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International Research Journal of Science and Technology
Published on 15th January 2019

Measuring Selection Intensities among Kolam Population: Manifested through Differential Fertility and Differential Mortality

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Paper Info

Paper Status
Received: 28th Oct. 2018
Revised : 20nd Nov. 2018
Accepted: 28th Dec. 2018
Published: 15th Jan. 2019

Key Words

Natural Selection
Crow's Index
Johnston & Kensinger's Index
Fertility
Mortality
Prenatal
Postnatal

Abstract

The objective of the study is to understand the selection intensities among Kolam, a particularly vulnerable tribal group (PVTG) of Adilabad district of Telangana State, India. Two prominent methods were employed to understand the intensities by using Crow's index and modified formula as given by Johnston and Kensinger's method. The intensities are computed on the basis of the reproductive history of mother with completed fertility and the results were compared with the available works on populations belonging to Andhra Pradesh, Telangana and India. The Crow's total index (I_I) value was found to be 0.3863. The mortality (I_m) component was found to be 0.2151 while fertility (I_f) component was found to be 0.1712. The contribution of mortality component is greater than that of fertility component among the present studied population using Crow's index. According to Johnston and Kensinger, the total index (I_I) was found to be 0.6017. Fertility component was found to be 0.2368, prenatal mortality component (I_{me}) and postnatal mortality component (I_{me}/P_b) where observed to be 0.0675 and 0.0933 respectively. Therefore, it is clear from the results that postnatal mortality contributes more than prenatal mortality for selection, i.e., Johnston and Kensinger's Index (0.6017) contributes more towards selection intensity than Crow's index (0.3863). Natural selection takes place when there is variability of fitness observed through the differences in fertility and mortality in any population.

Citation: Dr.Bharathi K "Measuring Selection Intensities among Kolam Population: Manifested through Differential Fertility and Differential Mortality ", International Research Journal of Science and Technology, 1 (1) 35-48, 2019.

1. Introduction

The concept of 'Natural Selection' was developed and explained by Charles Robert Darwin in his epoch making master piece, '*The Origin of Species*' in 1859 [1]. The essential barrier to selection can be traced from reproductive isolation which hinders to speciation [1,2,3].

Thus natural selection refers to difference in survival or fertility among different individuals with different genotypes and it is because of selection that populations become progressively more adapted to their environment.

The ability of a genotype to survive and reproduce is reflected in the average number of offspring born to individuals with that genotype and this number is called the genotype's fitness or Darwinian fitness. However, random drift overcomes selection onto new fitness [3,4] by shifting balance[5]. Natural Selection is responsible for the stability of the genetic composition of a population [6].

Selection intensity is a measure of the fitness of a population as expressed by the ongoing patterns of

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differential fertility and mortality, assuming that the heritability of fitness is complete [7]. It was 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 populations [8]. A number of works [9,10,11] exist on natural selection in human populations. Index was devised in such a way that facilitates quantitative estimation of selective pressure provided the reproductive pattern of a population is known [12].

This index '*I*' refers to the total amount of selection and consists of two components – mortality (I_m) and fertility (I_f). It measures the proportion by which fitness would increase with birth and death rates, if they were all selective and the heritability of fitness were complete [13]. Further, it was suggested that index of total selection (*I*) might be considered as an index of '*opportunity for selection*' [14].

The index of opportunity for selection measures the maximum potential rate of change by selection where 'zero' indicates no change [15]. An indirect method based on the maximum amount of differential fertility and mortality in a population was formulated by Crow [12] and modified to measure the maximum potential rate for prenatal life [16]. However, in reality, the genetic component in differential fertility and mortality is relatively small, due to the interplay of a host of environmental and behavioural factors [17, 18,19].

In populations of America, Europe and Africa it was recommended that most of the ethnic groups are characterized by high fertility with less individual and early mortality [14, 20, 21, 22]. However, factors like social, cultural, religious, ethnic, biogenetics also responsible for differential fertility and mortality among the populations [23]. Many studies were conducted by different scholars [18,24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38] on selection intensities; inter and intra religious variations of the index and its components were observed among different populations of Meghalaya [39]; between rural and urban populations [40, 41, 42, 43], socio-economically backward and advanced groups [44]; economic condition [45,46,47); education and social status [48, 49]; due to genetics and evolutionary implications [50] while [51] attributed that relatively improved health care facilities, nutrition, socio-economic conditions and biogenetic factors are responsible for differential fertility (I_f) and differential mortality (I_m) among Khond tribal population belonging to Eastern Ghats of Visakhapatnam district to understand the population fitness.

Accordingly it was reported that Pardhans showed greatest selection intensity of (1.1811) followed by the Kolams (0.8564) and Raj Gonds (0.7240) who are habiting in same environmental conditions and attributed that the selection intensity is operating through pre-reproductive mortality and infertility [52]. However, RajGond and Pradhans are considered as scheduled tribe while Kolam is identified as particularly vulnerable tribal group (PVTG) whose selection intensity differs due to the contributions made by differential fertility and differential mortality based on varying demographic, socio-cultural factors.

The aim of the study is to explore the selection intensities of women contributing to fertility and their proportions of survivors to birth, effective population size and variation in reproductive success among Kolam group.

2. Material and Methods

The data for the present research was collected from 168 households selected from the interior forests and hilly tracts villages of Utnoor, Narnoor, and Jainoor mandals of Adilabad district. Adilabad is 318 kms. from Hyderabad, a major town in Telangana State. Out of the total scheduled tribe population of Adilabad, 0.90% accounts to Kolam tribe [53]. As per Reorganization Act, 2014[i], stated that the Kolam population accounts to 0.004% when compared with the total scheduled tribe population [54]. Their spatial distribution is characterized by a tendency of clustering and concentration in pockets which have suffered from isolation. Kolam is identified as a particularly vulnerable tribal group (PVTG) who call themselves as "*Mannervarlu*". They possess own dialect "*Kolami*". The word "*Kola*" means stick or bamboo in their dialect and as such call themselves as '*Kolavar*'. Bamboo occupies an important place in cultural and religious lives of the people. They trace their descent to *Bheema* and *Hidimbi*, the well-known characters of the epic Mahabharata.

Kolam maintains symbiotic relationship and have identical clan systems and associated cultural practices with Gond, Pardhan and Thoti tribes. Kolam people practice agriculture as primary occupation and collect minor forest produce from the forest. Kolam living along ethno-cultural diversity may have significant influence on natural selection potential.

The total Kolam population in Adilabad district is 45,437 during 2010-2011 [55]. The mandals selected

for the study are covered under ITDA (Integrated Tribal Development Area) of Utnoor, Jainoor and Narnoor mandals. About 25% of the mandals in the scheduled area have been selected randomly taking into consideration the numerical predominance of the tribal population under study in the tribal sub-plan area. The households were selected after an extensive field visit to the villages. To achieve this goal, quantitative research design was used to ease interaction with the people directly about their culture and the practices followed from birth to death.

