Natural Selection Intensity in Settibalija,
A Mendelian Human Population from South India

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Abstract

The selection intensity indices were computed based on the demographic information pertaining to fertility and mortality among Settibalija, an endogamous Mendelian population of Andhra Pradesh, South India. The total fertility and mortality indices are slightly lower than other Andhra populations studied earlier. In the present caste population, the selection is manifested primarily through differential fertility rather than mortality, which is a not deviation from general trend. The results are discussed in the light of earlier studies on some caste and tribal populations inhabiting Andhra Pradesh, South India.

Key words: Natural Selection; Fertility; Mortality; Andhra Caste.

Introduction

The concept of natural selection 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.

Darwin's concept of natural selection for the descent of the organisms which refers to the evolution, by which operates "survival of the fittest" referring differential mortality of individuals within a species and include 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 the more effective agent. This transition occurred due to improved quality of life and use of modern healthcare among the present populations across the globe. However, the contribution of mortality is sizeable to the total selection among some less developed populations.

Based on this, Crow (1958) devised an index (I_t) of the opportunity for natural selection to quantify the influence of selection inherent in evolutionary process, which can be partitioned into two components. I_m – due to mortality prior to the reproductive age, and I_f – due to differences in fertility among women who have reached reproductive age. Since this index covers mortality only at the postnatal age, Johnston and Kensinger's (1971) revised the computation by considering the prenatal

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mortality too. The present paper aimed to estimate the intensity of selection in terms of Crow's as well as Johnston and Kensinger's indices among Settibalija an endogamous population living in coastal Andhra Pradesh state of South India. Settibalija is a toddy-drawing community and however, some of them depend on agriculture-related activities.

Materials and Methods

The Demographic data on the reproductive histories of 101 women of Settibalija living in rural and semi urban areas of west Godavari district of Andhra pradesh was collected and analyzed. The demographic information pertaining to fertility and mortality was obtained through personnel interview by schedule method. The collected data covers the mortality rates at both prenatal (abortions and still births) and postnatal (childhood / pre reproductive deaths) mortality. In the present study, indices of opportunity for natural selection was computed by analysis and the selection intensity indices were estimated by original formula of Crow (1958) and modified formula of Johnston and Kensinger (1971).

Results and Discussion

The details of indices of intensity of selection based on the methods of Crow as well as Johnston and Kensinger among Settibalija population are presented in Table 1. The contribution of fertility to the total index is greater than the contribution of mortality in this Settibalija caste. It depicts that the majority of populations are evolving through fertility component of selection mechanism rather than mortality. The indices of fertility (I_f/Ps) (0.0566) is higher than mortality (I_m) (0.0555) in this population.

Table 1: Indices of opportunity for Natural selection intensity among Settibalija population of South India

Selection component	Value
Crow's Index	
Mortality component (I_m)	0.0555
Fertility component (I_f)	0.3865
Total Index (I_t)	0.4634
Percentage of fertility component	92.76**%**
Johnston and Kensinger's Index	
Prenatal mortality component (I_{me})	0.0200
Postnatal mortality Component (I_{mc}/P_b)	0.0566
Fertility Component ($I_f/P_b.P_s$)	0.3735
Total index (I_t)	0.4501
Percentage of P_b/Ps	53.67%

The total index of Johnston and Kensinger (0.4501) is slightly lower than the index of Crow (0.4634), despite the addition of contribution of prenatal mortality. The fertility and mortality components of Crow's index are 0.3865 and 0.0555 respectively. As per Johnston and Kensinger's method, these values are 0.3735 and 0. 0.0566, respectively. The contribution of prenatal mortality (0.0200) is relatively low. All these indices of natural selection are slightly lower than the other neighboring caste (Babu et al., 1995) and tribal populations of Andhra Pradesh, India (Babu et al., 1997).

The averages of Andhra caste populations are lower than the present values. Cavalli-Sforza and Bodmer (1971) reported the general trend observed among tribal and agrarian societies where the mortality is higher than that of fertility. Studies among Indian Populations indicate that deaths prior to pre-reproduction age contribute more to the process of natural selection. The fluctuations of these communities may be due to varied reasons like differences in mean livebirths, which is inversely proportional to the selection intensity. But the present study shows slightly higher fertility indices (0.3735) than the mortality (0.0766), and the contribution of fertility to the total selection is higher than that of mortality. It indicates that the improved living conditions and healthcare system may be responsible for lower contribution of mortality. Rajani Kumari et al. (1985) reported that the contribution of fertility is higher than the mortality in majority of Andhra caste populations. In this population too, relatively lower mortality rates due to better healthcare, and readily available food from childhood, together with the higher proportion of fertility component lead to this trend of opportunity for natural selection.

