

A Demographic Profile of the People of Jammu and Kashmir

4. Selection Intensity

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Population components are of considerable importance not only in understanding population structure but also in measuring evolutionary dynamics. Differential fertility and mortality - the measures of fitness; are the most fundamental events of natural selection - a major process of evolutionary change in a population. Natural selection is differential viability and/or fertility according to genetic constitution and refers to genetically determined variation in Darwinian fitness (Harrison, 1990). In other words, a population is deemed fit, if it can maintain or increase its numbers from generation to generation in a given environment and natural selection is the process through which this occurs, eventually leading towards evolutionary changes. Neel (1958) has earlier pointed out that despite global mortality reductions and diminished constraints, there is a great need for studying selective factors in advanced and primitive societies, to understand the past and future trends of human population, in the rapidly changing world.

A number of theoretical treatises (Wallace, 1871; Fisher, 1930; Wright, 1938; Coon, 1955) exist on natural selection in human populations. But, Crow (1958) has devised an index that facilitates quantitative estimation of selective pressure provided the reproductive pattern of a population is known. This index I refers to the total amount of selection and consists of two components - mortality (I_m) and fertility (I_f). That is, it measures the proportion by which fitness would increase with specific birth and death rates, if they were all selective and the heritability of fitness were complete (Crow 1972). However, in reality, the genetic component in differential fertility and mortality is relatively small, due to the interplay of a host of environmental (physical socio-economic, cultural) and behavioural factors (Crow, 1966; Cruz-Coke et al., 1966; Matsunga, 1966). Thus, I does not represent total (net) intensity, but only its upper limit (maximum) for the potential action of natural selection intensity accordingly renamed as - 'Total

index of Opportunity for Natural Selection' (Crow, 1966).

Johnston and Kensinger (1971) later modified Crow's (1958) index, by incorporating embryonic mortality. Subsequently, a substantial number of studies were undertaken. Studies in various populations of America, Europe and Africa (Spuhlar, 1963, 1971; Salzano, 1963; Neel and Salzano, 1967; Neel and Changnon, 1968; Cavalli-Sforza and Bodmer, 1971) have suggested that the tribal populations are generally characterized by rather high fertility with less individual variation and early mortality. In them, the empirical values of I are roughly <1 , with rare exceptions. But the people from advanced technological levels generally display higher values of I . The fertility component in them is at least two times the magnitude of the mortality component in contrast to the populations with simpler technologies.

Spuhlar (1962, 1976) reviewed and compared a large number of studies from all over the world and pointed out that the value of I ranged from 0.23 among Hutterites in the United States and Canada, to 3.69 among Peri in Bismarck Archipelago; and also that the mortality component was higher than the fertility component in 35 of the 57 populations studied.

In India too, several studies have attempted to measure the total potential of selection in various populations through differential fertility and mortality and study the effects of various factors including economic, socio-cultural, and physical environmental factors as, altitude etc., on the same (Basu 1967, 1972; Ghosh, 1970; Talukdar, 1971; Mukherjee, 1972; Reddy and Mukherjee, 1975; Chaudhari, 1976; Chakravarty, 1976; Barua, 1976, 1983; Murty and Ramesh, 1978; Reddy and Ladshmanudu, 1979; Gupta, 1980; Rao and Murty, 1984; Padmanabha, 1985; Basu et al, 1988; Bhasin and Kshatriya, 1990). It may be mentioned here that the index values reported by Ghosh (1970) and Basu (1972) estimated for the Kotas seem to be the highest among Indian populations studied so far (1.37 and 2.25, re-

spectively). Evidence of contribution of above mentioned factors on the selection intensity have also been reported by Sphular (1962, 1963, 1976) Cavalli-Sforza and Bodmer (1971) Tripp Reimer, (1980), Jorde and Durbize, (1986).

