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An emperical analysis of the declining birth rate in different states of India

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Abstract
This paper mainly aims to study the trend of birth rate in India and the factors responsible for the rapid decline. In 1970, the birth rate was above five and now in 2024, the birth rate has fallen to 2.0 and it is further projected to fall to 1.29 by 2050. The greatest disadvantage will be the increase in the proportion of aging population which will have a great pressure on the economy. This study mainly takes into consideration two factors including-use of contraceptives and percentage of obese or overweight women. In order to study the trend, the time series data is collected from 1970 to 20224. On the other hand, in order to study the factors responsible, the data is collected from several states of India. After that, the Karl Pearson's Co-efficient of Correlation is used. The result of the correlation clearly shows that both the two factors, use of contraceptives and percentage of obese or overweight women have a high degree of correlation with the Total fertility rate. Higher the use of contractive, lowers is Total Fertility Rate and versa. Similarly, higher is the percentage of obese or overweight women, lower is the fertility rate and vice versa.

Keywords: Total fertility rate (TFR), contraceptives, obesity, population aging, correlation

Introduction

The birth rate can be measured by the Total Fertility Rate. The Total Fertility Rate is defined as the average number of births a hypothetical cohort of women would have at the end of their reproductive period if they were subject to the fertility rates of a given period during their whole lives and if they were not subject to mortality. It is the sum of the age-specific fertility rates for all women multiplied by five. The age-specific fertility rates measures the number of births to a women in the age group 15–49.

It is observed that, from 1880 until 1970, India's fertility rate was very consistent and it was found that, women in this period had an average of 5.7 to 6 children during their reproductive period. But, from the second half of the twentieth century, the fertility rate started to fall and continued to fall in 2000s. This decline indicated a common correlation between quality of life and fertility. As the standard of living improved, fertility rate declined.

The National Family Health Survey (NFHS-5) was conducted during 2019-2021. This survey was conducted by taking 6.1 lakh sample households from 707 districts of India. It covered 7, 24,115 women and 1, 01,839 men. The Total Fertility Rate in India declined from 2.2 in 2015-2016 to 2.0 in 2019-2021 which is considered as lower than the replacement level. A population growth below replacement level indicates that the population is not producing enough children to replace itself which is leading to reduction in population growth.

There are many factors which are contributing towards declining fertility rate. These factors include: Late marriage, low infant mortality rate, higher female literacy, financial independence, access to family planning methods and use of contraception etc.

As recorded by NFHS-5, the Infant and Child Mortality Rate have been improved. The mortality rate of the children under 5 recorded a decline from 49.7 to 41.9 deaths per 1000 live births. The factors contributing to this decline are-increased vaccination rate, control of diseases, increased awareness and practice of child-feeding practices and improvement in the nutritional status of the children etc. The vaccination rate amongst children between 12 to 23 months has improved from 62% to 76% in NFHS-5. The childhood disease like diarrhea recorded a decline in NFHS 5 as it was found that the percentage of children receiving Zinc and ORS were increasing. Due to the increased spread of awareness about the benefits of breastfeeding, the percentage of children under six months who were breastfed also recorded an improvement from 55% in NFHS-4 to 64% in NFHS-5. The Nutritional status of children also recorded a slight improvement.

Literature review

According to the National Family Health Survey-5, for the first time in India, the birth rate has fallen below the replacement rate of 2.1 and the fertility rate has come down to just 2.0. According to this survey, only five states- Bihar, Meghalaya, Uttar Pradesh, Jharkhand and Manipur have recorded relatively high fertility rate which are also above the replacement rate.

Coale (1973) [12] and Van de Walle (1992) [30] highlighted the impact of educating females on bringing fertility within the calculus of conscious choice which enhances the numeracy in desired family size. Basu (2002) [3], Lutz & Skirbekk (2013) [13], Martin & Jurez (1995) [14], Jejeebhoy (1996) [16], Kravdal (2002) [19], pointed out that, increased mean age at marriage, women empowerment to pursue their desire for a small family and increased opportunity costs of children are also resoponsible for bringing down the fertility rate.

