GYANBODH

ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

Sociodemographic, Economic, and Marital Determinants of Fertility in Sikkim: A Comprehensive Analysis of Urban and Rural Dynamics

Dr. Ishfaq Nabi Najar, Research Associate, CSIR IIIM.

Dr. Lhamu T. Dukpa, Assistant professor, Department of Sociology, HNB Garhwal University

Prof. Komol Singha Professor. Center for Economics studies and Planning, Jawaharlal Nehru University,

Prof. Swati A. Sachdeva, Professor. Department of Sociology. Sikkim University

Prof. Veenu Pant

Abstract

The rapid decline in fertility is a crucial driver of population ageing worldwide. In India, the Total Fertility Rate (TFR) has decreased from 2.9 (NFHS-2) to 2.0 (NFHS-5). Sikkim, however, has an alarmingly low TFR of 1.1, significantly below the national average of 2.0 and far below the replacement rate of 2.1 needed to maintain population stability. Given these trends, understanding the factors influencing fertility in Sikkim is critical. This study, a community-based cross-sectional analysis covering all districts of Sikkim, examines various sociodemographic, economic, and marital factors affecting fertility in the state. The analysis of fertility in Sikkim highlights critical influencing factors. Urban residence significantly lowers fertility by 41% (OR=0.59, p=0.02), while caste has no notable impact (OR=0.81, p=0.30). Education shows an inverse relationship with fertility; illiterate women are 2.08 times more likely to have children than their educated counterparts (OR=2.08, p=0.012). Financial stability also reduces fertility, with higher-income women 44.4% less likely to have children (OR=0.55, p=0.0002). Early marriage (ages 0-18) strongly increases fertility, making women 4.1 times more likely to have children (OR=4.09, p<0.0001). The length of marriage has a strong negative correlation with fertility (r=-0.91), explaining 81.98% of fertility variation (p<0.0001). Coital frequency has a substantial positive effect, with women engaging in weekly sexual activity being 3.9 times more likely to have children (OR=3.9, p<0.0001). Family planning significantly reduces fertility (OR=0.6, p=0.008), while contraceptive use shows a

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

non-significant effect (OR=0.76, p=0.118). The age of menarche does not impact fertility (p=0.40), but menopause has a strong negative association with fertility (r=-0.8). Women in loving relationships are likelier to have children (OR=0.5, p=0.05). A mix of social, economic, and biological factors drives fertility in Sikkim. Urbanization, education, financial stability, and family planning significantly lower fertility, while early marriage, longer marriages, and higher coital frequency enhance it. Targeted policies are crucial to managing these dynamics for sustainable development.

Introduction

Fertility is a critical factor in population growth, and extensive research has been conducted to examine its various influences. The decline in fertility rates significantly impacts the composition and structure of a country's population and contributes to a reduction in long-term economic growth (Azmoude et al., 2017). In the 1950s, the average woman had five children, whereas the global average was around 2.5 children per woman (Roser, 2014). Declining fertility rates are considered the primary factor behind the rapid population ageing worldwide, surpassing reduced mortality's impact (Shafto & Tyler, 2014).This global shift in population structure toward older age groups presents significant challenges to public health (Beard et al., 2016) and the economy (Bloom et al., 2010). The fertility transition from 1950 to 2020 can be divided into three phases in the developing world. From 1950 until the late 1960s, the pretransition period was characterised by consistently high fertility levels, averaging around 6 children per woman. The rapid decline phase began in the late 1960s and continued until the end of the century, during which the total fertility rate (TFR) was halved from 6.0 in 1965–1970 to 3.0 in 1995–2000. The final phase began around 2000 and continues to the present day, with the TFR decreasing more slowly from 2.9 in 2000–2005 to 2.6 in 2015–2020 as more countries reach the end of their fertility transitions (Bongaarts & Hodgson, 2022).

A range of demographic and social factors influences fertility rates. Early detection of population issues is crucial for understanding underlying realities and their causes. Social determinants of health, including socioeconomic, societal, environmental, and cultural factors, shape the conditions in which people live and make decisions, significantly influencing fertility rates. Examining the complex interplay between these multifaceted variables is essential for developing targeted interventions and policies to address declining fertility rates and support

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

individuals during their reproductive years (Adhikari, 2010; Rai et al., 2014). While declining fertility has been extensively debated globally, there is a notable lack of observational studies examining fertility indicators at the population level (Shafto & Tyler, 2014). A thorough analysis of key factors, such as fertility rates, is necessary to address this gap and develop targeted interventions to support individuals during their reproductive years (Oura, 2021).