However, the researcher in order to increase the reliability has conducted informal observations and participated in different cultural events, like birth ceremony, women visiting the hill, women observing distant pollution, and child birth. These events during field work gave a chance to understand the cultural and social meanings attributed by the people.

Demographic data have been collected from 55 ever married women aged 40 and above on fertility and mortality. Informed consent was obtained from ITDA office, Utnoor; village head and women while collecting the data. The data includes age, sex, socio-cultural characteristics, fertility and mortality at prenatal and postnatal stages by using a pretested schedule and by following interview technique.

Reproductive performance of women was collected based on the pregnancies which were cross-checked from elderly members of the household. Assuming that some phenotypic variation in reproduction has a genetic basis and fitness is heritable; an index was proposed [7]. This index of opportunity for selection was computed using internationally accepted indirect method of postnatal mortality and modified formula [16].

Crow's Index (1958)

$I=I_m+ I_f/ P_s$

$I_m=P_d/ P_s$

$P_s=1-P_d$

$I_f=V_f/ X^2$

Where, I = Index of total selection intensity
I_m= Index of selection due to mortality
P_d= Probability ofdeaths up to Pre-reproductive age
P_s = Probability of survival up to reproductive age
I_f = Index of selection due to fertility
V = Variance due to fertility
X = Mean number of live births

Johnston and Kensinger's Index (1971)

$I = I_{me}+ I_{mc}/ P_b + I_f/P_bX P_s$

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

$P_b= 1 P_{ed}$

$I_{mc}= P_d/ P_s$

$P_s=1 P_d$

$I_f = V/ X^2$

Where; I = index of total selection intensity
I_{me}= index of total selection due to prenatal mortality
P_{ed}= probability to die before birth
P_b= probability to survive till birth
I_{mc}= index of total selection due to postnatal mortality
P_d= probability to die before reaching reproductive age
P_s = probability to survive till reproductive age
I_f = index of total selection due to fertility
V = Variance due to fertility
X^2 = mean number of children per woman

3. Results and Discussion

The parameters used in calculating the total selection intensity in the study tribal population are presented in Table 1&2. From Table 1, it is found that the socio-cultural factors that influence fertility and mortality among Kolam. The mean age at menarche was found to be 12.56 ± 0.77 and mean age at marriage as 16.52 ± 1.85 leading to early conceptions among women. The mean educational attainment of women is found to be 1.25 ± 0.74 which is extremely low. The data pertaining to differential fertility and mortality has been analyzed by using the methodologies of [7, 16]. It is clear from the table 2, that out of 307 pregnancies among Kolam, the average live births per mother (X) of 40 years and above is 4.04 whereas the frequency of premature death (P_d) is 0.1531. The proportion of surviving children up to reproductive age is 0.7231 and that of embryonic deaths is 0.048.

Table 3 shows the values of the selection intensity indices. The Crow's total value of the Kolam tribe of Narnoor, Utnoor, and Jainoor mandals of Adilabad district was found to be 0.3863. The mortality component was 0.2151 while the fertility component was found to be 0.1712. The percentage of the fertility component is observed to be 44.4 percent while the percentage of mortality component is 55.6 percent. The contribution of mortality in total index is greater than fertility among Kolam people.

According to Johnston and Kensinger's modified formula, the total index (I_t) was found to be 0.6017. Fertility component was found to be 0.2368; prenatal mortality component (I_{me}) and postnatal mortality component (I_{me}/ P_b) were observed to be 0.0675 and 0.0933 respectively. The percentage of fertility component (73.3%) exceeds the percentage of prenatal

mortality component (11.2%). Further the percentage of postnatal mortality (15.5%) is slightly more than prenatal mortality. Therefore, it is clear from the results that prenatal and postnatal mortality together contributes for Johnston and Kensinger's Index.

However, the findings of the present study, according to Crow's Index shows that the total index (I_t) the contribution of mortality component is more in selection process (55.6%) than that of fertility component (44.4%). According to Johnston & Kensinger's Index, the contribution of fertility component is more in selection process (73.3%) than that of the mortality component (26.7% of prenatal and postnatal mortality together). Further, the postnatal mortality component (0.0933) is more when compared with prenatal mortality component (0.0675). The total index for the opportunity of natural selection according to Crow's Index (0.3863) is less than Johnston & Kensinger's Index (0.6017).

Further, the results were compared with other population groups using Crow's index. The values obtained from differential fertility and mortality during their reproductive age shows disparity with respect to their reproductive success for natural selection. Table 4 shows the state wise comparison of mean live birth, fertility component (I_f), mortality component (I_m) and total index (I_t) of the present population with other ethnic groups of India. From the table, it is evident that the highest number of live births per mother of 40 years and above is observed among the Jaintias of Assam (8.10) followed by Toto of West Bengal (7.63) and lowest among the SankarKoch of Meghalaya (2.25). Highest mortality component (I_m) was found among Mannedora of Andhra Pradesh (0.82) followed by Pahira (North) (0.81) of West Bengal and lowest among Yanadi, Plains I (0.05) of Andhra Pradesh. The fertility component (I_f) was observed to be highest among Yerukula II (1.05) of Andhra Pradesh and lowest among Bhoska (0.058) of Uttar Pradesh. It is also clear that the total index was highest among Kota I of Tamilnadu (2.250) followed by Chenchu II (1.45) of Andhra Pradesh and lowest among Chakesang (0.23) of Nagaland. There is substantial variation in fertility as well in mortality when compared with Hill Kolam (0.284 & 0.346) and Manne Kolam (0.306 & 0.540). The index of selection among Kolam is found to be 0.870 [52] which is high when compared with the present study (0.386). This marked variation in the present study indicates that the contribution of fertility and mortality decreased in the process of selection. The results of the Kolam sample corroborate with the results of Manzaimali [50,56]; and Mala I [28]. The index of selection manifested through fertility (I_f) among Kolam shows 0.1219 which is found to be almost similar with the listed ethnic groups, Jiantias of Assam and Rajaka of Andhra Pradesh; with Ezava of Kerala, Kaibarta and Dibongiya Deori of Assam. The total index (I_t) shown by Kolam is 0.386 which substantiate with the results exhibited by the ethnic groups, Bhil [57] of Rajasthan; Bodh [48] of Jammu & Kashmir; Kinnaura [58]of Himachal Pradesh. The total index (I_t) is almost similar with the other groups, KoppalaVelama [59] of Andhra Pradesh, slightly similar with Sonowal II [60] of Assam.

