is a quantity designed to measure the loss of fitness of a population resulting from selection against the deleterious homozygotes (Cavalli-Sforza and Bodmer 1971).

The present paper reports the inbreeding effects on the reproductive wastage in terms of genetic load among four endogamous populations, namely Kapu, Settibalija, Paki and Yerukala living in Coastal Andhra Pradesh. Kapu is a peasant community and predominantly depends on agriculture and other related activities. Settibalija is a toddy-drawing community and however, some of them depend on agriculture-related activities. Paki is traditionally, a scavenging community and most of them are now involved in sanitary and other labour works. Yerukula is tribe living in plain areas. They mostly depend on daily-wage labouring, in addition to traditional occupation like pig breeding, basket making, sooth saying, etc.

MATERIAL AND METHODS

Estimates of genetic load were calculated from the data on the reproductive histories of 400 couples belonged to four endogamous populations, namely, Kapu, Settibalija, Paki and Yerukula. These couples were selected randomly from rural and semi-urban areas of Narsapuram mandal of West Godavari district of Andhra Pradesh. The stillbirths and abortions were considered as prenatal loss while deaths up to 15 years of age were considered as pre-reproductive postnatal mortality. The inbreeding effects in terms of genetic load on foetal loss and pre-reproductive mortality were estimated by an exponential regression model as illustrated by Rao (1988).

$P_i = 1 - e^{-(A+B\,Fi)}$

where, P^i is the expected proportion of survivors and F_i is Wright's coefficient of inbreeding of the i^{th} subgroup based on the type of marriage. Coefficient 'A' and 'B' were obtained by iterative computational method. The B/A ratio explains the relative influence of mutational and segregation loci in maintaining genetic load. Usually the B/A ratio will be 10, if the load is predominantly mutational; and »2 if the load is predominantly segregational (Morton et al. 1956).

RESULTS AND DISCUSION

Estimates of genetic load among the four endogamous populations are shown in table 1. Two populations showed positive regression coefficients 'B' for pre-natal wastage while among Yerukula tribe, it is a negative value. It indicates that foetal loss was reduced with an increased inbreeding coefficient among the Yerukula, which is a deviant from general observation. The B/A values suggest that the pre-natal genetic load is segregational among Settibalija and Yerukula populations and is mutational among Paki caste. For pre-reproductive post-natal mortality, the relation between mortality and inbreeding was positive. The B/A values indicated that the load is predominantly segregational among all, except among Kapu caste. Among the Kapu, the genetic load is predominantly mutational. The analysis based on total mortality data revealed that the association between mortality and inbreeding is positive except among Settibalija caste. Also, according to B/A value, the load is segregational among Settibalija and Yerukula. Among other two populations, the genetic load is predominantly mutational.

Table 1: Estimates of genetic load among four endogamous populations of Coastal Andhra Pradesh

Variable and population	*Genetic load estimates*		
	A	*B*	*B/A*
Prenatal wastage			
Kapu	0.0000	0.0000	0.00
Settibalija	0.0245	0.0928	3.79
Paki	0.0192	0.3253	16.94
Yerukula	0.1633	-0.2761	-1.69
Postnatal mortality			
Kapu	0.0202	1.7439	86.33
Settibalija	0.0498	0.0580	1.16
Paki	0.9046	0.1033	0.11
Yerukula	0.6180	0.0757	0.12
Total mortality			
Kapu	0.0305	1.4325	46.97
Settibalija	0.0762	-0.0457	-0.60
Paki	0.0210	1.0823	51.54
Yerukula	0.2192	0.8257	3.77

The regression coefficient values of genetic load also determine lethal equivalents per gamete which lies between B and A+B. The lower and upper limits of lethal equivalents per gamete among present populations range between 0.04 and 1.94 and average around 0.82 and 0.91, respectively. The coefficient 'A' measures the mortality of the non-inbred fraction supposed to be an index of public health and developmental conditions of the population. The values of 'A' are highest for Yerukula, and for other populations the values are relative low and consistent with their better socio-economic condition and improved health-care facilities. The socio-economic condition of the Yerukula tribal population is very backward, and access and utilization levels of health care are also very poor.

A review of literature of studies of genetic load among Andhra populations revealed that among majority of populations the relation between mortality and inbreeding is positive (Rao and Murty 1986; Reddy 1992; Babu et al. 1994; Naidu et al. 1995). Although studies are available on effect of inbreeding, methodologically it is very difficult to explain the effect of inbreeding on mortality due to presence of several confounding factors of mortality. It is to be acknowledged that higher levels of inbreeding do not always elevate the prenatal and postnatal mortality as expected, especially among contemporary Indian populations, due to elimination of deleterious genes through prolonged cultural practice of consanguineous marriages and high levels of inbreeding over several generations (Sanghvi 1966).

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