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Research Article

Fertility and mortality differentials among the Paundra Kshatriya community living in a peri-urban setting, West Bengal, India

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Abstract

Relationship between fertility and mortality is well known, which exists among different populations of the world. This is known as a genetic phenomenon that has been operating in all human populations. This study examines fertility and mortality differentials among the Paundra Kshatriya community living in a peri-urban setting of West Bengal, India. Altogether, 249 Paundra Kshatriya women were interviewed. A subsample was drawn from this sample, numbering 98, who have completed their reproductive span. Differential fertility is 0.3134 and differential mortality is 0.1393, whereas, index of total selection intensity is 0.4964 according to Crow's (1958) formula and 0.5980 according to Johnston and Kensinger's (1971) formula in the study population. The higher value according to Johnston and Kensinger's (1971) formula is probably because of inclusion of embryonic deaths in the latter. Findings of the present study reveals that differential fertility (I_f: 0.3134) contribute more than the differential mortality (I_m: 0.1393) towards the total opportunity for selection (I=0.4964) in the study population. Paundra Kshatriya is placed with other populations of West Bengal like Jale, Tili, Muslim, Kayastha, Paschtya Vaidya Brahmin, Duley Bagdi, Namasudra and Lepcha in this respect.

Keywords: fertility and mortality components; India; Paundra Kshatriya; selection intensity; West Bengal

Introduction

Every variation in fertility or mortality is thought to be the result of natural selection. This aids in assessing the environmental fitness of a population group. According to Spuhler (1973), it is a genetic phenomenon that has affected all human populations. Changes in gene frequencies in a population are caused by forces of fertility and mortality, and selection intensity is a measurement of the fitness of a population as indicated by persistent patterns of differential fertility and mortality coupled in a specific way. The highest potential rate of change through selection is measured by the index of opportunity for selection, where zero denotes no change (Livingston and Spuhler, 1965; Sarkar, 1997). The technique for calculating the overall selection index is based on the largest possible disparity.

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Many of India's traditional tribes have seen significant change as a result of urbanisation and industrialization. It is commonly known that factors such as the physical environment, sociocultural factors, religious factors, and ethnic factors affect differential fertility and mortality. In several Indian populations, the impact of religion on the index of opportunity for selection has been seen (Basu and Mukhopadhyay, 1980; Khongsdier, 1994). This index has been shown to be impacted by socioeconomic status in many populations (Bharati, 1981; Rao and Murthy, 1984; Rajni Kumari *et al.*, 1985; Sarkar *et al.*, 1994; Sokhlet, 2013; Kuiti *et al.*, 2015; Limbu and Gogoi, 2019).

The index differs between two altitudinal subgroups of the Sherpa, according to Gupta (1980). According to Ghosh Dastidar and Gupta (1993), Muslims living in Kolkata's slums exhibit a greater index of selection intensity than Muslims living in rural areas. In comparison, Padmanabham notes (1985) that the urban Naika have a larger chance of selection than their rural equivalent.

Although numerous writers have extensively investigated selection intensity in a variety of Indian groups, no peri-urban community has been the subject of such a study. In West Bengal, India, a caste population known as the Paundra Kshatriya lives in a peri-urban environment. This study looks at the strength of natural selection in this population.

Materials and Methods

General information about the investigated area and the working method

By paying a visit to the Paundra Kshatriya family in Sonarpur, a peri-urban area of the South 24 Parganas district, West Bengal, India, overall demographic and socioeconomic data were gathered. A total of 249 women were questioned. However, a subsample of 98 individuals who have reached the end of their reproductive cycle was chosen from the entire population for the purposes of the current study.

The largest group among the diverse people in the study area is the Paundra Kshatriya or Pod (caste). In terms of total socio-economic development, they are regarded as a disadvantaged group. The neighborhood is made up of both landowners and those without land (Singh 2008). The Paundra Kshatriya who live in this region rely heavily on several types of self-engaged work for their sustenance economy. For a clear view, the position of the state West Bengal has been shown in Figure 1 and location of Sonarpur in West Bengal is shown in Figure 2.

Figure 1. Position of West Bengal in India

Figure 2. Position of Sonarpur in West Bengal

Workflow and formulas

Using the formulas of Crow (1958) and Johnston and Kensinger (1971) the index of opportunity for selection (I) and its fertility and mortality components (I_f and I_m) were determined.