Population momentum was described as the continued population growth for several decades despite an immediate decline to replacement-level fertility in highly fertile populations (Blue & Espenshade, 2011). This phenomenon occurs because a history of high fertility has led many women of reproductive ages to sustain high crude birth rates long after age-specific rates have declined (Keyfitz, 1971). However, Social scientists have observed a "demographic transition" over the past fifty years, representing a worldwide decline in birth and death rates. This trend has raised concerns in several societies where birth rates are now lower than death rates (Babu & Padma, 2024). A crucial factor influencing the size and composition of the population is the total fertility rate (TFR) (Alkema et al., 2011). It is the average number of children a woman would have if she lived through her entire reproductive age, experiencing the typical fertility rates for each age (Alkema et al., 2011; Cheng et al., 2022). Therefore, studying the factors responsible for the decline in fertility rates is crucial.

India, the second most populous country in the world, is home to nearly a fifth of the global population. According to its National Population Policy, India aims to stabilize its population by 2045 (International Institute for Population Sciences (IIPS) and ICF., 2021). However, the transition to smaller family sizes is advanced in India, with a national TFR of 2.2 in 2015-16 (Singh et al., 2022). Analyzing differences across states and population subgroups in India is crucial due to the wide variation in access to education, wealth, and social status (such as caste), all impacting sexual and reproductive behaviours, including childbearing (Singh et al., 2022). It is essential to describe the trend of TFR and explore the factors influencing it. TFR is influenced by factors such as race, place of residence, educational attainment, women's employment, and age at marriage (Lai et al., 2014). Different studies have been conducted in India to check the influence of various factors such as marriage, contraception, abortion and postpartum in fecundability, desired family size, unwanted fertility, son preference, fertility postponement, etc (Dharmalingam et al., 2014; Singh et al., 2022).

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

The present study focuses on the state of Sikkim. This is because Sikkim has shown a decline in TFR from 2.8 (as per NFHS-2) to 1.1 (as per NFHS-5). Thus, these findings are less than half of the replacement level of fertility (International Institute for Population Sciences (IIPS) and ICF., 2021). Few preliminary studies have evaluated some variables, such as higher education levels among women, increased female workforce participation, and family planning efforts (Chauhan & Bhutia, 2022). However, a comprehensive cross-sectional study examining the diverse sociodemographic factors influencing the declining fertility rates in Sikkim has yet to be conducted. Therefore, this study aims to thoroughly assess the variables leading to decreasing fertility in the state, facilitating the implementation of timely measures to preserve and support Sikkim's ethnic communities. By examining the complex interplay of demographic, social, and economic factors, this study seeks to provide a deeper understanding of the underlying causes of the declining fertility rates in Sikkim. The findings have also been compared with Sikkim's NFHS-5 report. The findings will inform policymakers and stakeholders in developing targeted interventions to address this issue and ensure the preservation of the state's unique cultural heritage and ethnic diversity.

Material and Methods:

Study Design:

To conduct this comprehensive study, the sociodemographic and economic status of Sikkim's urban and rural areas were examined. After obtaining clearance from the institutional ethics committee, a community-based cross-sectional study was conducted from [26th December 2023 to [31st March 2024]. The study covered all six districts of Sikkim, targeting married women aged 15 to 49 years from urban and rural areas. Women who were unmarried or unwilling to provide consent were excluded from the study.

Sikkim’s population has gradually increased from 1.38 lakh in 1951 to 6.1 lakh in 2011, showing a 28% growth rate over the 70 years. This moderate rise in population appears to have been contributed mainly by migrant populations (Gyaltsen Tsh Bhutia & R K Srivastava, 2014). However, the survey was conducted only on the native women of the state. A total of 2,402 women within the reproductive age group, i.e., 15–49 years, were surveyed. Data were collected through face-to-face interviews using a predesigned and pretested structured

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

questionnaire. Informed consent was obtained from the study participants after explaining the study's objectives and assuring them of the confidentiality of their data.

The questionnaire was designed to gather information on various factors, including age, religion, socioeconomic status, education level, employment, family structure, household type, duration of marriage, age at marriage, age of menarche, coital frequency, contraceptive use, relationships, and family planning practices.

