# Changing Trends in Twinning *

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**Abstract.** Birth statistics (on 13,887.943 births) from 11 Indian States indicate a fall in the dizygotic twinning rate and a rise in the monozygotic twinning rate over the decade between 1982 and 1991. These figures seem to reverse the trend of the period 1960-1982. One plausible explanation is offered by the age-data on mothers, which indicate that twins of different sex are more frequently born to mothers above the age of 35. Since extensive family planning measures have reduced the upper age-limit of mothers, the birth-rate of twins of different sex has also fallen. Due to the increased proportion of twins of the same sex, Weinberg's differential method will therefore report a decline in the dizygotic twinning rate, wherever the mean age of mothers has fallen (i.e. most mothers do not reproduce after the age of 35).

**Key words: Twinning in India, Twinning trends, Mother's age, Twinning**

## INTRODUCTION

Earlier studies on the estimation of twinning rates indicated that twinning frequency, particularly of DZ twinning, when compared to data published on India's population during the 1950s and 1960s [1,13], rose significantly during the 1970s [7,8,10]. In seeking to present an accurate picture of the incidence of twinning, however, this paper reports a rise in the monozygotic twinning rate between 1980 and 1991. It is suggested that this increase over the decade is probably due to a simultaneous rise in the proportion of births of like-sex twins. A hypothesis is advanced that due to increased family planning measures, the upper age-limit of mothers has been reduced, and that motherhood at less

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than 35 years of age may favour like-sex twin pregancies, rather than twins of different sexes, who are more frequently born to mothers of 35 and above [7,8].

## MATERIALS AND METHODS

Since 1964, two main types of information on twinning have been collected from personal visits made by a large number of post-graduate students, doctors and nurses. Firstly, population data have been gathered from different hospitals and maternity centres, in cities, towns and villages (including those in isolated tribal areas), comprising 48 different centres of study located in 13 Indian States (provinces).

Secondly, family data has been collected, based on personal interviews with the mothers of each of the families. Such an approach provided a better understanding of the reproductive history of each mother, as well as general information on inbreeding levels and related practices. This paper presents the findings of most of these investigations of twinning estimates (Tables 1 & 2), as well as data on 6200 mothers relating to the sex of their twins and the mother's age when they were born (Table 3).

**Table 1 - Differential twinning rates in India (per thousand births)***

|  | MZ | DZ | N° of maternities |
|---|---|---|---|
| 1. Sarkar (1930-1964) (see Sarkar & Sarkar, 1967) | 3.6 | 6.3 | 1,173,524 |
| 2. Bulmer (1970) | 4.3 | 7.8 | 463,719 |
| 3. Goswami, 1970, 1983 Goswami & Wagh, 1975 | 2.72 | 11.73 ($x^2 = 1.980$) | 4,038,224 |
| 4. Up to 1991 (Present study) | 3.24 Insignificant | 10.51 Insiginificant | 13,887,943 |

*for detailed birth statistics see Goswami [8]

One plausible explanation of the peculiar fact that high altitude settlement samples seem to favour or select proportionately more MZ twins than samples from low altitude settlements, appears to lie in maternal age. In both Manipur and Himachal Pradesh, 76% of the mothers who delivered twins were below 31 years of age. Additionally, the greatest number of like-sex twins were born to mothers in this age group. Although it was possible to record maternal age from thousands of case-sheets, also from other Indian States, it is not felt that the sole use of these hospital case sheets provides adequate data [10]. Further information on more personal matters (including abortion, etc.) was obtained from families by door-to-door survey [9]. The information that was gathered in this way during the period up until 1991 is presented below.