M. Al-Otaiby (1994) explained that, mortality decline is an underlying cause of fertility decline even though government policy, contraceptive availability, education, ideation and culture are also some of the important factors. V. Ndahindwa, C. Kamanzi, M. Semakula, F. Abalikumwe, B. Hedt-Gauthier, D.R. Thomson, educational upliftment along with economic opportunities of women, improved access to reproductive health information, services at

schools, health campaigns, and involvement of men in family planning decision making have an impact on fertility. Kravdal conducted a study in 2002 by using the Demographic and Health Survey data of 22 countries in Sub-Saharan Africa and found that, education at community level had a strong negative impact on fertility rates.

According to, Bongaarts, (2016, 2017) [6, 7] Canning D, Schultz TP, (2012) [8], Cleland J Philips JF, Amin S. G M.K (1994) [11] and Philips JF *et al*. (2012), Family Planning programs spread information, counsel couples and make contraceptives easily available, all of which may reduce TFR. Use of modern contraceptives is important and there is experimental evidence that FP programs increase contraceptive use and reduce TFR.

Amin *et al*. (1987) [1] analyzed trends in the use of contraceptives between 1969 and 1983 and found that there was a steady increase in conception among all women of all subgroups, irrespective of place of residence, education, or parity. But, women of high parity, women with more education and women living in urban areas were more likely to use contraceptives.

Carty *et al*., (1993) [9]; Cleland *et al*., (1994) attributed the decline in fertility to increased use of contracep [11] tives.

Bongaarts 1984 [4]; Mauldin and Segal 1988 [21]; Jain *et al*. 2014; Tsui 2001; Westoff 1990 [32]; United Nations 2000) observed that, the total fertility rate (TFR) is around six to seven births per woman in countries with no contraceptive use, while on the other hand, fertility is near two births per woman in countries in which the contraceptive prevalence rate (CPR) among women in union is around 75%.

Were, Stranges, & Creed, 2020 [31] observed that, being underweight and obesity are major international problems which affect many reproductive health issues. It leads to several adverse reproductive outcomes such as infertility, ovarian dysfunction, miscarriage, prelymphosia, gestational diabetes mellitus, premature delivery, operative delivery, and fetal development disorders. On the other hand, losing weight can reduce a women's fertility by generating hormonal imbalances which affects ovulation and the possibility of getting pregnant. Underweight women may also take more than a year to conceive, compared to women in a healthy weight range.

Ramlau-Hanse *et al*, Conducted a study and found that, in women of childbearing age, the risk of infertility is increased by 78% and 27% with obesity and overweight, respectively, as compared with women of normal weight (BMI 18.5 - 25)

Zain, M.M. and Norman, R.J. (2008) [33] Klenov, V.E. and Jungheim, E.S. (2014) [17] found that, obesity negatively affects both menstrual and ovulatory functions in women of reproductive age group. They also indicated impact on development of oocytes. Studies have also discussed detrimental effect of obesity and overweight on quality of oocyte.

Objective

This study aims to study the trend of the birth rate by observing the Total Fertility Rate in India by analyzing the time series data starting from 1970; the second objective is to analyze the factors responsible for declining birth rate in different states of India.

Hypothesis

In order to analyze the second objectives, two hypotheses are considered-

H_0: Use of contraceptives and percentage of women who are overweight or obese have no effect on Total Fertility Rate.

H_1: Use of contraceptives and percentage of women who are overweight or obese have significant effects on Total Fertility Rate.

Data Source

The data for the purpose of analysis of the first objective is secondary data which is collected from United Nations Worlds Population Prospects and for analyzing the second objective, the data is collected from NFHS-5.

Methodology

The birth rate is measured by the Total Fertility Rate. In order to find the trend of the birth rate, the data on Total Fertility Rate in India is collected from 1970 to 2024. In order to analyze the second objective, the data on three variables namely- Total Fertility Rate, use of contraceptives and percentage of women who are overweight or obese are collected and are analyzed by using Pearson's Coefficient of Correlation to find out how these factors are related to the Total Fertility Rate.