Statistical Analysis:

Data were entered into Excel and refined using various formulas for processing and analysis. Statistical analysis was done using GraphPad Prism 10.1.2 and XLStat 2014. Associations between variables were evaluated using ANOVA, the correlation coefficient and coefficient of determination tests. Odds ratios (OR) were computed to compare variables between women with children and those without, with a 95% confidence interval (CI). All probability tests were two-sided, with statistical significance at $P < 0.05$.

Results:

1. *Sociodemographic and Economic Attributes in Urban and Rural Areas of Sikkim.*

An inclusive survey covered socio-religious categories, age, education, income, employment, family structure, household types, and available facilities. A total of 2,402 respondents were surveyed and interviewed using a structured questionnaire.

1.1. Percentage of respondents surveyed from different districts: The survey covered all six districts of Sikkim nearly equally, with each district accounting for approximately 1517% of the total respondents. A similar distribution pattern was observed in rural areas, where West, District had the highest percentage of respondents at 20%. In urban areas, East District, North District, and South District had the highest percentages of respondents, with East District leading at 36.3%, followed by North District at 25.9%, and South District at 24.9% as shown in **Fig 1.**

1.2. Percentage of respondents within different Age Groups: Age groups between 26-40 represent the highest percentage (19-22%) of respondents surveyed in urban and rural areas. The NFHS-5 survey results demonstrated a sigmoidal pattern of respondents by age, with the highest percentage in the 25-40 age group. These findings

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

are consistent with our survey results, indicating the authenticity of our study, as shown in **Fig 2**.

1.3. Percentage of respondents within distinct Social status categories: The survey results indicate that Sikkim's urban and rural areas have similar and highest percentages (3639%) of respondents in the ST and OBC categories. This is followed by respondents from the General category, who make up 15% of both rural and urban populations. However, the SC category is the least represented, with only 6-9% of respondents, as shown in **Fig 2**.

1.4. Percentage of respondents within different Communities: The survey results show that the Lepcha community has the highest representation, with 13-15% of respondents in both rural and urban areas. This is followed by the Rai community, which accounts for

10-14% of respondents. Other significant communities in Sikkim, such as Bhutia, Sherpa, and Tamang, have a smaller representation of 2-6% in urban and rural areas. However, in rural areas, the Limbu community is notably represented by 10% of respondents. Moreover, the remaining communities also significantly contributed to this survey, representing a total of 45%, as shown in **Fig 2**.

1.5. Percentage of respondents with different religions: In both the urban and rural areas, the highest percentage of respondents belongs to Hindu (≤60%) and Buddhist (≤31%) religions. Respondents from the Muslim community and other religions were the least, as shown in **Fig 2**.

1.6. Percentage of respondents with different Education Levels (Years of Schooling): In urban areas, the largest percentage of respondents (53.3%) have studied up to Class X or more years of schooling. Similarly, in rural areas, the highest percentage (59.1%) of respondents have studied up to Class X. Additionally, a higher percentage (36.5%) of respondents in urban areas possess graduation-level education than the rural areas (26.3%). Higher education (post-graduation) in rural and urban areas is significantly less prevalent in Sikkim **Table 1.**

1.7. Percentage of respondents with Monthly Family Income (in Rs): In urban areas, the highest percentage of respondents (40-44%) report a monthly income between

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

10,00050,000 INR. In contrast, a lower percentage of rural respondents (20-30%) report the same income range. Additionally, 26% of rural respondents indicate their monthly income falls between 5,000 and 10,000 INR **Table 1.**

1.8. Percentage of respondents living in different Types of Houses: In urban areas, most respondents (**80%**) reside in pucca houses, with **17%** living in semi-pucca houses. In contrast, in rural areas, while **51.7%** of respondents live in pucca houses, a significant proportion also live in semi-pucca houses (**34.7%**) and kuccha houses (**13.6%**) **Table 1.**

1.9. Percentage of respondents who owned Agricultural Land: The highest percentage (**78.7%**) of respondents from rural areas own agricultural land compared to those living in urban areas, corresponding to only **46.9% Table 1.**

Reproductive and Marital History:

1.10. The Age of Women in Sikkim when married: The survey results indicate that the optimal age of women in Sikkim (when married) is between 15-30. Urban and rural areas have similar and highest percentages (~87%) of respondents married between this age group. Around half (52%) of the women in Sikkim's urban and rural areas believe their marriage occurred at the correct age **Table 2.**