The intensities among the caste groups of India shows (Table 5), the total selection index (I_t) were highest among Mala II (1.687) followed by Madiga I (1.545) of Andhra Pradesh and among scheduled caste (1.344) of Kerala. The total selection index (I_t) is found to be least among Oraon (0.094) followed by Dibongiya Deori (0.174) and Manipuri Meities (0.207) of Assam. The range of index of fertility (I_f) among caste populations is 0.10 among Manipuri Meities that predominantly settled in the central valley of Manipur [49] to 1.20 among Christians of Kerala [61]. However, among ethnic groups, it ranged from 0.05 among Bhoska of Uttar Pradesh [62] to 1.05 among Yerukula II of Andhra Pradesh [38]. Similarly, the index of mortality (I_m) among caste populations ranged from 0.012 among Christians of Kerala [61] to 1.062 among Mala II, a scheduled caste living in rural areas [63]. The mortality index ranged from 0.048 among Gangte (Town) [64] to 0.82 among Manne Dora of Andhra Pradesh [65]. Comparatively, the range of index of fertility as well as mortality is more among caste groups than ethnic groups. From the Table 3 and Fig.1 & 2[ii], different ethnic groups listed belong to South India, North India, North-Eastern region, Eastern and Western parts of India and to the Central region. The selection is manifested through fertility among the tribes belonging to northern, western and central parts of India and through mortality among the tribal groups belonging to south, north-east and eastern parts. It is noted that index of selection manifested through fertility is due to the demographic transition among the stated population(s).

Similarly from the Table 4 and Fig. 3 & 4[iii], various caste groups belong to South India, North India, North-East India, western and eastern parts of India. The selection is manifested through fertility among north and south Indian caste groups and through mortality for the caste groups belonging to north-eastern region, central and eastern parts of India. Index of fertility among majority of the caste groups can be attributed to better economic conditions and awareness towards the availability of modern medical care.

Table 1: Socio-Cultural factors influencing Fertility and Mortality among Kolam group

Socio-Cultural Factors	Mean (n=168)	Standard Deviation
Age at Menarche	12.56	0.77
Age at Marriage	16.52	1.85
Age at First Conception	18.89	2.25
Age at Menopause	44.44	4.94
Ever pregnant	1.98	0.15
Educational status among women	1.25	0.74

Table 2: Parameters used for calculating the Total Selection Intensity among Kolams of Adilabad district

Parameter(s)	Kolam
Number of women aged 40 years and above	55
Number of reported pregnancies	307
Mean conceptions	5.58
Number of live births	222
Mean live births	4.04
Variance of live births	1.99
Number of surviving children	158
Number of survivors to birth	213
Proportion of survivors to births (P_b)	0.7231
Number of embryonic deaths	15
Number of premature deaths (< 14 years)	34
Proportion of child deaths (before 14 years of age (P_d)	0.1531
Proportion of embryonic deaths (P_{ed})	0.048
Total breeding population size (N)	164
Effective population size (Ne)	331.95
Number of males aged between 15-59 years	241
Number of females aged between 15-44 years	234

Table 3: Values of Selection Intensity Indices among Kolam (According to Crow's Index (1935) and Johnston and Kensinger (1971))

Indices	Value of Indices for Kolam
According to Crow's Index (1958)	
Mortality Component (I_m)	0.2151
Fertility Component (I_f / P_s)	0.1712
Total Index (I)	0.3863
% of fertility component	44.4
% of mortality component	55.6
According to Johnston and Kensinger's Index (1971)	
Prenatal mortality component (I_{me})	0.0675
Postnatal mortality component (I_{me}/P_b)	0.0933
Fertility Component (I_f/ P_b.P_s)	0.2368
Total Index (I)	0.6017
% of Fertility component	73.3
% Prenatal mortality component	11.2
% Postnatal mortality component	15.5

Table 4: Cross-comparison of Selection Indices prevalent among different ethnic groups of India

Population groups/ Tribes	No. of Mothers	Mean live births	Selection Indices (According to Crow, 1958)			References
			I_m	I_f	I	
In South IndiaAndhra Pradesh&Telangana						
Kolam	55	4.04	0.215	0.121	0.386	Present Study
Khond	41	3.68	0.324	0.372	0.613	Rao*et al.*, 2006
Gadaba	269	3.39	0.160	0.147	0.331	Bharathi, 2015
Savara	167	3.48	0.194	0.154	0.378	
Chenchu I	146	5.70	0.500	0.200	0.810	Sirajuddin and Basu, 1984
Chenchu II			0.49	0.96	1.45	
Kolam	229	5.65	0.443	0.295	0.870	Murthy and Ramesh, 1978
Hill Kolam	104	5.81	0.348	0.284	0.728	
ManneKolam	125	5.51	0.540	0.306	1.012	
Pardhans	28	6.18	0.802	0.222	1.186	
Raj Gonds	52	4.52	0.346	0.287	0.724	
Sugalis	73	6.08	0.375	0.162	0.606	Reddy and Reddy, 1984
Yanadi, Plains I	-	-	0.053	0.194	0.258	Vasulu, 1978
Yanadi, Plains II	-	-	0.109	0.301	0.443	
Yanadi, Hills	-	-	0.110		0.570	
Yerukula I	-	-	0.444	0.35	0.79	Narahari, 1982
Yerukula II	-	-	0.19	1.05	1.24	Prakash and Narayanan, 2009
Manne Dora	-	-	0.82	0.35	0.82	Ramana, 1991
Bod Mali	-	-	0.20	0.45	0.65	Babu and Kusuma, 2002
Manzai Mali	-	-	0.21	0.50	0.71	
Karnataka						
Koraga	-	3.97	0.075	-	0.336	Sekar *et al*.,1998
Tamilnadu						
Irula	279	5.03	0.327	0.370	0.818	Reddy, 1985
Kota I	120	4.10	0.790	0.815	2.250	Basu, 1972
Kota II	328	3.73	0.445	0.638	1.367	Ghosh, 1970
In North India						
Himachal Pradesh						
Bodh	61		0.105	0.143	0.263	Chaudhury, 1982
Shipi	**79**		0.227	0.207	0.482	
Swangla	**63**		0.157	0.157	0.339	
Kinnuara	160	4.89	0.194	0.159	0.384	Gautam *et al*, 2009
Jammu & Kashmir						
Tibetan	92	4.2	0.142	0.324	0.512	Kapoor*et al*., 2003
Bodh	122	4.58	0.114	0.244	0.386	
Bodhs			0.201	0.327	0.594	Bhasin and Nag, 2002
Baltis			0.624	0.243	1.020	
Brokpas			0.506	0.168	0.759	
Arghuns			0.265	0.455	0.828	
Uttar Pradesh						
Bhoska	30	6.45	0.282	0.058	0.356	Garg*et. al.* 1980
Uttaranchal						
Barbatiya	54	3.89	0.243	0.443	0.794	Kapoor *et al*., 2003
Buthalia Bora	118	4.79	0.148	0.226	0.407	
Harkotiya	113	4.58	0.223	0.330	0.627	
Rajput	62	5.26	0.148	0.263	0.450	
Central India						
Madhya Pradesh						
Kol			0.504	0.122	0.688	Gharami *et al*., 2003
Baiga	111	5.16	0.077	0.249	0.345	Gautam *et al*.2007
Gond	59	4.42	0.125	0.253	0.409	