Crow's (1958) index:

$I = I_m + I_f/P_s$

where:

I = Index of total selection intensity

I_m = Index of mortality

I_f = Index of fertility

Johnston and Kensinger's (1971) index:

$I = I_m + I_f/P_s$

where:

I = Index of total selection intensity

I_{me} = Index of embryonic mortality

$I_{mc} = I_m$ = Index of mortality

I_f = Index of fertility

P_b = Proportion of survivors up to birth

P_s = Proportion of survivors

The findings of the present study were compared with other populations of West Bengal on the basis of the data available from secondary sources (citations are given in Table 3 as well as in reference section).

Results

There were 393 pregnancies in all among the 98 Paundra Kshatriya moms, 368 of which resulted in live births. The average number of live births per mother with full fertility is 3.7551, with a standard deviation of 4.4069, while the percentage of early deaths (deaths occurring before the age of 15) is 0.1223 (Table 1).

Table 1. Indices of the total selection intensity's various parameters

Parameter	Data
Total number of mothers with completed fertility	98
Number of reported pregnancies	393
Number of live births	368
Proportion of premature deaths (P_d)	0.1223
Proportion of embryonic deaths (P_{ed})	0.0636
Proportion of survivors up to birth (P_b)	0.9364
Mean number of live births per women with completed fertility	3.7551
Variance in the number of live births	4.4069

Table 2 displays selection intensity indices computed in accordance with Crow (1958) and Johnston and Kensinger (1971). It shows that the mortality component (I_m: 0.1393) is lower than the fertility component (I_f: 0.3134) whereas, embryonic mortality component (I_{me}: 0.0679) is also found to be lower than the fertility component (If: 0.3134). However, this value is greater than the mortality component (Im: 0.1393). Nonetheless, it appears from both analyses that differential fertility contributes more to overall selection opportunity. Also, it reveals that the index of total selection (I) estimated by Crow (1958) is considerably smaller than the index of total selection (I) determined by Johnston and Kensinger (1971). This is most likely caused by the latter's inclusion of embryonic fatalities.

Table 2. Indicators of selection intensity

Calculated according to Crow's (1958) formula			Calculated according to Johnston and Kensinger's (1971) formula			
I_m	I_f	I	I_{me}	I_m	I_f	I
0.1393	0.3134	0.4964	0.0679	0.1393	0.3134	0.5980

The results of this study show that the Paundra Kshatriya are more likely to fall into the lower level of the spectrum of Indian populations, which ranges from 0.24 to 2.25 (Basu, 1972; Reddy and Lakshmanadu, 1979). For instance, the Paundra Kshatriya is similar to the Maheswari (I = 0.555) of Maharashtra (Gandhi, 1989), the Mala (I = 0.575) of Andhra Pradesh (Reddy and Lakshmanadu, 1979), the Muria Joria (I = 0.550) of Madhya Pradesh (Saha, 1981), and the Muslim (I = 0.534) of West Bengal (Roy and Bharati, 1982). In contrast to the results of the current study, this index is significantly lower among the Mahisya (I = 0.275) of West Bengal (Bharati, 1981), the Jatav (I = 0.320) of Uttar Pradesh (Mukherjee, 1974), and the Brahmin (I = 0.330) of Andhra Pradesh (Rajani Kumari *et al.*, 1985). The index of total opportunity for selection has higher values than those of the Paundra Kshatriya population in Madiga (I = 1.545) in Andhra Pradesh (Rao and Murthy, 1984), Jalari (I = 1.078) in Odisha (Reddy, 1983), and Kota (I = 1.367) in Tamil Nadu (Ghosh, 1970).

It is well recognised that there is a connection between mortality and fertility in several global demographic groups (Woodbury, 1926; De Jong, 1972; Brown and Wray, 1974; Frisancho *et al.*, 1976; Krishnan, 1976). For various populations in West Bengal, including the study population Paundra Kshatriya, figures for fertility (I_f), mortality component (I_m), and Crow's indices of opportunity for natural selection (I) have been provided in Table 3.