The description of area and people illustrates the tremendous ethnic, linguistic and cultural diversity within the Jammu and Kashmir state. Against this backdrop, it seems reasonable that differential fertility and mortality along with their ethno-cultural diversity may have significant impact on natural selection potential.

MATERIAL AND METHODS

The study sample was collected from four districts of Jammu and Kashmir state; and comprised of 209 Buddhist and Muslim mothers (78-Bodhs; 67-Baltis-18 Brokpas; 46-Arghuns) from Ladakh regions; 9 Hindu and Muslim mothers (4 Kashmiri Pandits; 5-Kashmiri Muslims) from the Kashmir region (Srinagar district); 101 Hindu and Muslim mothers (35-Dogra Brahmins; 35-Dogra Rajputs; 25-Scheduled Caste; 6-Gujjars) from the Jammu region (Jammu district); who have completed their reproductive performance. The households were selected after an extensive field visit to the various districts of the state and identifying the villages predominantly inhabited by these population groups. A nuclear family ultimately was taken as the unit of the study.

The fertility and mortality data were collected using structured schedules and through genealogies. Reproductive performance data were collected by obtaining information on the serial outcome of each frequency or pregnancy histories. The collected information was also cross-checked from elderly members of the households. For details see Bhasin and Nag (2002).

The index of total selection has been computed following Crow (1958) and Johnston and Kensinger (1971). The two indices are as follows :

$$I_1 = I_m + I_f/P_s;$$

$$\text{where } I_m = P_d/P_s; \text{ and } I_f = V_f/(\bar{x})^2$$

$$\text{(Crow, 1958)}$$

$$\text{and } I_2 = I_{me} + I_{mc}/P + I_f/I/P_b P_s$$

$$\text{Where } I_{me} = 1 - P_b/P_b, I_{mc} = P_d/P_s; I_f = V_f/(\bar{x})^2;$$

$$P_b = (1 - P_{ed}) \text{ (Johnston and Kensinger, 1971)}$$

$I_f = V_x/(\bar{x})^2$, where V_x and $\bar{x}$ are the variance of live births and average number of live births respectively; and

$$I_{me} = 1 - P_b/P_b \text{ and } I_{mc} = 1 - P_d/P_s$$

(P_b, P_s, P_d have been explained in Table).

RESULTS AND DISCUSSION

In the present paper, the indexes of total selection based on differential fertility and mortality data (Table 1) have been computed using the methodologies of Crow (1958) [Table 2] and Johnston and Kensinger (1971) [Table 3]. In the Ladakh region, the mean number of live births was found the lowest among Bodhs (4.06); while the means were observed higher and much higher among Arghuns (4.70) and Baltis (6.33), respectively. It was found the highest among Brokpas (6.78). Whereas the mean number of live births for Muslims on the whole was estimated as 5.82, which was higher than that observed for Buddhist Bodhs; the mean number of live births for the Ladakh (Pooled) group worked out to 5.16.

The proportions of survivors from birth to reproductive age were observed the highest among Bodhs (0.833) and the lowest among Baltis (0.616); while Arghuns and Brokpas registered values within this range (0.796 and 0.664, respectively). Conversely, the Baltis showed the highest proportion of pre-reproductive death (0.384) while the Bodhs recorded the lowest value (0.167). On the whole, therefore, the proportion of survivors from birth to reproductive age was observed lower, and the proportion of pre-reproductive deaths was found higher in Muslims than in Buddhist Bodhs. The proportion of survivors from birth to reproductive age was found 0.721 for the total population (Table 3). However, the proportions of embryonic (prenatal) deaths were observed not much different across the study population groups [range 0.054 (among Brokpas) to 0.113 (among Baltis)]. Hence, the proportions of survivors to birth also fluctuated within a very narrow range of 0.887 (among Baltis) to 0.946 (among Brokpas). At the aggregate level, these proportions were found 0.093 and 0.907, respectively (Table 3). It has been noticed that, the index is the highest in Baltis; while it is the lowest in Bodhs, irrespective of the methodology used. However, all the estimates (as per Crow's formulation), seem to be