The results are compared with studies on selection intensity indices among Andhra caste and tribal Populations (Table-2). Among the Andhra castes, the lowest and the highest values of selection Indices are recorded by Rajaka (Parvatheesam and Babu, 1997) and Mala-2 (Rao and Murthy, 1984), respectively. The indices of the present study population show medium values of that of Andhra castes. It is evident that the majority of caste populations of Andhra Pradesh (Babu et al., 1997) also recorded higher values of selection intensities. Reddy and Chopra (1990) reviewed the indices of opportunity for natural selection and reported higher averages of total as well as fertility and mortality indices for Indian population. It is also observed that the mortality and fertility components as well as total index values are higher among low socio economic Andhra tribe/castes population than developed castes. The present study population, Settibalija belongs to backward caste and lower social stratum.

In the present study, the index of mortality is 0.05, which is relatively low. The index of mortality is registered as high as 1.06 among Mala, which is considered to be at the bottom of the social hierarchy of Hindu caste system. This population rural areas and is less developed and healthcare is less accessible to these people. The component of prenatal mortality varies between 0.01 among Kolam and Pardhan (Murthy and Ramesh, 1978) to 0.18 among Koppula Velama, a backward caste (Sudhakar, 1993). The total selection index varies from 0.73 (Rajgond; Murthy and Ramesh, 1978) to 1.45 in Chenchu (Sirajuddin, 1984). It is observed that in no caste population except Mala (Rao and Murthy, 1984), recorded the total index more than one, and in Chenchu and Yerukula (both are tribal populations living in rural areas with caste population, unlike majority of tribes in India), the total selection index exceeded the value of one. Contribution of fertility to the total selection is higher than that of mortality in a majority of Andhra Populations. The present study is not deviate from the general trend observed among tribal and agrarian societies where the contribution of mortality is lower than that of fertility. (Cavalli-sforza and Bodmer, 1971). The Settibalija are inhabitants of well developed rural and semi urban area with better public health care and modern facilities, hence the mortality is playing lesser role in the manifestation of selection. However, these indices give an indication of relative opportunity for natural selection as these results are based on the data in which both genetic and non-genetic factors are involved.

Table 2: Selection intensity indices among Andhra caste and tribal populations of South India

Caste populations	I	I_f	I_m	I_{me}	Source
Settibalija	0.46	0.38	0.05	0.02	Present study
Koppula velama	0.37	0.30	0.06	0.18	Sudhakar,1993
Rajaka	0.28	0.12	0.16	0.03	Parvatheesam and Babu,1997
Chakali	0.63	0.43	0.20	0.02	Babu et al., 1995
Pattapu	0.67	0.19	0.37	0.011	Srinivasa Rao,1991
Palle	0.65	0.16	0.38	0.024	Srinivasa Rao, 1991
Jalari	0.31	0.12	0.19	-	Rajani Kumari et al., 1985
Kummari	0.95	0.63	0.32	-	Babu et al, 1995
Madiga	0.70	0.47	0.23	0.02	Babu et al, 1995
Maheswari	0.50	0.30	0.20	-	Rao and Murthy, 1984
Mala-1	0.58	0.36	0.22	0.02	Reddy and Lakshmandu, 1979
Mala-2	1.69	0.63	1.06	-	Rao and Murthy, 1984
Mangali	0.68	0.48	0.20	0.04	Babu et al 1995
Palle	0.94	0.50	0.44	-	Reddy and Chopra, 1990
Reddy-1	0.61	0.40	0.21	-	Reddy and Reddy, 1984
Reddy -2	0.43	0.26	0.17	-	Reddy and Reddy, 1984
Reddy-3	0.75	0.33	0.42	-	Rao and Murthy, 1984
Vada	0.69	0.34	0.35	-	Reddy and Chopra, 1990
Vyshya	0.70	0.28	0.42	-	Rao and Murthy, 1984
Brahmin	0.33	0.20	0.13	-	Rajani Kumari et al, 1985
Madiga-1	0.81	0.57	0.24	0.05	Reddy and Chopra, 1990
Madiga-2	0.75	0.29	0.46	0.09	Reddy and Chopra, 1990
Tribal populations					
Yerukula	1.24	1.05	0.19	0.16	Prakash et al, 2009
Manne Dora	0.82	0.35	0.41	0.06	Ramana, 1991
Kolam	0.86	0.41	0.44	0.01	Murthy and Ramesh, 1978
Pardhan	0.88	0.41	0.46	0.01	Murthy and Ramesh, 1978
RajGond	0.73	0.38	0.35	-	Murthy and Ramesh, 1978
Chenchu	1.45	0.96	0.49	-	Sirajuddin, 1984
Yerukala	0.79	0.44	0.35	-	Narahari, 1982

I, I_f and I_m are from Crow's method, and I_{me} is from Johnston and Kensinger's method.

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