Eastern India						
West Bengal						
Pahira (North)	39	4.97	0.815	0.175	1.133	Basu, 1967
Pahira (Southern I)	50	5.44	0.529	0.137	0.738	
Pahira(Southern II)	50	5.70	0.484	0.137	0.687	
Sherpa		7.44	0.206	0.173	0.415	Gupta, 1980
Lepcha		5.83	0.111	0.294	0.438	Mukhopadhyay, 1982
Toto	40	7.63	0.320	0.100	0.550	Debnath and Sen, 1983
Munda	31	5.23	0.132	0.166	0.353	Kapoor and Kshatriya, 2000
Santhal	64	3.97	0.081	0.302	0.462	
Lodha	74	4.19	0.157	0.292	0.668	
Odisha						
Bhuiyan	71	2.69	0.587	0.190	0.7804	Kuiti and Bose, 2014
Santhal I	15	4.73	0.7167	0.3299	1.2046	Sahoo *et al*. 2013
Santhal II	90	2.87	0.539	0.185	0.725	Binoy *et al*., 2015
Western India						
Gujarat						
Naika	49	5.71	0.305	0.135	0.481	Padmanabham, 1985
Rajasthan						
Sahariya	72	4.28	0.145	0.212	0.524	Kapoor and Kshatriya, 2000
Mina	80	5.21	0.104	0.146	0.334	
Bhil	88	5.27	0.105	0.203	0.386	
Kathodi	62	4.06	0.245	0.250	0.557	Bhasin and Nag, 2007
Damor	47	4.47	0.167	0.265	0.477	
Garasia	27	5.37	0.160	0.358	0.575	
In North-Eastern India						
Assam						
Jaintias	39	8.10	0.456	0.125	0.638	Deka, 1978
SonowaiKachari	200	7.04	0.192	0.141	0.360	
Deori	-	4.38	0.226	0.179	0.445	Das and Sikdar, 2010
Garo	-	5.21	0.116	0.114	0.244	
Oraon	-	7.58	0.083	0.087	0.094	
Meghalaya						
Hajongs	51	6.80	0.443	0.131	0.631	Barua, 1983
Jiantias			0.456	0.125	0.638	Deka, 1989
Phar			0.236	0.134	0.401	Khongsdier, 1990
SankarKoch	23	2.25	0.262	0.070	0.531	Kotal and Sengupta, 2003
Garo		5.21	0.116	0.114	0.244	Das and Sikdar, 2010
Mizoram						
Hmar	132	7.48	0.085	0.250	0.357	Varte and Varte, 2006
Manipur						
Hmar			0.072	0.250	0.340	Varte, 1998
Nagaland						
Chakesang	74	7.16	0.076	0.143	0.233	Chanu and Varte, 2009
North-Easternpart						
Gangte (Pooled)	444	6.45	0.060	0.145	0.213	Hemam and Reddy, 1999
Gangte(Town)	227	6.15	0.048	0.156	0.211	
Gangte (Settled)	77	7.11	0.052	0.104	0.161	
Gangte (Shifting)	140	6.45	0.080	0.162	0.0256	

Table 5: Cross-comparison of Selection Indices prevalent among different caste groups in India

Caste group	X	Crow (1958)				Reference (s)
		V_f	I_m	I_f	I_t	
In South India						
Andhra Pradesh&Telangana						
Brahmans	3.7	2.4	0.127	0.180	0.330	RajaniKumari *et al*, 1985
Jalari	4.3	1.9	0.188	0.103	0.310	
Madiga I	6.3	9.5	1.059	0.236	1.545	Rao and Murthy, 1984
Madiga II	4.8	9.8	0.239	0.429	0.770	Reddy and Lakshmanudu, 1979
Madiga (Gampa)	5.7	7.1	0.451	0.217	0.766	Reddy, 1984
Madiga III			0.23	0.47	0.70	Babu *et al*., 1995
Maheswari	5.3	7.9	0.204	0.282	0.543	Rao and Murthy, 1984
Mala I	4.5	6.0	0.217	0.294	0.575	Reddy and Lakshmanudu, 1979
Mala II	4.9	7.4	1.062	0.303	1.687	Rao and Murthy, 1984
Mala (Rampala)			0.336	0.700	0.936	Ramesh Babu, 2003
Palle I	5.3	9.9	0.441	0.347	0.941	Reddy and Chopra, 1990
Palle II			0.38	0.16	0.65	SrinivasaRao, 1991
Reddy I	6.2	8.8	0.424	0.227	0.747	Rao and Murthy, 1984
Reddy II			0.17	0.26	0.43	Reddy and Reddy, 1984
Reddy, Pedakanti	4.4	6.3	0.211	0.326	0.606	Reddy and Reddy, 1984
Vadde	5.9	8.7	0.346	0.253	0.687	Reddy and Chopra, 1990
Vyshya	5.6	6.1	0.422	0.194	0.698	Rao and Murthy, 1984
Chakali	-	-	0.13	0.20	0.63	Babu *et al*, 1995
Kshatriya	-	-	0.10	0.33	0.43	DharaniPriya *et al*. 2003
KoppalaVelama	-	-	0.06	0.30	0.37	Sudhakar *et al.* 1998
Kummari	-	-	0.32	0.63	0.95	Babu *et al.* 1995
Mangali	-	-	0.20	0.48	0.68	
Pattapu	-	-	0.37	0.19	0.67	Rao, 1991
Rajaka	-	-	0.16	0.12	0.28	Parvatheesam and Babu, 1998/7
Settibalija	-	-	0.05	0.38	0.46	Prakash and Sudhakar, 2011
AryaVysya	183	3.46	0.1064	0.3385	0.4809	Lakshmi *et al*., 2005
KalingaVysya	192	4.01	0.1493	0.2215	0.4039	
Thrivarnika	165	2.96	0.1346	0.2607	0.4304	
Pattusali	90	6.29	0.2263	-	0.5625	Rao *et al*., 2015
Padmasali	116	5.56	0.1168	-	0.3629	
Kerala						
Ezava	3.4	1.4	0.082	0.123	0.216	Kapoor *et al*., 2001
Christians	3.2	12.9	0.012	1.20	1.22	
Scheduled Castes	3.1	9.1	0.204	0.946	1.344	
Maharashtra						
Sindhi			0.130	0.284	0.452	Das *et al*., 2006
In North India						
Jammu and Kashmir						Bhasin and Nag, 2002
Dogra Brahmins	5.60	6.31	0.256	0.201	0.513	
DograRajputs	4.97	5.50	0.074	0.223	0.313	
Dogra Scheduled Castes	5.92	7.91	0.265	0.226	0.551	
Kashmiri Pandits	4.50	4.33	0.059	0.214	0.286	
Bodhs	4.06	5.39	0.201	0.327	0.594	
Baltis	6.33	9.74	0.624	0.243	1.020	
Brokpas	6.78	7.71	0.506	0.168	0.759	
Arghuns	4.70	10.04	0.256	0.455	0.828	
Kashmiri Muslims	3.00	5.00	0.154	0.556	0.795	
Gujjars	5.61	6.27	0.173	0.195	0.401	