1.11. Age of Menarche: The survey indicates that the optimal age of menarche among women in rural and urban areas of Sikkim is between 10 and 16 years, with 92-96% of respondents falling within this age group **Table 2.**

1.12. Age of Menopause: According to this survey, around 90% of the female respondents in rural and urban areas were in the fertility phase, and only 6-7% have attained the age of menopause, mainly between the age of 40-50 years. Thus, women in Sikkim are reaching menopause at the appropriate age, which, according to the literature, is 45±5 years among Indian women **Table 2.**

1.13. Number of Years of Married Life: The current survey shows the highest percentage (**21-22%**) of women in rural and urban areas of Sikkim are newly married. This is followed by women married for **6-10** years and more **Table 2**.

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

1.14. Loving and comfortable physical relationship: In this survey, around **90%** of the respondents from rural and urban areas of Sikkim believe they have loving and comfortable physical relationships **Table 2**.

1.15. Coital Frequency per month: The highest percentage (~60%) of respondents in rural and urban areas of Sikkim possess a coital frequency of 1-7 days a month. However, a study shows this is slightly less frequent for attaining a significant fertility rate **Table 2**.

1.16. Use of contraceptives: The present survey revealed that the highest percentage (**6267%**) of respondents in rural and urban areas of Sikkim don't use contraceptives **Table 2**.

1.17. Opted Family planning consciously: This survey depicts that in urban and rural areas of Sikkim, the highest percentage, **71-80%** of respondents, do not opt for family planning consciously. This optimistic outlook suggests a potential increase in the fertility rate among women in Sikkim **Table 2**.

1.18. The number of children respondents currently have: The survey indicates that most respondents (**90-94%**) have **1-5** children, with mothers having **2** children being the most common in urban and rural areas of Sikkim **Table 2**.

2. ***Correlation of variables influencing Fertility:***

2.1. Place of Residence:

The statistical analysis was started by checking the impact of the place of residence (urban or rural) on women's fertility in Sikkim. The results have shown that Urban residence is associated with lower fertility compared to rural residence. The odds ratio of **0.59** implies that living in urban areas reduces the likelihood of having children by about **41%**. The CI suggests that this result is statistically significant, but the effect is not extremely strong, as the values are close to 1 with a p-value of **0.02**. The difference between urban and rural fertility is significant but moderate, indicating that other factors beyond place of residence might also be influencing fertility **Table 3**.

2.2. Caste Category:

The Odds ratio was calculated to be **0.81** with **CI 0.5485 to 1.207**. Meanwhile, the odds ratio of 0.814 suggests that those with any caste category different from the general category

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

population are less likely to have children. The confidence interval (0.550 to 1.204) indicates that this relationship is not statistically significant, with a p-value of **0.30**. Therefore, based on this analysis, it is likely that the caste category does not have a substantial or statistically significant effect on fertility **Table 3**.

The correlation coefficient **r=0.03546** indicates a weak positive correlation between caste category and fertility. In this case, the positive value suggests that fertility slightly increases as the caste category shifts (from general to other), but the relationship is extremely weak. Moreover, **R^2=0.001258** means that only **0.13%** of the variation in fertility is explained by the caste category. This is a meagre value, indicating that the caste category has extremely limited or almost no predictive power in explaining fertility differences **Table 3**.

2.3. Education: The results have shown that education has an inverse effect on fertility. Women with more education have slightly less fertility in Sikkim. These results were validated by Odds ratio, correlation, and regression analysis. The odds ratio of **2.085** with confidence intervals of **1.102 to 3.94** suggests that illiterate women are 2.08 times more likely to have children than women with higher education. This indicates that illiterate women are significantly more likely to have children than their educated counterparts. The confidence interval supports this finding by showing the relationship is statistically significant, with a p-value of **0.012**. The correlation coefficient (**r = -0.3**) indicates a weak negative correlation between education and fertility, meaning fertility decreases as education levels increase. However, this relationship is relatively weak, as the correlation is not very strong. The regression analysis, with an R^2 value of **0.09**, suggests that 9% of the variability in fertility can be explained by education. In comparison, the remaining 91% is due to other factors that education alone does not capture **Table 3**.