Table 3. Crow's indices of opportunity for natural selection among the populations of West Bengal

Sl. No.	Population	Crow's (1958) index			Source
		I_m	I_f	I	
1.	Duley Bagdi I	0.266	0.393	0.763	Talukdar (1971)
2.	Duley Bagdi II	0.250	0.386	0.732	Talukdar (1971)
3.	Christian (CNI)	0.173	0.183	0.394	Chatterjee and Piplai (1985)[1]
4.	Christian (RC)	0.183	0.219	0.442	Chatterjee and Piplai (1985)[1]
5.	Christian (others)	0.258	0.212	0.525	Chatterjee and Piplai (1985)[1]
6.	Christian (Portuguese)	0.164	0.180	0.374	Basu *et al*. (1980)
7.	Gangu	0.500	0.460	1.190	Bhattacharya (1985)[1]
8.	Jale	0.218	0.310	0.596	Talukdar (1977)
9.	Lepcha	0.297	0.464	0.899	Mukhopadhyay (1982)
10.	Kayastha (Varendra)	0.169	0.360	0.590	Talukdar (1977)
11.	Mahisya	0.280	0.144	0.464	Mukhopadhyay (1981)
12.	Muslims	0.290	0.189	0.534	Roy and Bharati (1982)
13.	Muslims (consanguineous)	0.435	0.337	0.919	Barua (1976)
14.	Muslims (non-consanguineous)	0.307	0.329	0.737	Barua (1976)
15.	Namasudra	0.307	0.418	0.833	Mukhopadhyay (1981)
16.	Pahira (North)	0.815	0.175	1.133	Basu (1967)
17.	Pahira (Southern I)	0.529	0.137	0.738	Basu (1967)
18.	Pahira (Southern II)	0.181	0.137	0.687	Basu (1967)
19.	Sherpa	0.206	0.173	0.415	Gupta (1980)
20.	Tili	0.198	0.316	0.578	Talukdar (1977)
21.	Toto	0.320	0.100	0.550	Debnath and Sen (1983)
22.	Paschatya Vaidya Brahmin	0.166	0.368	0.594	Chatterjee (1985)[1]
23.	Varendra Brahmin	0.182	0.378	0.629	Talukdar (1977)
24.	Paundra Kshatriya	0.139	0.313	0.496	Present study

[1]Unpublished (cf. Reddy and Chopra, 1990)

The coefficient of correlation value has been produced in order to comprehend the relationship between fertility and mortality among various West Bengali populations as well as the study population. The regression equation (y) of Figure 1 is given as follows: y=0.2965-0.0636x. This takes into account the values of the mortality component (I_m) as a regressor (i.e., X) and the values of the fertility component (I_f) as a regress and (i.e., Y). $R^2 = 0.0075$ is the correlation coefficient between x and y. This shows that despite its relatively small magnitude, there is a positive association between these two components.

For a clear view of the situation the regression line has been drawn and the values of mortality component are plotted along with the regression line on Figure 3. It appears that 24 populations of West Bengal can be classified into the following three groups, which are based on the relationship between fertility and mortality components.

These are as follows:

Group A: Index of mortality: 0.100-0.300 and index of fertility: 0.300-0.500: Jale, Paundra Kshatriya, Tili, Muslim (Non consanguineous), Kayastha (Varendra), Paschatya Vaidya Brahmin, Duley Bagdi I, Duley Bagdi II, Namasudra and Lepcha.

Group B: Index of mortality: 0.150-0.320 and index of fertility: 0.100-0.220: Toto, Pahira (Southern II), Mahisya, Sherpa, Christian (Portugese), Christian (CNI), Muslim, Christian (others), Christian (RC).

Another group: Pahira (Southern I), Pahira (North), Muslim (Consanguineous), Gangu.

Thus, the study population Paundra Kshatriya is placed in Group A with the other populations of West Bengal like Jale, Tili, Muslim, Kayastha Paschtya Vaidya Brahmin. Duley Bagdi, Namasudra and Lepcha.

