Natural Selection Intensity among four Hindu Varna populations of Lucknow Disttict, Uttar Pradesh

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ABSTRACT

The selection intensity indices were calculated based one demographic information pertaining to fertility and mortality among the four Varnas of Lucknow population. The highest value of Crow's index is observed in Kshartiya (0.494934) where as lowest in Brahmins (0.365809). Johnston and Kensinger index varies from 0.3866 among Brahmins to 0.5294 among Kshtiya. The total index of opportunity (Crow's) is in the order Brahmin > Vaishya > Shudra > Kshtirya. However the mortality component is more in Kshtirya and Vaishyas reflecting the accessibility of poor medical facilities and socio-economic condition. Another reason may be due to the delay in care seeking practices.

Key words: Natural selection intensity, Fertility, Mortality, Brahmin, Kshatriya, Vaishya, Shudra.

Introduction

Selection is one of the important evolutionary factors, which brings about a change in the gene pool of a population. This change is brought about by differential fertility and differential mortality. Differential fertility and mortality are due to difference in genetic fitness of individuals which can be determined in terms of viable offspring produced by the individual.

Crow (1958) devised the index of total selection which can be computed using the reproductive success of a population. This is a generation analog of Fisher's 'Fundamental Theorem of Natural Selection', 1930. The index assumes that the reproductive differentials are due to genotypic differences and fitness is completely heritable. In reality the effect of genetic component in differential fertility and mortality is rather small and reproductive outcome of an individual or population is the result of the interaction of a variety of socio-cultural factors (Crow, 1966).

Therefore, the index sets an upper limit for the potential action of natural selection and is renamed as opportunity for natural selection. It has two components, due to differential fertility and differential mortality (Crow, 1972). These two components determine the relative fitness of the populations. Later Johnston and Kensinger (1971) extended its scope to include prenatal mortality as the Crow's method takes into consideration only postnatal mortality.

The present paper reports the intensity of the Natural Selection in terms of Crow's as well as Johnston and Kensinger indices among the four Varnas population of Lucknow, U.P. The object of the present work is to study the extent of variation provided for the natural selection to operate through differential mortality and also to find out the factors responsible for the variation.

Materials and Methods

The sample consisted of 400 households of four Varnas population living in Lucknow U.P. The data pertaining to fertility and mortality were obtained by interviewing 554 married women (139 from Brahamin, 125 from Kshtriya, 151 from Vaishya and 139 from Shudra) by using a schedule. Out of these women, 61 Brahmin, 37 Kshatriya, 57 Vaishya and 90 Shudra women were found to have completed their reproductive life. A detailed schedule was used to collect the demographic data. The women were requested to recollect the information about abortions and still births if any because of its significance in the present work. The selection intensity indices were calculated by original formula of crow (1958) and modified formula of Johnston and Kensinger (1971).

The computed procedures are given below:-

I $=$ $I_m + I_f / P_s$ (Crow, 1958)

I_m $=$ P_d / P_s

I_f $=$ V_f / X^2

Where, I is the index of total selection intensity, I_m is the index of selection due to mortality, P_d is the proportion of deaths below 15 years of age, P_s is the proportion of children surviving from birth to reproductive age, I_f is fertility component, V_f is the variance due to fertility, and X is the mean number of live births per women who completed fertility.

$$I = I_{me} + \frac{I_{mc}}{P_b} + \frac{I_f}{P_b \times P_s}$$ (Johnston and Kensinger, 1971)

$I_{me} = P_{ed} / P_b$

$I_{mc} = P_d / P_s$

$$I_f = V_f / X^2$$

Where, I is the index of total selection intensity, I_{me} is the index of total selection due to prenatal mortality, P_{ed} is the probability to die before birth and P_b is the probability to survive till birth. I_{mc} is the index of total selection due to postnatal mortality, P_d is the proportion of deaths below 15 years of age, P_s is the proportion of children surviving from birth to reproductive age. I_f is the index of selection due to fertility component, V_f is the variance due to fertility and X is the mean number of live births per women who completed fertility. (N. Lakshmi, T. Venkateswara Rao, P. Veerraju, 2005).