Table 1: Demographic variables utilized in calculating index of total selection for population groups of Ladakh, Kashmir, Jammu regions in Jammu and Kashmir, India

Region/Population group	Number of mothers	Number of pregnancies	Number of live births	Number of live births $\bar{x}$	Variance of live births V_x
Ladakh Region					
Buddhists					
Bodhs	78	341	317	4.06	5.39
Muslims					
Baltis	67	478	424	6.33	9.74
Brokpas	18	129	122	6.78	7.71
Arghuns	46	242	216	4.70	10.04
Muslims (Pooled)	131	849	762	5.82	10.14
Ladakh (Pooled)	209	1190	1079	5.16	9.05
Kashmir Region					
Hindus					
Kashmiri Pandits	4	18	18	4.50	4.33
Muslims					
Kashmiri Muslims	5	15	15	3.00	5.00
Jammu Region					
Hindus					
Dogra Brahmins	35	196	196	5.60	6.31
Dogra Rajputs	35	177	174	4.97	5.50
Dogra Scheduled Castes	25	158	148	5.92	7.91
Dogra Hindus (Pooled)	95	531	518	5.45	6.44
Muslims					
Gujjars	6	35	34	5.67	6.27

Table 2: Selection intensities (based on live births and pre-reproductive mortalities-Crow, 1958); among population groups of Ladakh, Kashmir, Jammu regions in Jammu and Kashmir, India

Region/ Population group	Proportion of pre-reproductive deaths P_d	Proportion of survivors from birth to reproductive age P_s^a	Index of selection due to mortality I_m^a	Index of selection due to fertility I_f^a	Total index of selection ^a I_i^a	Percentage of :	
						Fertility component	Mortality component
Ladakh Region							
Buddhists							
Bodhs	0.167	0.833	0.201	0.327	0.594	66.17	33.83
Muslims							
Baltis	0.384	0.616	0.624	0.243	1.020	38.75	61.25
Brokpas	0.336	0.664	0.506	0.168	0.759	33.29	66.71
Arghuns	0.204	0.796	0.256	0.455	0.828	69.09	30.91
Muslims (Pooled)	0.326	0.675	0.483	0.300	0.927	47.93	52.07
Ladakh (Pooled)	0.279	0.721	0.387	0.340	0.858	54.90	45.19
Kashmir Region							
Hindus							
Kashmir Pandits	0.056	0.944	0.059	0.214	0.286	79.37	20.63
Muslims							
Kashmiri Muslims	0.133	0.867	0.154	0.556	0.795	80.65	19.35
Jammu Region							
Hindus							
Dogra Brahmans	0.204	0.796	0.256	0.201	0.513	49.25	49.97
Dogra Rajputs	0.069	0.931	0.074	0.223	0.313	76.33	23.67
Dogra Scheduled Castes	0.210	0.791	0.265	0.226	0.551	51.86	48.14
Dogra Hindus (Pooled)	0.160	0.840	0.191	0.217	0.449	57.49	42.51
Muslims							
Gujjars	0.147	0.853	0.173	0.195	0.401	57.03	42.97

a. $P_s = (1 - P_d)$; $I_m = (P_d/P_s)$; $I_f = [V_x/(\bar{x})^2]$; $I_i = (I_m + I_f/P_s)$

Table 3: Selection intensities (based on pregnancies and pre-reproductive mortalities including embryonic mortalities-Johnston and Kensinger, 1971) among population groups of Ladakh, Kashmir, Jammu regions in Jammu and Kashmir, India