Table 2 - Twinning trends in India, 1960-1991

| | N. of maternities recorded 13,887,943 | Differential twinning per thousand | | Sex distribution of twins | | | Total no. of twins |
|---|---|---|---|---|---|---|---|
| | | DZ | MZ | MM | MF | FF | |
| **Andhra Pradesh** | | | | | | | |
| 1960-82 | 120,780 | 12.17 | 2.47 | 500 | 735 | 533 | 1,768 |
| 1982-91 | 870,554 | 10.55 | 3.12 | 3,508 | 4,592 | 3,800 | 11,900 |
| **Bengal** | | | | | | | |
| 1960-82 | 435,534 | 11.80 | 3.15 | 1,540 | 2,570 | 2,401 | 6,511 |
| 1982-91 | 402,444 | 7.20 | 3.85 | 1,157 | 1,449 | 1,800 | 4,406 |
| **Bihar** | | | | | | | |
| 1960-82 | 118,850 | 10.55 | 2.30 | 400 | 637 | 500 | 1,537 |
| 1982-91 | 510,080 | 11.20 | 2.80 | 1,900 | 2,856 | 1,877 | 6,633 |
| **Himachal Pradesh** | | | | | | | |
| 1960-82 | 173,384 | 7.25 | 3.70 | 700 | 628 | 570 | 1,898 |
| 1982-91 | 205,445 | 6.50 | 4.85 | 860 | 668 | 804 | 2,332 |
| **Kerala** | | | | | | | |
| 1960-82 | 235,544 | 11.80 | 3.10 | 1,005 | 1,390 | 1,115 | 3,510 |
| 1982-91 | 435,765 | 8.60 | 3.20 | 1,568 | 1,874 | 1,700 | 5,142 |
| **Madhya Pradesh** | | | | | | | |
| 1960-82 | 1,457,590 | 12.01 | 2.56 | 6,320 | 8,752 | 6,165 | 21,237 |
| 1982-91 | 4,580,020 | 9.80 | 2.85 | 18,096 | 22,442 | 17,400 | 57,938 |
| **Maharashtra** | | | | | | | |
| 1960-82 | 417,050 | 12.80 | 3.12 | 1,823 | 2,667 | 2,150 | 6,640 |
| 1982-91 | 550,600 | 10.95 | 3.05 | 2,240 | 3,014 | 2,454 | 7,708 |
| **Manipur*** | | | | | | | |
| 1982-91 | 15,747 | 5.90 | 6.00 | 79 | 47 | 65 | 191 |
| **Orissa** | | | | | | | |
| 1960-82 | 112,456 | 11.15 | 2.80 | 512 | 627 | 429 | 1,568 |
| 1982-91 | 267,450 | 8.94 | 3.21 | 1,002 | 1,196 | 1,052 | 3,250 |
| **Rajasthan** | | | | | | | |
| 1960-82 | 815,670 | 13.10 | 2.21 | 4,517 | 5,343 | 2,628 | 12,488 |
| 1982-91 | 1,050,040 | 9.25 | 3.20 | 4,112 | 4,856 | 4,104 | 13,072 |
| **U.P.** | | | | | | | |
| 1960-82 | 417,050 | 12.80 | 3.12 | 2,055 | 2,670 | 1,925 | 6,650 |
| 1982-91 | 695,890 | 11.50 | 3.05 | 2,995 | 4,001 | 3,129 | 10,125 |

* data for the period 1960-82 was unavailable.

## Family data

As has been indicated above, personal interviews were used to record the reproductive history of each woman studied. Data on abortions, inbreeding status, and other perinatal aspects will be analysed separately. Table 3, which shows age of mothers at the time

of delivery of twins (over the period 1980-1991), indicates clearly that twins of different sex are most frequently born to mothers aged 36-40.

## RESULTS

## 1. Population data on twinning frequency

Table 1 presents data collected over a period of more than fifty years, and compares various estimates [1,8,13] with those yielded by more recent studies. Some of the earlier of these estimates [1,13] were based exclusively on hospital data, but a subsequent study [10] also gathered information from both small hospitals and maternity centres. Although the earlier and more recent approaches are not strictly similar, they are nonetheless comparable enough to formulate the working hypothesis that MZ and DZ twinning frequency estimates in India during the late 1960s have shown apparent differences in the late 1980s. (The MZ twinning rate has declined from 4.3 to 2.7 per thousand births: $x^2 = 0.980$. The DZ rate, on the other hand, has increased from 7.8 to 11.73 per thousand births: $x^2 = 1.98$)

The intriguing fact that India is showing a simultaneous rise in the MZ twinning rate and decline in the DZ twinning rate, although statistically insignificant, is of biological importance. Table 2 provides a more detailed breakdown of twinning rates in each State for the periods 1961-1982 and 1982-91. It can be seen that there are some States, for example Bengal, Kerala, Madhya Pradesh, Orissa and Rajasthan, where the decline in DZ twinning rates has been quite marked, while other States manifest only minor differ-