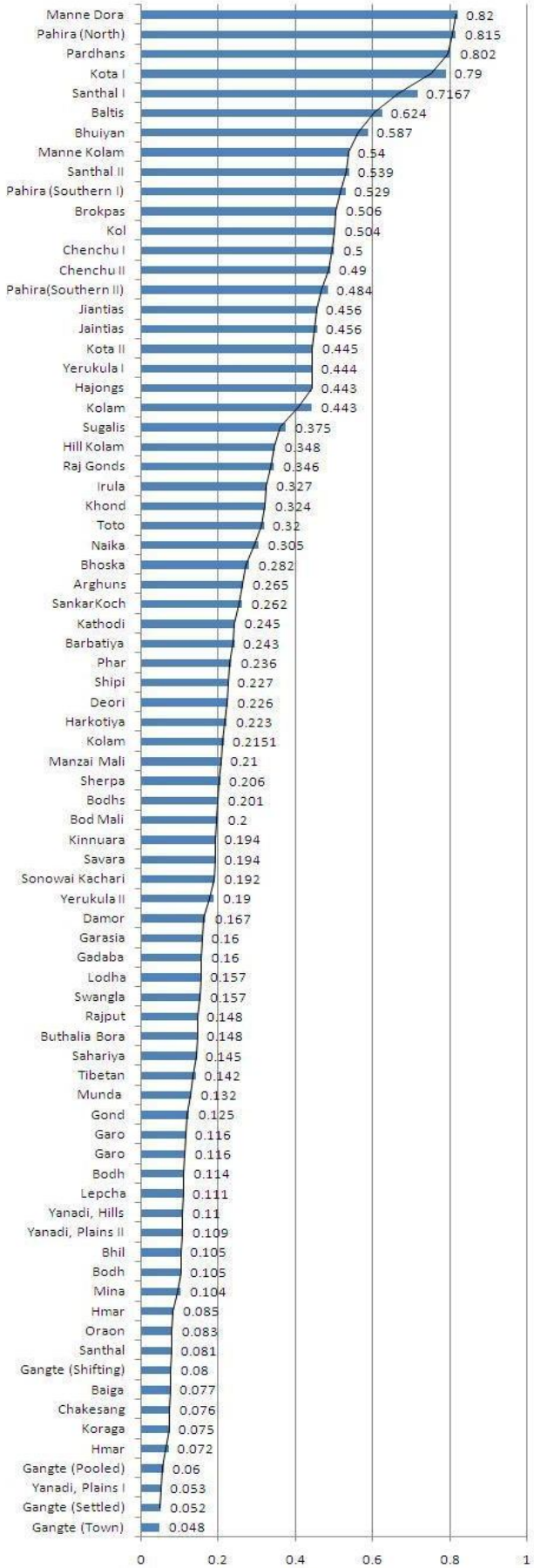

Figure 1.Index of Mortality among different ethnic groups

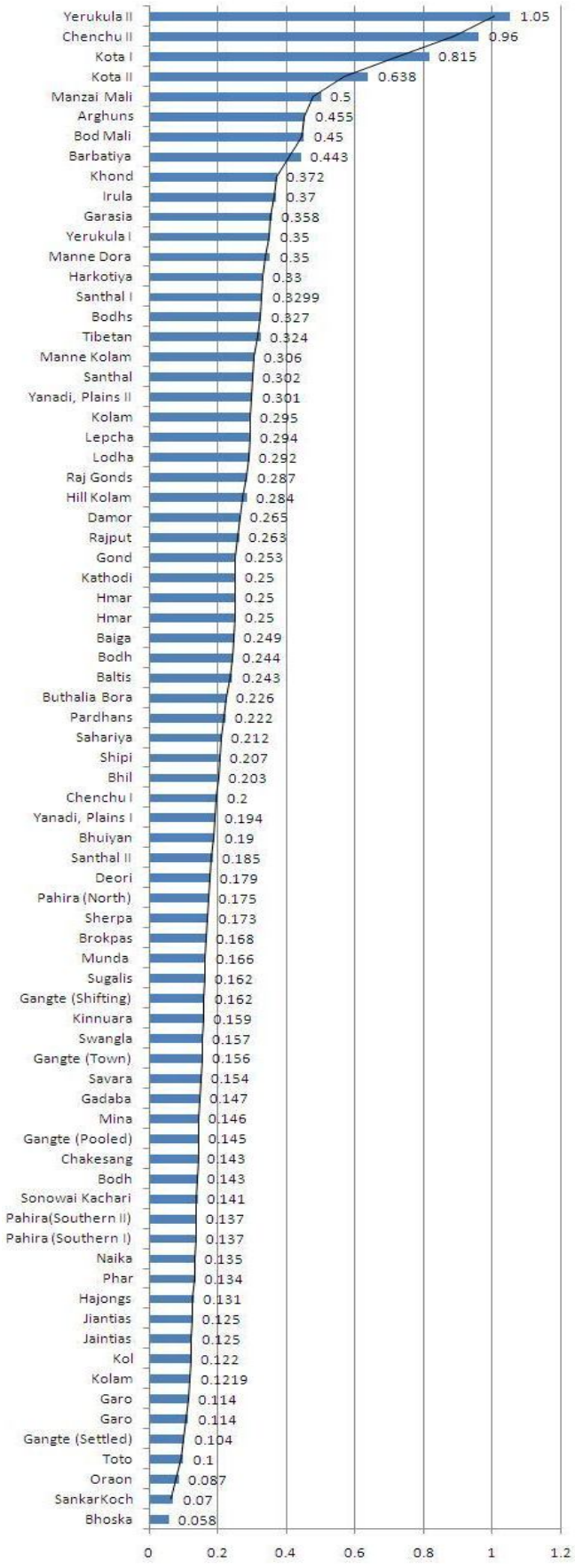

Figure 2. Index of Fertility among different ethnic groups

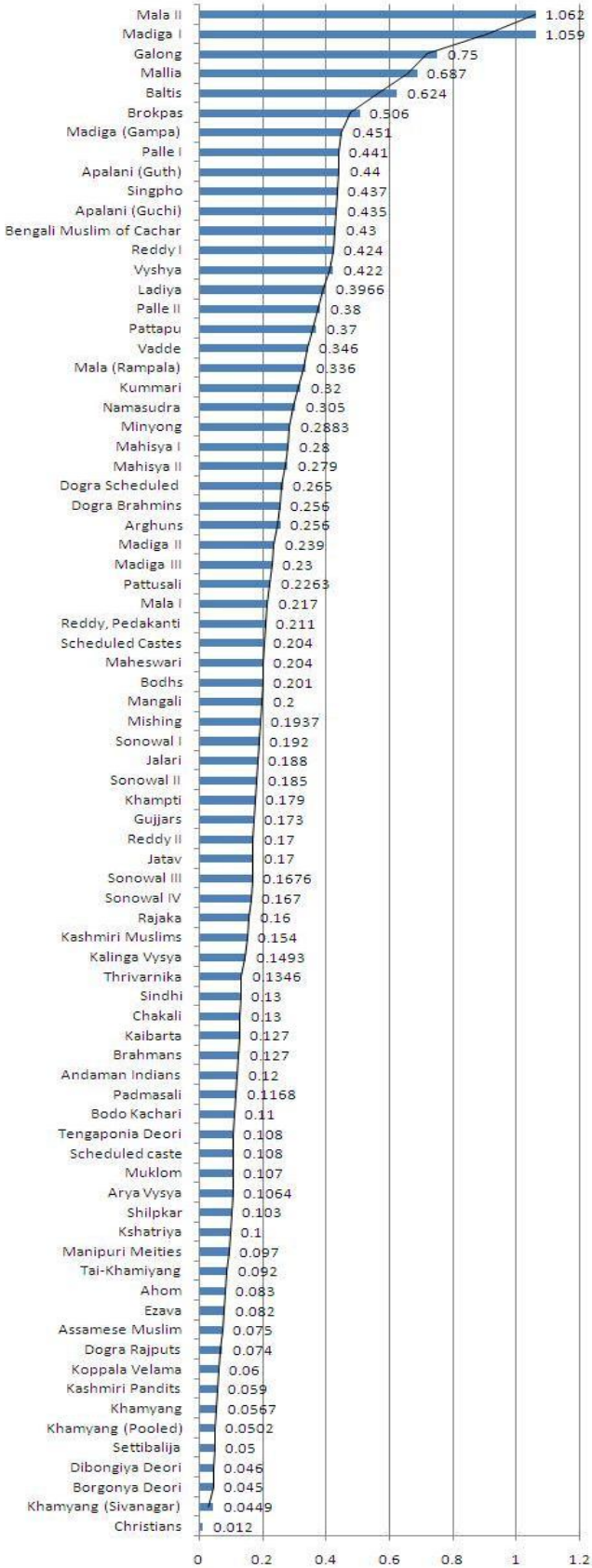

Figure 3. Index of Mortality among different caste groups

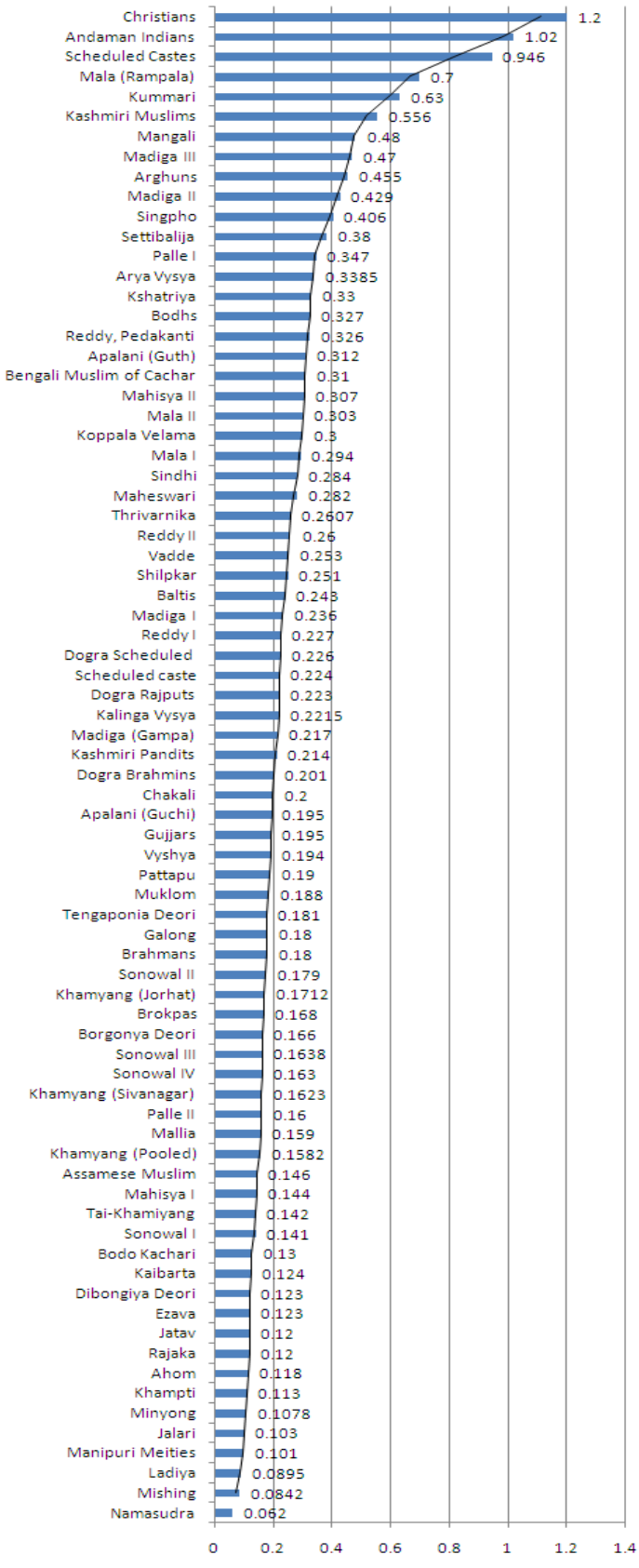

Figure 4. Index of Fertility among different caste groups

Conclusion

Natural selection shows differences due to fertility among different individuals with different genotypes. The ability of a genotype to survive and reproduce is reflected in the average number of offspring or live births for a woman. The average number of children per couple is larger than the variance in the number of children and hence resulted in low level of selection. According to Crow's Index, the selection among Kolam manifested through differential mortality rather than differential fertility. Further, the present results also substantiate with Johnston & Kensinger postnatal mortality component findings which are more than prenatal mortality component. The cause for high mortality in the studied population is due to lack of adequate knowledge of mother(s) towards neonatal care. This situation can be attributed to incomplete educational levels among Kolam women. Another contributing factor is due to early marriage among girls which endorses early conception resulting in postnatal mortality.