2.4. Financial stability:

Income appears to have an inverse effect on fertility, meaning higher-income women are less likely to have children compared to lower-income women. These results were validated through statistical analysis. The odds ratio was found to be **0.55** with a confidence interval (CI) of **0.4068** to **0.7588**. An odds ratio below 1 indicates that higher income is associated with lower odds of having children. Specifically, women with high income have 44.4% lower odds

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

of having children compared to women with low income. The CI (0.407 to 0.758) does not include 1, indicating that this result is statistically significant, with a p-value of **0.0002**. The correlation coefficient (r) was **-0.6**, where the negative sign indicates an inverse relationship between income and fertility. As income increases, fertility decreases. The R^2 value was calculated to be **0.4**, meaning that 40% of the variability in fertility is explained by income. This suggests that income is a moderate to strong predictor of fertility, although other factors also play a significant role **Table 3**.

2.5. Age when married:

The age of marriage significantly influences fertility in Sikkim, as shown by statistical analysis. The Odds ratio was found to be **4.09** with **CI 2.17 to 7.7**. This indicates that women who married between the ages of 0-18 are approximately 4.1 times more likely to have children compared to women who married between the ages of 19-50. Confidence Interval (CI) of 2.18 to 7.71 indicates that we are 95% confident that the true odds ratio lies within this range. Since the interval does not include 1, it confirms that the association is statistically significant with a p-value of **< 0.0001**. Thus, marrying at a younger age (0-18) is associated with a significantly higher likelihood of having children compared to marrying at an older age (19-50).

A correlation coefficient of **r=0.58** indicates a moderate to strong positive relationship between marriage at a younger age (0-18) and having children. A positive r value confirms the positive association between younger marriage age and higher fertility, aligning with the odds ratio of 4.09, which also suggests a higher likelihood of having children for those marrying younger. The coefficient of determination $\mathbf{R^2=0.33}$ means that the marriage age can explain 33% of the variability in fertility. This suggests that marriage age is a relatively significant factor in determining fertility in Sikkim **Table 3**.

3.6. Number of Years of Married Life:

Women who are newly married (5 years or less) are significantly less likely to have children than those who have been married for more than five years in Sikkim. Statistical methods validated these results. The Odds ratio was found to be **0.067** with a CI of **0.04 to 0.09**, suggesting that women who are newly married (5 years or less) are much less likely to have children compared to women who have been married for more than five years. Since the CI is well below 1, it confirms that the association is statistically significant with a p-value of <

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

0.0001. The correlation coefficient (r) and coefficient of determination (R^2) have been found to be **-0.9054** and **0.8198**, respectively.

The correlation coefficient **r=−0.9054** indicates a very strong negative relationship between the length of marriage and fertility. This negative correlation means fertility declines significantly as married years decrease (closer to 5 years or less). The R^2 value of **0.8198** means that the length of marriage can explain **81.98%** of the variability in fertility. This indicates that the size of marriage is a highly significant predictor of fertility. Thus, these results highlight that the likelihood of having children increases with the duration of marriage **Table 3**.

3.7. Age of Menarche:

The age of menarche has no significant influence on fertility in Sikkim. Although the odds ratio (**1.3**) is greater than 1, suggesting a higher likelihood of having children (fertility) in women with menarche at 16-20 than in the control age group (5-15). However, the result is not statistically significant due to the wide confidence interval (**0.76 to 2.35**) crossing 1. The p-value (**0.40**) was also not statistically significant. Moreover, the correlation coefficient (r) and coefficient of determination (R^2) was calculated to be **0.04** and **0.002**. these results indicate a very weak positive correlation. The r and R^2 values confirm almost no linear relationship between age at menarche and fertility outcomes **Table 3**.

3.8. Age at Menopause:

It has been shown that age at menopause has some influence on fertility in Sikkim. The Odds ratio was calculated to be **0.6** with CI **0.326 to 1.210.** The correlation coefficient (r) and coefficient of determination were **-0.8** and **0.8,** respectively. An odds ratio of less than 1 (0.6284) implies that pre-menopausal women have a lower likelihood of having children compared to post-menopausal women. This is expected because pre-menopausal women are still in their reproductive years, while post-menopausal women have completed theirs and are more likely to have had children already. This shows that earlier women had more fertility than present women. The fact that the odds ratio is below 1 aligns with the idea that many pre-menopausal women are still in the process of having children, and therefore, their childbearing is not yet complete. However, the CI suggests that the effect may not be significant, with a p-value of **0.20**. This negative correlation coefficient value (-0.8) indicates a strong negative correlation between menopause and fertility outcomes. As women approach menopause, their

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

fertility potential decreases (which is biologically expected). The strong negative correlation and the high R^2 value (0.8) support the idea that menopause substantially affects fertility. Once women reach menopause, their ability to have children decreases, making it one of the determinants of fertility outcomes **Table 3**.