Results and Discussion

The indices of intensity of selection and their components, based on the methods of Crow as well as Johnston and Kensinger are given in Table 1 and 2 respectively. Table 1 presents the mean number of live births is more in case of Kshatriya (3.5135) followed by Vaishya (3.3333), Brahmin (3.1967) and Shudras (2.8666). The proportion of prenatal deaths is highest in Kshatriya (0.0226) and least in Vaishyas (0.0105). Whereas the proportion of pre-reproductive deaths are highest in Kshatriya and least in Brahmins (Table 2).

When Crow's index is considered the index of selection intensity is found to be highest among Kshatriyas (0.4949) and lowest among Brahmins (0.3658). The contribution of fertility component is more in all the four Varna study populations and highest contribution is observed in Kshatriya (0.4260), whereas the lowest among Brahmins (0.3450), and index of mortality is also highest among Kshatriyas (0.0483), whereas lowest among Brahmins (0.0152). However, the Shudras represents second higher selection intensity (0.3966) with smaller number of children per couple (2.8666) than in the Kshatriyas with larger value of selection intensity and larger number of children per couple (3.5135). Further more

proportion of surviving children is more among Brahmins (0.9846) and Shudras (0.9844).

Table – 1: Index of Selection intensity among four Varnas of Lucknow

| Crow Index	Brahmin	Kshatriya	Vaishya	Shudra
No. of women aged 40+	61	37	57	90
Total No. of live births	195	130	190	258
No. of surviving upto 15 yrs	192	124	187	254
No. of death upto 15 yrs	3	6	3	4
Proportion of surviving (P_s)	0.9846	0.9538	0.9842	0.9844
Proportion of death(P_d)	0.0154	0.0462	0.0158	0.0156
Mean live births (X)	3.1967	3.5135	3.3333	2.8666
Variance of live births (V_f)	3.5250	5.2588	4.0408	3.0816
Index of mortality $I_m = P_d/P_s$	0.0152	0.0483	0.0159	0.0157
Index of fertility $I_f = V_f/X^2$	0.3450	0.4260	0.3636	0.3750
Index of opportunity $I = I_m + I_f/P_s$	0.365809	0.494934	0.385337	0.396655
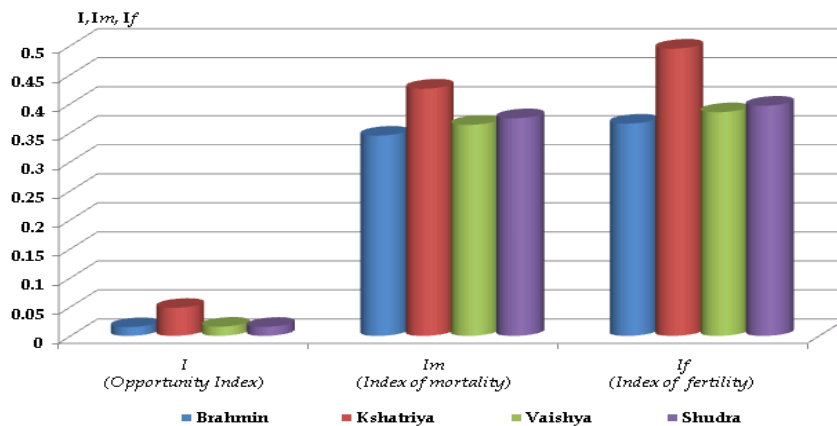
Fig. 1 : Index of Selection Intensity among four Varnas of Lucknow
(according to Crow Index)

This is so because the variance of the number of children per family grow relatively less rapidly than do the squares of the average number of children. That is why the index of total fertility is lowest among Brahmins (0.3450) and highest among Kshatriyas (0.4260). In other words, large families of the Kshatriyas (5.2588) are by no means necessary for natural selection to occur. Variation in the number of children per family are sufficient, provided of course that they are genetically conditioned.