Acknowledgements

The author is grateful for the financial assistance provided by University Grants Commission, New Delhi extended through Major Research Project-F.No.37-23/2009 (SR) dated 12 Jan 2010. The author wishes the Kolam ethnic group who co-operated in extending the information.

[i] *data excludes ST popolation of Submergence of Sch.villages of 7 mandals from Khammam district to the A.P. State (as per Reorganisation Act 2014).*

[ii] *Fig.2 shows the differential fertility of 76 ethnic groups only (data of 2 groups not available)*

[iii] *Fig.4 shows the differential fertility of 76 caste groups only (data of 2 groups not available)*

References

[1]. Darwin, C. (1859): On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life.London, UK: In John Murray. (modern reprint- Charles Darwin, Julian Huxley; 2003).

[2]. Huxley, T. H. (1860). The origin of species. *Westminster Review*. 17, 541–560. Cited from Barton, N.H. (2010). What role does natural selection play in speciation? *Philosophical transactions of the Royal Society of London.Series B, Biological sciences Royal Society(Great Britain)*. 365 (1547), 1825-1840.

[3]. Mayr, E. (1963). Animal species and evolution. Cambridge, MA: Harvard University Press. Cited from Barton, N.H. (2010). What role does natural selection play in speciation? *Philosophical transactions of the Royal Society of London.Series B, Biological sciences Royal Society(Great Britain)*. 365 (1547), 1825-1840.

[4]. Carson, H. L., & Templeton, A. R. (1984). Genetic revolutions in relation to speciation phenomena: the founding of new populations. - *Annual Review of Ecology and Systematics*. 15: 97–131.

[5]. Wright, S. (1932). The roles of mutation, inbreeding, crossbreeding and selection in evolution. Proceedings of the Sixth International Congress in Genetics, *Ithaca, NY, 1932*, vol. 1, 356–366, Menasha, WI: Brook.

[6]. Harrison, G.A. (2004). Population Genetics-Gene Frequency Changes. In Harrison, G.A., Tanner, J.M., Pilbeam, D.R., & Baker, P.T., *Human Biology: An introduction to Human Evolution, Variation, Growth and Adaptability*. Pg. 208, Oxford: Oxford University Press.

[7]. Crow, J.F. (1958). Index of total selection intensity-some possibilities for measuring selection intensities in man. *Human Biology*, 30, 1-3.

[8]. Neel, J. V. (1958). The study of natural selection in primitive and civilized human populations.*Human Biology*, 30, 43. Cited from Bhasin, M.K., & Nag, S. (2007). Demorgaphy of the Tribal Groups of Rajasthan: 4. Selection Intensity, *Anthropologist*, 9(2): 93-97.

[9]. Fisher, R.A. (1930).*The Genetical Theory of Natural Selection*.London: Oxford University Press.

[10]. Wright, S. (1938). The distribution of gene frequencies under irreversible mutation.*Proceedings of the National Academy of Sciences*, 24, 253.

[11]. Coon, C.S. (1955). Some problems of human variability and natural selection in climate and culture.*American Society of Naturalists*, 89, 257.

[12]. Crow, J.F. (1958). Some possibilities of measuring selection intensities in man.*Human Biology*, 30, 1.

[13]. Crow, J.F. (1972).Some effects of relaxed selection and mutation.In J. DeGrouchy, E.J.G. Ebling and I. W. Henderson (Eds.).*Proceedings of theIVth International Congress of Human Genetics*.Amesterdam Excerpta Medica.

[14]. Cavalli-Sforza, L.L., & Bodmer, W.F. (1971): *The Genetics of Human Populations*. - San Francisco: W.H.Freeman.

[15]. Livingston, F.B., & Spuhler, J.N. (1965). Cultural determinants of Natural Selection.*International Social Science Journal*, 17, 118–120.

[16]. Johnston, F.E., & Kensinger, K.M. (1971). Fertility and mortality differentials and their implications for micro evolutionary change among cashinahua. *Human Biology*, 43, 356-364.

[17]. Crow, J.F. (1966). The quality of people: Human evolutionary changes. *Bioscience*, 16, 863.

[18]. Cruz-Coke, R., Cristoffanini, A.P., Aspillaga, M.,&Biancani, F. (1966).Evolutionary forces in human populations is an envionmental gradient in Africa, Chile. *Human Biology*, 38, 421-438.

[19]. Matsunaga, E. (1966). Possible genetic consequences of family planning. J. Am. Med. Assoc., 198: 533.

[20]. Salzano, F.M. (1963). Selection intensities in Brazilian CaingangIndians.*Nature,* 199, 514.

[21]. Neel, J.V. & Salzano, F.M. (1967). Further studies on the Xavante Indians. Some hypotheses-generalizations resulting from these studies. American *Journal of Human Genetics*, 19, 554-574.

[22]. Neel,J.V. & Chagnon, N.A. (1968).The demography of two tribes of primitive, relatively unacculturatedAmerican Indians. Proceedings of the National Academy of Sciences of the United States, 59:680-689.

[23]. Barua, S. (1983): The Hajongs of Meghalya: A bio-cultural study. -*Human Sciences*,32: 19–20.

[24]. Spuhler, J.N. (1962). Empirical studies of quantitative human genetics. *In Proceedings of UN/WHO Seminar on the Use of Vital Health Statistics for Genetics and Radiation Studies*. New York, United Nations.

[25]. Spuhler, J.N. (1963).The scope of natural selection in man pp. 1-111. In W. J. Schull (Ed.) *Genetic Selection in Man*. Ann Arbor: University of Michigan Press.

[26]. Spuhler, J.N. (1976). The maximum opportunity for natural selection in some human populations, pp. 185-226. In E.B.W. Zubrow (Eds) *Demographic Anthropology: Quantitative Approaches*. Albuquerque: University of New Maxico Press.

[27]. Barrai, I., &Fraccaro, M. (1964): Intensities of selection in nomadic and setteled Lapps.-*Folia Hereditaria et Pathology(Milano)*, 14: 1-6.

[28]. Reddy, P.C., & Lakshmanudu, M. (1979). Indices of opportunity of selection in Mala, Madiga and other Andhra Populations. *Journal of Indian Anthropological Society*, 14, 245-252.

[29]. Mukhopadhyay, B. (1981): A comparative micro-demographic study of two communities in coastal Midnapore district, West Bengal. *Journal of Biosocial Science,*13: 1-11.

[30]. Mukhopadhyay, B. (1989). Sociocultural variation and selection intensity among the Lepchas of Kalimpong subdivision, Darjeeling, West Bengal.*Journal of Indian Anthropological Society,* 24, 197-200.

[31]. Basu, S.K., Kshatriya, G.K., & Jindal, A. (1988): Fertility and Mortality differentials among the tribal population groups of Bastar District, Madhya Pradesh, India.-*Human Biology*, 30: 407-416.