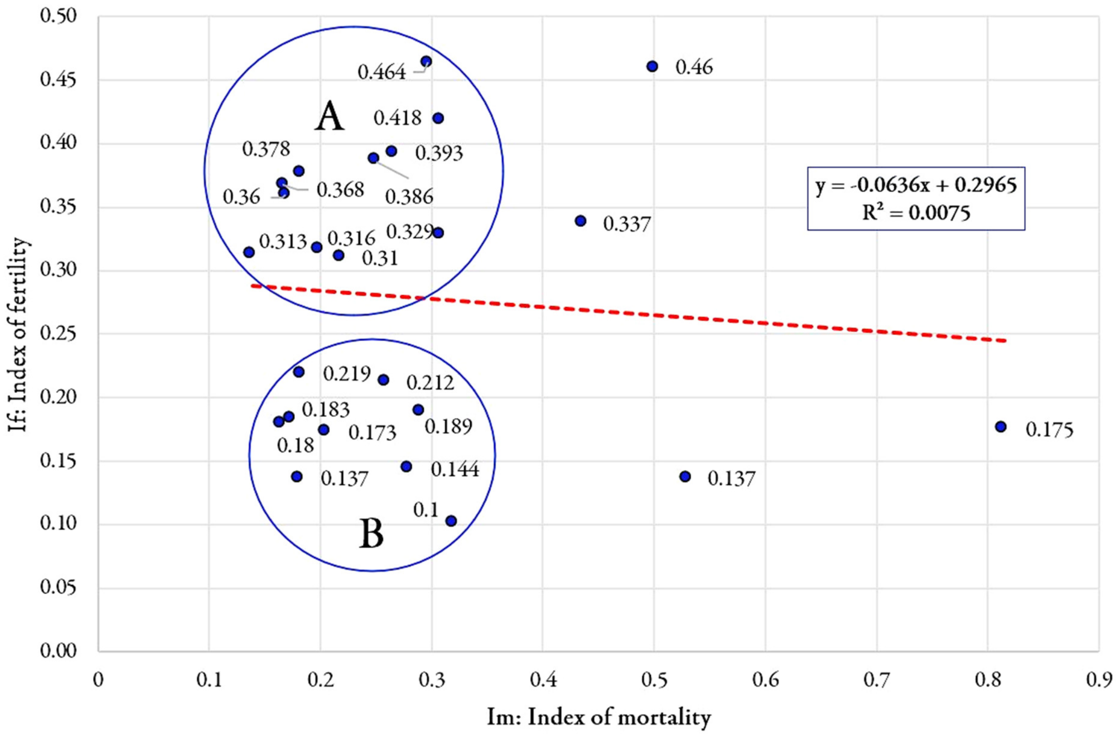

Figure 3. Diagram plotting the indices of fertility to mortality

Discussion

Differential in fertility and mortality is operating in general in all human populations (Singh *et al.*, 2022). But the populations vary in terms of these two components. In some populations differential fertility contribute more than the differential mortality towards the total opportunity of selection, whereas a reverse trend is perceptible in some populations (Das and Mithun, 2010; KC *et al.*, 2018; Lerch, 2019; Radkar, 2020; Karri and Mathew, 2022). A similar trend is noticed among different population groups of the state of West Bengal in India. This has been extensively studied in many populations (Kun, 2022).

The index of selection intensity accepts that the reproductive differentials are due to phenotypic differences. The reproductive outcome is known to be influenced by a large variety of socio-cultural factors (KC and Lutz, 2017; Lerch, 2019). Small-scale studies, at local levels, amply demonstrate the effect of changing socio-cultural conditions of the indices (Reddy and Chopra, 1990; Muttarak, 2021).

Paundra Kshatriya are regarded as disadvantaged group in the state of West Bengal in terms of socio-economic development. For subsistence economy they depend on several types of self-engaged work. Their residing area (Sonarpur), a peri-urban area, is well connected with the city Kokata, which is well connected by railway and road. In the study population, Paundra Kshatriya, differential fertility contributes more than differential mortality. They fall in the category of index of mortality, ranges between 0.100-0.300 and index of fertility, ranges between 0.100-0.220.

Conclusions

Considering differential fertility and mortality, index of total opportunity of selection is calculated in a peri-urban population namely the Paundra Kshatriya of West Bengal, India. It is found that differential fertility is 0.3134 and differential mortality is 0.1393 in the study population. This reveals that differential fertility contribute more than that of the differential mortality towards total opportunity for selection. In this respect, Paundra Kshatriya is placed with the populations of West Bengal like Jale, Tili, Muslim, Kayastha, Paschtya Vaidya Brahmin, Duley Bagdi, Namasudra and Lepcha in this respect.

Authors' Contributions

Conceptualization: DKA and NB; Data curation: DKA and NKB, Formal analysis: DKA, NB, NKB and TB; Funding acquisition: DKA and NKB; Investigation: DKA and NKB; Methodology: DKA, NB and TKB; Software: DKA and NB; Supervision: DKA; Writing - original draft: NB and TKB; Writing review and editing: DKA and NB. All authors read and approved the final version of the manuscript.

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Conflict of Interests

The authors declare that there are no conflicts of interest related to this article.

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