3.9. Loving relationship:

This factor has a positive correlation and thus influences fertility in Sikkim. The Odds ratio was calculated to be **0.5** with a CI of **0.3077 to 0.9782**. The value of 0.5 suggests a protective effect, implying that women in loving relationships are likelier to have children. Women in a loving relationship with their husbands are more likely to have children (since an odds ratio of **0.5** implies that those not in a loving relationship are less likely to have children). Since the confidence interval does not include one and is statistically significant with a p-value of **0.05**, this suggests that being in a loving relationship has a positive association with fertility, and women in such relationships are more likely to have children than those who are not **Table 3**.

3.10. Coital Frequency per month:

Coital frequency (number of days in a month when intercourse) is an essential factor and has a significant positive effect on fertility in Sikkim. The Odds ratio was calculated to be **3.9** with a CI of **2.88 to 5.35.** This odds ratio suggests that women who engage in coitus weekly are 3.93 times more likely to have children than women who engage in coitus less frequently (more than a week apart). This indicates a strong positive association between higher coital frequency and having children. The data shows that women who have weekly sexual activity are significantly more likely to have children compared to those who engage in coitus less frequently (more than a week apart). The odds of having children are nearly four times higher for women with weekly coital frequency, and this result is statistically significant with a pvalue of **<0.0001**. The R^2 was calculated to be **0.8,** indicating that about 80% of the variation in fertility (whether women have children) is explained by coital frequency. This means that coital frequency strongly predicts fertility in our dataset **Table 3**.

3.11. Use of contraceptives:

Based on the data analysis, contraceptive use does not show a clear or significant impact on fertility (in terms of having children). The Odds ratio was calculated to be **0.76** with a CI of **0.55 to 1.05**., The odds ratio of 0.7622 indicates that women who use contraceptives are

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

23.78% less likely to have children compared to those who do not use them. However, the confidence interval (CI) of 0.5508 to 1.055 includes 1, suggesting that the result is not statistically significant at the 95% confidence level with a p-value of **0.118**. This means that, while there appears to be a negative association between contraceptive use and having children, the result is inconclusive and could be due to chance. Further investigation or a larger sample size might be necessary to draw a more definitive conclusion **Table 3**.

3.12. Family planning:

Another important factor is family planning, and here we have analysed how women who opted for family planning consciously affect fertility in Sikkim. The results have shown that this factor significantly and inversely affects fertility in Sikkim. The Odds ratio was calculated to be **0.6** with a CI of **0.46 to 0.88**. This odds ratio suggests that women who use family planning are 35.6% less likely to have children than women who do not. In other words, the odds of having children are reduced among those who use family planning methods. The data shows that women who use family planning are significantly less likely to have children than those who do not. The confidence interval supports the statistical significance of this finding with a p-value of **0.008**, indicating that family planning is effectively associated with reduced fertility **Table 3**.

Discussion:

Early detection of population issues such as fertility is essential for understanding the underlying realities and identifying their root causes. Various demographic and social factors influence fertility rates, which have been studied by social and natural scientists worldwide. In this study, we wanted to highlight different factors affecting fertility among women in Sikkim. According to NFHS 5 data, there is a rapid fall in TFR to 1.1; this consistently dropping fertility rate is a more pressing concern in the state today. The Sikkim government fears that if the current population decline persists, the indigenous population of Sikkim could face extinction within a few decades (Rai et al., 2014). In response, on July 10, 2023, the Government of Sikkim convened a gathering of demographers, fertility experts, doctors, policymakers, and academics from across the country to investigate the causes of declining fertility rates in the state and offer recommendations (GoS, 2023). This suggests that the key factors driving the

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

state's declining fertility must be identified to safeguard the Indigenous population and raise fertility levels to at least the replacement rate of 2.1 children per woman.