Region/Population group	Proportion of pre-reproductive deaths P_d	Proportion of survivors from birth to reproductive age $P_a P_s$	Proportion of embryonic (prenatal) deaths P_{ed}	Proportion of survivors to birth P_b	Index of selection due to embryonic mortality I_{me}^a	Index of selection due to post-natal mortality I_{mc}^a	Index of selection due to fertility I_f^a	Total index of selection I_2	Percentage of		
									Fertility Component	Post-natal mortality component	Embryonic Mortality component
Ladakh Region (Study Area)											
Buddhists											
Bodhs	0.167	0.833	0.070	0.930	0.076	0.201	0.327	0.714	59.15	30.25	10.60
Muslims											
Baltis	0.384	0.616	0.113	0.887	0.127	0.624	0.243	1.277	34.89	55.13	9.98
Brokpas	0.336	0.664	0.054	0.946	0.057	0.506	0.168	0.860	31.06	62.26	6.68
Arghuns	0.204	0.796	0.107	0.893	0.120	0.256	0.455	1.048	61.16	27.36	11.48
Muslims (Pooled)	0.326	0.675	0.103	0.898	0.114	0.483	0.300	1.147	43.15	46.89	9.96
Ladakh (Pooled)	0.279	0.721	0.093	0.907	0.103	0.387	0.340	1.049	49.51	40.68	9.81
Kashmir Region											
Hindus											
Kashmir Pandits	0.056	0.944	0.000	1.000	0.000	0.059	0.214	0.286	79.37	20.63	0.00
Muslims											
Kashmiri Muslims	0.133	0.867	0.000	1.000	0.000	0.154	-	0.795	80.65	19.35	0.00
Jammu Region											
Hindus											
Dogra Brahmins	0.204	0.796	0.000	1.000	0.000	0.256	0.201	0.513	49.25	49.97	0.00
Dogra Rajputs	0.069	0.931	0.017	0.983	0.017	0.074	-	0.223	72.42	22.46	5.12
Dogra Scheduled Castes	0.210	0.791	0.063	0.937	0.067	0.265	0.226	0.655	46.51	43.17	10.31
Dogra Hindus (Pooled)	0.160	0.840	0.025	0.976	0.025	0.191	0.217	0.485	54.51	40.31	5.17
Muslims											
Gujjars	0.147	0.853	0.029	0.971	0.029	0.173	0.195	0.443	53.23	40.13	6.64

a. $P_s = (1 - P_d)$; $P_b = (1 - P_{ed})$; $I_{me} = (P_d/P_s)$; $I_{mc} = (P_{ed}/P_b)$; $I_f = [V_x / (x)^2]$; $I_2 = [(I_{me} + (I_{mc}/P_b) + (I_f/P_s))]$

below the average value of 1.18 reported by Sphuler for various populations (1976) [the total range being 0.23 (among Hutterites) to 3.69 (among Peri of Bismarck Archipelago)]. That is, the selection pressure may be moderate among the population groups of Ladakh. The index values are also lower than the indexes estimated for the Kotas by Ghosh (1970) and Basu (1972) [1.37 and 2.25 respectively].

Further, it has also been observed that the relative contribution of the fertility component exceeds the pre-reproductive mortality component among Bodhs and Arghuns, while the reverse is true among Baltis and Brokpas. Muslims on the whole too show higher contribution of mortality than fertility component to the total index of selection. A number of factors are contributing to the higher pre-reproductive mortality component, including socio-cultural and physical environmental factors. The Pooled Ladakh data however, have registered the opposite trend (Table 3).

Studies among Indian tribes indicate that pre-reproductive mortality contributes heavily to the process of natural selection, whereas in the population of industrially developed countries pre-reproductive mortality is extremely low (Spuhler, 1962; Cavalli-Sforza and Bodmer, 1971). According to this differentiation, Bodhs and Arghuns living in the developing and relatively backward Ladakh region, may be showing a disparate trend. Even though certain socio-economic transformation is noticed amongst them, with the ongoing changes in Ladakh as compared to Baltis and Brokpas, who are residing predominantly in the more backward Kargil district, they are not on a par with populations of developed countries. However, in India, many other populations, tribes with varying levels of development have recorded such trend, i.e. higher contribution of fertility than mortality component to the total index of selection (Ghosh, 1970; Basu, 1972; Mukherjee, 1972; Talukdar, 1971; Murthy and Ramesh, 1978; Reddy and Lakshmanudu, 1979; Bhasin and Kshatriya, 1990).