Index of mortality is highest among Kshatriya whereas lowest among Brahmins. It is well known that better medical facilities reduce the mortality component. There is considerable improvement of medical facilities in India in the last two decades and people can also afford medical and healthcare expenditure. These factors might have led to low mortality component among these populations. The highest postnatal mortality in Kshatriya and Shudra may be due to the poor medical facilities available to them because of their low socioeconomic condition. Another reason may be the delay in care seeking. The same is observed by Bharati (1981), Kapoor and Patra (2002), and Dharanipriya et al (2003) suggesting the influence of socioeconomic conditions. Kapoor et al (2003) also found an inverse relationship between various indices (I_m, I_f and I_t) and social categories in their study of selection potential for 24 different Himalayan populations.

The effect of demographic transition on the opportunity for natural selection among the populations of industrialized nations are a marked reduction in the total index, a decline in selection due to pre-reproductive mortality, an increase in the fertility index initially, followed by a gradual decline and increase in the relative contribution of fertility component to the total selection. (N. Lakshmi, T. Venkateswara Rao, P. Veerraju, 2005).

Table – 2: Index of Selection intensity among four Varnas of Lucknow

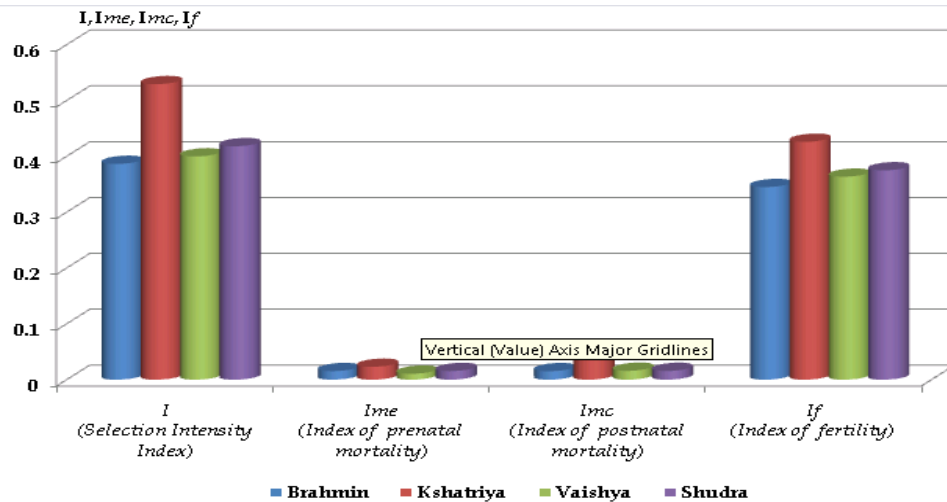| Johnston and Kensinger Index	Brahmin	Kshatriya	Vaishya	Shudra
No. of women aged 40+	61	37	57	90
Total no. of Pregnancies	198	133	192	262
No. of surviving upto birth	195	130	190	258
No. of prenatal deaths	3	3	2	4
Proportion of survivors upto birth (P_b)	0.9848	0.9774	0.9895	0.9847
Proportion of prenatal deaths (P_{ed})	0.0152	0.0226	0.0105	0.0153
$I_{me} = P_{ed} / P_b$	0.0154	0.0231	0.0106	0.0155
$I_{mc} = P_d / P_s$	0.0152	0.0483	0.0159	0.0157
Index of fertility $I_f = V_f/X^2$	0.3450	0.4260	0.3636	0.3750
$I = I_{me} + \dfrac{I_{mc}}{P_b} + \dfrac{I_f}{P_b \times P_s}$	0.3866	0.5294	0.3999	0.4182

Fig 2 : Index of Selection Intensity among four Varnas of Lucknow
(according to Johnston and Kensinger Index)

Johnston and Kensinger index is also more due to fertility than the mortality components in Kshatriya (0.4260) and also the contribution of mortality is more in Kshatriya (0.0483). As explained earlier it may be due to better medical facilities.