Table 3A - Distribution of twins in 6200 mothers (1980-91)

| Age group (yrs) | No. of mothers studied | No. of maternities | | | Twins | | | |
|---|---|---|---|---|---|---|---|---|
| | | M | F | N | MM | FF | MF | N |
| Below 30 (A) | 785 | 1,100 | 1,075 | 2,175 | 5 | 13 | 14 | 32 |
| 30-35 (B) | 1,350 | 1,329 | 1,503 | 2,837 | 4 | 14 | 12 | 30 |
| 36-40 (C) | 2,200 | 6,700 | 7,004 | 13,704 | 44 | 47 | 123 | 214 |
| 41-45 (D) | 1,480 | 1,748 | 1,706 | 3,454 | 15 | 18 | 12 | 45 |
| 46 and above (E) | 3,85 | 602 | 580 | 1,182 | 4 | 2 | 2 | 8 |
| Total | 6,200 | 11,479 | 11,873 | 23,352 | 72 | 94 | 163 | 329 |

Table 3B - Number and frequency of twin births

| Total no. of twin births | No. of mothers who delivered twins (275) | | |
|---|---|---|---|
| | Once | Twice | Three times |
| 329 | 233 | 30 | 12 |

ences in DZ twinning rates between the two periods. However, nowhere has the DZ twinning rate shown an increase, while the MZ twinning rate does appear to have risen slightly. Interestingly, the mountainous state of Manipur (lying 5000 ft above sea-level) has shown almost equal DZ and MZ twinning rates over the same period (5.9 per thousand and 6.0 per thousand births respectively), a situation that has never previously been reported in India. High MZ twinning rates are also recorded in another mountainous state, Himachal Pradesh (3.70 and 4.85 per thousand births respectively).

## DISCUSSION

The major hypothesis emerging from twinning data collected from different Indian States seems to be that monozygotic twinning has increased in the past decade. This is obviously due to the increase in the proportion of births of twins of the same sex (as Tables 2 and 3 show). One possible explanation of this phenomenon, which is suggested by the data on maternal age provided in Table 3B, is that, due to increasing family planning measures, maternal age has fallen. Mothers are now opting to stop having children by the age of 30-32, as by this age, they normally have 2 or 3 children. Twins of the same sex are also most frequently born to mothers who deliver by the age of 30 and who are otherwise "prone" to having twins [12]. It is presumed that the selection risk for MZ or DZ twins must be identical, but there appears to be a selective advantage in twins of different sex being born to mothers aged above 35 (see Tables 3A and 3B).

In fact, twinning increases overall with maternal age and high parity [2]. For this reason, the more rigorous adoption of family planning measures by women of 35 years of age and above will constitute a decidedly more effective method of population control [7,8]. Findings from Swedish data also reported this age group of 35 and above to be "twinning prone" [5].

**Table 4 - Some factors associated with twinning in India**

| | Increase | Decrease |
|---|---|---|
| Like-sex | High proportion of mothers with high parity; upper age-limit 35; better health; inbreeding levels negligible (F = 0.01, 1 - 0.09); some couples with history on either side. | High proportion of mothers with moderate inbreeding levels (F = 0.001 - 0.009); normal health conditions; less stressful environmental conditions; effective family planning measures. |
| Unlike-sex | High proportion of mothers with family history; reproductive age range 20-45; moderate inbreeding (F = 0.01 - 0.02); hormonal instability due to irregular use of oral contraceptives, or any other sociological stress; high parity, with good health. | High proportion of couples with higher inbreeding levels (F = 0.02 and above); increassed rate of abortions still births; effective family planning measures resulting in reduction of upper age-limit of mothers, i.e. most mothers do not bear children after 34 yrs of age. |

The recent trend represented by the increase in monozygotic twinning rates is not a purely Indian phenomenon; the MZ twinning rate has also been increasing in Taiwan, Hungary and Denmark, due to the rise in maternal age (most mothers reproduce between the ages of 25 and 34) [2]. At this juncture, we would like to emphasize the role of family planning measures in twinning trends. Worldwide twinning rates have actually declined, due mainly to a fall in dizygotic twinning rates, a phenomenon which has in turn been positively correlated with the increased age of mothers and high parity [5]. Table 4 contains some observations on factors associated with twinning in India.

The implication would clearly be that that both monozygotic and dizygotic twinning may be expressions of different genotypes [3,6,11], and that their incidence may also vary from mother to mother. The preponderance of such genotypes within each population may fluctuate over time, and such fluctuations may be influenced in turn by prevailing environmental and, or, sociobiological stresses.

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