It may also be mentioned that the fertility component has also been found higher in the high altitude upper Khumbu than in the Kalimpong subgroup at low altitudes (Gupta, 1980). This is however, unlike the situation in Latin American high altitude region (Cruz-Coke et al., 1966; Garruto and Hoff, 1976).

The comparison of fertility and offspring mortality data for women who have completed

their reproductive life span across the major population groups of Jammu and Kashmir state has shown large variations. The mean numbers of live births have been found the lowest and second lowest among Kashmiri Muslims (3.00) and Bodhs (4.06), respectively. And, the highest estimate was noticed among Brokpas (6.78), followed by Baltis (6.33).

The proportions of survivors from birth to reproductive age were found the highest and the lowest among Kashmiri Pandits (0.944) and among Baltis (0.616); while others registered intermediate values within this range. Conversely, the Baltis showed the highest estimate of pre-reproductive deaths (0.384), while Kashmiri Pandits registered the lowest one (0.056).

The proportions of embryonic (prenatal) deaths to ever-married women at the end of their reproductive careers (45+ years) recorded much narrower range, and the values were found fluctuating between nil (among Kashmiri Pandits, Kashmiri Muslims, Dogra Brahmans) to 0.017 (among Dogra Rajputs) to 0.113 (among Baltis). The comparison of the total index of selection across major population groups of Jammu and Kashmir have shown that irrespective of the methodology utilized, the total index of selection is the lowest in Kashmiri Pandits, whereas it remains the highest in Baltis (Tables 2, 3). And, the relative contribution of fertility component exceeds the pre-reproductive mortality component among Kashmiri Pandits, Kashmiri Muslims, Dogra Rajputs, Gujjars, Bodhs and Arghuns, while the reverse is the case among Dogra Brahmans, Dogra Scheduled castes, Baltis and Brokpas.

These findings also seemed to agree somewhat with the earlier suggestion of greater fertility component than the mortality component with socio-cultural change and/or technological advancement and urbanization / modernization, although in case of Gujjars and Dogra Brahmans, the same did not seem to apply.

Further, the suggested pattern of the increase of the index with technological advancement of the population has neither been apparent in the present study, not in the existing Indian data. Indices of the highest order, that is, greater than 1, appeared to be restricted to tribes and small populations of India (Basu, 1967, 1972; Ghosh, 1970; Murthy and Ramesh, 1978), including the Baltis another scheduled tribe. On the other hand, certain relatively advanced population groups such as, Varendra Brahmans, Varendra Kayasthas, Jats as well as Kashmiri Pandits,

Kashmiri Muslims, Dogra Brahmans, Rajputs in the present study, registered relatively low indices (>1).

KEYWORDS Jammu and Kashmir. Fertility, Mortality. Selection Intensity.

ABSTRACT Natural selection is one of the major evolutionary factors that brings about changes in the gene frequencies in a population through the action of differential fertility and mortality. Selection potential based on the differential fertility and mortality data have been computed for the major population groups of Jammu and Kashmir, using the methodology of Crow (1958) and Johnston and Kensinger (1971). It has been observed that irrespective of methodology, the index of total selection was the highest among Baltis of Ladakh region while it was the lowest among Kashmiri Pandits of Kashmir region. The relative contribution of fertility to the index of total selection has been found exceeding that of mortality among Bodhs, Arghuns of Ladakh region; Kashmiri Pandits, Kashmiri Muslims of Kashmir Region and Dogra Rajputs and Gujjars of Jammu region. The reverse appeared true among Baltis, Brokpas of Ladakh region; and Dogra Brahmans and Dogra Scheduled Castes of Jammu region.

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