[32]. Bhasin, M.K., & Kshatriya, G. (1990): Fertility and Mortality differentials among the different groups of Sikkim, India.- *Journal of Human Ecology*, 1: 267.

[33]. Sarkar, N.C. (1997). Opportunity for natural selection among the Muklom of Arunachal Pradesh. *Current Anthropology*, 38, 140–143.

[34]. Patra, P.K., & Kapoor, A.K. (1996). Opportunity for natural selection among the Dalu of West Garo Hills, Meghalaya. *Journal of Human Ecology*, 8, 127-129.

[35]. Patra, P.K., & Kapoor, A.K. (2009). *Demography and Development Dynamics in a Primitive Tribe of the Himalayas.* Dehradun: International Book Distributors.

[36]. Kapoor, A.K.,& Patra, P.K. (1998). Selection intensity in a high altitude tribe of Central Himalayas. *Indian Anthropologist*, 28, 81-7.

[37]. Chanu,T.J., &Varte,R.Th. (2009). Opportunity for Natural Selection among Chakesang of Nagaland, India.*Anthropologist*,11(1), 59-60.

[38]. Prakash, D.S.R.S., & Narayanan, S. (2009). Opportunity for Natural Selection in Yerukula Tribe of Coastal Andhra Pradesh.*Studies in Tribes and Tribals*, 7, 67-69.

[39]. Khongsdier, R. (1994). Opportunity for natural selection among the War Khasi of

Meghalaya.*Journal of Human Ecology*, 5, 307-310.

[40]. Sengupta, S., & Chakravarty, K. (1998).Selection intensity in the Ahom of Assam.*Journal of Human Ecology*, 9, 83-85.

[41]. DharaniPriya, B., Veerraju, P., &Rao, T.V. (2003).Selection intensity among Kshatriyas, an endogamous population of Andhra Pradesh.*Indian Journal of Human Genetics*,9, 69-73.

[42]. Kar, S., Mozumdar, A.,& Roy, S.K. (2007). Comparison of demographic characters between Bengali and Meitei population groups of Cachardistrict, Assam. In: Sharma, A. N. (Ed.) *Trends in Anthropological Demography*, 40-61, New Delhi: Sarup and Sons Publishers.

[43]. Sikdar, M. (2008). Influence of socio-economic transition on genetic structure: A case study in upper Assam, India. *Annals of Human Biology*, 35, 112-120.

[44]. Reddy, B.M. & Chopra, V.P. (1990).Opportunity for natural selection among Indian populations.*American Journal of Physical Anthropology*, 83, 281-296.

[45]. Frisancho, A.R., Klayman, J.E., & Matos, J. (1976).Symbiotic relationship of high fertility, high childhood mortality and socioeconomic status in an urban Peruvian population.*Human Biology*, 48, 101-111.

[46]. Bharati, P. (1981): Economic condition and demography among the Mahishyas of Chakpota village, Howrah district, West Bengal.- *Journal of Biosocial Science,*13: 345-356.

[47]. Sikdar, M. (2012).Socioeconomic covariates and their impact on the opportunity for natural selection in a riparian tribe of Northeast India.*AnthropologischerAnzeiger*, 69:273-287.

[48]. Kapoor, A. K., Kshatriya, G. K. & Kapoor, S. (2003).Fertility and mortality differentials among population groups of the Himalayas.*Human Biology*,75(5), 729–747.

[49]. Das, F.A., & Sikdar, M. (2010). Opportunity for natural selection among some selected population groups of Northeast India. *Indian Journal of Hum Genetics*, 16(2), 61-66.

[50]. Babu, B.V., & Kusuma, Y.S. (2002): Demographic structure and its implications among two breeding isolates of Mali tribe from Andhra Pradesh, India. - *International Journal of Anthropology,*17: 7-16.

[51]. Rao, V. L. N., Dharma Rao, B., Rao, C. S., Bharathi, K. & Busi, B. R. (2006).Selection intensity among Khonds of Andhra Pradesh.*Anthropologist*,8(2), 143–144.

[52]. Murthy, J. S. & Ramesh, A. (1978). Selection intensities among the tribal populations of Adilabad district, Andhra Pradesh, India. *Social Biology*,25, 302–305.

[53]. Census of India, (2001): *Tribe wise population data among the scheduled tribe population of Adilabad district of Andhra Pradesh*. - New Delhi: Government of India.

[54]. Census of India,.(2011): *Tribe-wise and sex-wise population and their percentages of Total Population in Andhra Pradesh*. - New Delhi: Government of India.

[55]. Utnoor, ITDA Statistics, 2011. Population Information, ITDA office, Utnoor, Adilabad district, Andhra Pradesh.

[56]. Reddy, V.R., & Reddy, B.K.C. (1984).Selection Intensities among the Reddis of Chittor district of Andhra Pradesh. India. *Comparative Physiology and Ecology*, 9, 33-36.

[57]. Kapoor, A. K. & Kshatriya, G. K. (2000). Fertility and mortality differential among selected tribal population groups of north-western and eastern India. *Journal of Biosocial Science*,32, 253–264.

[58]. Gautam, R.K., Kapoor, A.K., & Kshatriya, G.K.(2009). Natural selection among Kinnaura of Himalayan highland: A comparative analysis with other Indian and Himalayan populations. *Indian Journal of Human Genetics*, 15, 125-136.

[59]. Sudhakar, G., Padma, V., &Babu, B.V. (1998).Opportunity for natural selection in KoppalaVelama caste of West Godavari district, Andhra Pradesh.*South Asian Anthropologist*, 19, 107-109.

[60]. Deka, R. (1980). Selection potential among the SonowalKachari of upper Assam.*Bulletin of the Department of Anthropology*, Dibrugarh University.9, 136- 140.

[61]. Kapoor, A.K., Kuar, J., Trivedi, K. & Sinha, R. (2001). The Role of Natural Selection in demographic fluctuation among the various caste groups of Kerala, India. *International Journal of Emerging.Ech.,*. 3(4),82-88.

[62]. Garg, S. K., Sankayan, A. R.,& Tyagi, D. (1980).Selection intensity in the Bhoksa of Doon valley, Uttar Pradesh, India. *Bulletin of the Anthropological Survey of India,*28, 12–16.

[63]. Rao, V. V.,& Murty, J. S. (1984).Selection intensity and inbreeding among some caste groups of Andhra Pradesh, India. *Social Biology,*31, 114–119.

[64]. Hemam, N.S.Y., & Reddy, B.M.H. (1999).Opportunity for natural selection among the occupationally different groups of Gangte tribe of Manipur, North-East India.*Journal of Human Ecology*, 10(3), 161-166.

[65]. Ramana, G.V. (1991). *An Anthropogenetic Study of Manne Dora Tribe.*Ph. D. Thesis (Unpublished), Andhra University, Visakhapatnam.