Although both indices of selection intensity are highest among Kshatriya and lowest among Brahmin yet the total index of Johnston and Kensinger's method is slightly higher than the index of Crow, due to additional contribution of prenatal mortality.

The total I is a measure of increase in fitness. Therefore, it is a measure of the rate of evolution of the population. It is influenced by the socioeconomic conditions which include medical facilities. Therefore, increase in medical facilities leads to survival of individuals suffering from genetic diseases for example invention and availability of insulin has greatly increased the survival of diabetes. This will lead to increase of genetic load in the populations. At the same time the diseased persons survive, marry and reproduce. Thus, their fitness-measured through fertility performance – increases (N. Lakshmi, et al, 2005).

However, it is important to mention that strict interpretation of these indices is difficult as the natural selection is effective only to the extent that these vital events are genetically determined. There are empirical evidences to the change of selection opportunities with changing environment over a period and to demonstrate the relevance of socio-economic change to the evolution of selective patterns (Ch. Nooka Raju, et al, 2009).

SEE TABLE OF ANALYSIS SECTION

When the present four Varna population is compared with the other populations of India reported by Rajani Kumari et al,Sita Lakshmi, Sri Krishna, Dharani Priya et al, Agnihotri Vibha respectively indicate the more or less same trend in the total index of selection intensity (I), with a decline in mortality and fertility indices respectively. There is a increase in total selection intensity among Kanyakubja Brahmins of Uttar Pradesh studied by Agnihotri Vibha than the four Varnas of the present study.

Conclusion

Index of opportunities based on the fertility and mortality performance of the four Varna population reports the highest value in Kshtiryas whereas lowest value in Brahmins. It could be noted the total number of live births is highest in Shudras and comparatively prenatal and postnatal deaths are less than Brahmin, Kshatriya and Vaishyas populations indicates the genetic fitness of the Shudra Varna population. Here it can be said that availability of batter medical facilities is not a constrain in the Lucknow district, therefore the reason of high mortality in Kshatriyas may be socio-economic for accessibility and affordability of medical facilities. Another reason of high mortality rate may be due to the long gap between the recognition of problem to care seeking of medical facility and it can be prove by case studies.

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TABLE ANALYSIS SECTION

Comparision of Crow Indices among the different populations of India

population	No. of women	I_m	I_F	I	SOURCE
BRAHMINS	61	0.152	0.3450	0.3658	PRESENT STUDY
KSHATRIYA	37	0.0483	0.4260	0.4949	PRESENT STUDY
VAISHYA	57	0.0159	0.3636	0.3853	PRESENT STUDY
SHUDRA	90	0.0157	0.3750	0.3866	PRESENT STUDY
BRAHMIN I	450	0.1270	0.1800	0.3300	RAJNI KUMARI et al.
BRAHMIN II	196	0.0396	0.3484	0.3879	SITA LAKSHMI
BRAHMIN III	212	0.1823	0.2247	0.4384	SRI KRISHNA
KHSHATRIYA	355	0.0987	0.2982	0.4263	DHARANI PRIYA et al.
KANYAKUBJA BRAHMIN	73	0.078	0.2706	0.8666	AGNIHOTRI Vibha

SARYUPARIN BRAHMIN	73	0.0795	0.2610	0.2640	AGNIHOTRI Vibha
SARASWAT BRAHMIN	75	0.058	0.4050	0.4897	AGNIHOTRI Vibha
GAUR BRAHMINS	70	0.118	0.3116	0.4721	AGNIHOTRI Vibha
SANADHAYA BRAHMIN	59	0.062	0.2665	0.3224	AGNIHOTRI Vibha