Table 1: India - Historical Fertility Rate Data

Year	Fertility rate
1970	5.598
1975	5.236
1980	4.857
1985	4.516
1990	4.093
1995	3.693
2000	3.346
2005	3.002
2010	2.636
2015	2.334
2020	2.200

Data Source: United National World Population Prospects

From the above data, it is observed that, in 70s, the fertility rate was above 5, in 8os, it fell to 4 or above 4, from late 90s, it fell to 3 or above 3 and from mid twentieth century, it Started to fall to 2 or above 2 and finally in 2023 to 2024, it became 2.0.

The recent study published in the Lancet projects that, India's fertility rate will further fall to 1.29 per women by 2050. Although, declining birth rate is good for a developing country like India, but at the same time, this decline will lead to adverse effects in the Economy. The economy may face lot of challenges including aging population, shrinking workforce, economic slowdown due to reduced labour supply and reduced consumption.

Table 2: Total Fertility Rate in different states (Rural) of India

States	Total fertility rate (TFR) R	use of contraceptives (R) (%)	% of women obese or overweight (R)
Assam	1.9	60.7	13.6
Arunachal pradesh	1.9	59.5	32.6
Bihar	3.1	54.6	14.2
Gujarat	2	62.2	17
Jharkhand	2.5	60.4	8.6
Karnataka	1.8	68.2	25.6
Kerala	1.8	60.1	36
Madhya pradesh	2.1	71.9	13
Maharastra	1.9	66.5	18.3
Manipur	2.4	61.2	31
Meghalaya	3.3	25.9	9.7
Mizoram	2.2	33.5	21.2
Nagaland	2	55.7	13
Odisha	1.9	73.6	19.2
Punjab	1.7	65.4	38.8
Rajasthan	2.1	71.7	10.5
Tamil nadu	1.9	69.5	35.4
Uttar pradesh	2.5	60.8	18.3
Uttarkhand	1.9	69.5	25.4

Data source: National Family Health Survey-5 (2019-21)

The above is the data of states with different rates of Total Fertility Rate, use of contraceptives and percentage of women who are obese or overweight. In the above data, it is observed that, Total Fertility rate is highest in Meghalaya. The use of contraceptives is highest in Odisha and the total fertility rate is also low in Odisha. The percentage of overweight and obese women is highest in Punjab and consequently, the Total Fertility Rate is lowest in Punjab.

Analysis

The coefficient of correlation between Total Fertility Rate and percentage of women using contraceptives is -0.642409789 which is a significant value as it is greater than 0.5. The negative value indicates that, the Total Fertility Rate and percentage of women using contraceptives are negatively related. This indicates that, higher is the use of contraceptives, lower is the fertility rate and vice-versa. The coefficient of correlation between Total Fertility Rate and the percentage of women overweight and obese is -0.55777968 which indicates that there exists a negative relationship between the two and the relationship is also significant.

From the above analysis, it is clear that, both percentage of women using contraceptives and the percentage of women overweight and obese are significantly correlated with the Total Fertility rate. Therefore, we reject the null hypothesis and accept the alternative hypothesis that, use of contraceptives and percentage of women who are overweight or obese have significant effects on Total Fertility Rate.

Conclusion

Due to the decline in the fertility rate, the percentage of children below the age of 15 in the total population is declining rapidly. As per the National Family Health Survey-1 (1992-93), the population of children under this age group was 38 percent which has now fallen to 26.5 percent. This indicates that, the percentage of the ageing population is rising in India which in future will have a negative impact on economic and social fabric of the country. In the face of the declining birth rate and increased percentage of ageing population, it becomes very important to focus on uplifting the economic condition by focusing on creating better employment opportunities so that the limited working population can improve their standard of living, formulate policies to control the higher medical costs to meet the medical needs of the aged population, make provision for affordable social security systems which will provide pensions to the elderly and meet their daily needs and medical expenses etc. At the same time, the government should also adopt proper strategies for making the couples aware about the infertility issues and if possible, make provision for reduced ART (Assisted Reproductive Technology) facilities.

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