Our study may significantly impact and assist experts in formulating different policies to enhance fertility rates in Sikkim. Our study has been divided into two sections. The first section evaluates the overall description of various socio-demographic and economic factors and those related to reproductive and marital factors. The first section estimates the percentage of women respondents surveyed from different districts, within different age groups, within various communities, having any caste-based reservations, etc, as shown in **Fig.1**. Our data represents almost similar estimates as estimated by the NFHS 5 survey. For instance, the NFHS-5 survey results demonstrated a sigmoidal pattern of respondents by age, with the highest percentage in the 25-40 age group. These findings are consistent with our survey results, which show age groups between 26-40 represent the highest percentage (1922%) of respondents surveyed in urban and rural areas indicating the significance of our study results. The NFHS-5 survey results showed a high prevalence of respondents from the OBC (48-52%) and ST (31-38%) categories. These findings also align with our survey results. Among religions, the highest prevalence of respondents was Hindu (56-58%) and Buddhist (24-29%) communities as per NFHS 5 data. These findings are consistent with our survey results, where we have found Hindu respondents the most. According to the NFHS-5 report, the highest percentage of male and female respondents had completed 5-9 years and

12 or more years of schooling in urban and rural areas. Similarly, we have found that around 80% of women in Sikkim have more than 5-9 years of schooling. These findings suggest the significant education among women in Sikkim. Similar to our findings (80%), the NHFS report reveals that a substantial majority of respondents (68-85%) reside in Pucca houses in both urban and rural areas. The NFHS survey findings align with our results, showing that the highest percentage of respondents (64%) who own agricultural land are from rural areas. In contrast, a significantly lower percentage (21%) of respondents owning agricultural land are from urban areas.

The impact of education on fertility is a complex and widely studied topic in research on reproductive behavior (Testa, 2014). While modern contraception has not eliminated socioeconomic differences in fertility rates, college-educated women generally have fewer

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

children than those with only a high school education or less (Yang & Morgan, 2003). Education influences fertility through fertility intentions, but these intentions do not always match actual fertility rates, and there is limited research on this. Evidence shows that highly educated people often plan to have more children than those with less education (Heiland et al., 2008), but they end up having fewer (Bongaarts, 2001; Quesnel-Vallee & Morgan, 2003). Additionally, highly educated women tend to adjust their birth plans downward more often, especially as they approach the end of their reproductive years (Iacovou & Tavares, 2011).

Many studies have explored the relationship between education and fertility, often finding that educated women have lower fertility levels compared to those with less education. For example, a study conducted in Assam, India, found that each additional year of schooling for wives and husbands was associated with a decrease in live births by 0.025 and 0.019, respectively. The reduced fertility among educated women may be linked to their later age at marriage, particularly among women in Assam. Another study suggests that the influence of education on fertility behaviours has not decreased over time and may even have increased. Highly educated women often delay their first childbirth or choose to remain childless to advance their careers. Overall, the tension between career and family appears more pronounced among women with graduate degrees (Impicciatore & Tomatis, 2020). However, in our study, we have also found a similar trend. Education has an inverse effect on fertility in Sikkim, meaning that women with higher education tend to have slightly fewer children. The results show that illiterate women are 2.08 times more likely to have children compared to women with higher education. This indicates that illiterate women are significantly more likely to have children than their educated counterparts. These findings are statistically significant.

Recent global changes have significantly transformed women's status, with women now making up about 40% of the world's workforce, including an increasing number in low- and middle-income countries, particularly in agriculture, manufacturing, and service sectors. Concurrently, global fertility patterns have also changed, with most significant regions experiencing declines in Total Fertility Rates (TFRs) (Morgan, 2003). The link between women's employment and fertility has garnered considerable interest due to their close ties to women's economic and social status. In high-income countries, a well-documented negative correlation exists between women's wage employment and fertility (Ahn & Mira, 2002).

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

Research has shown a significant negative association between women's wage employment and TFR across various regions. Additionally, women's employment is negatively associated with unmet needs for family planning and is positively related to the use of modern contraception.

In India, Yadava et al. (1999) (Yadava & Yadava, 1999)found a difference of about two births in TFR between low and high-status women, highlighting an inverse relationship between decision-making autonomy and fertility levels. Similarly, Banerjee et al. (2023) observed a reverse relationship between educational achievement, employment, socioeconomic status, and primary infertility among women. The present study supports these findings, showing that as women's access to education increases, infertility rates also rise. This trend is attributed to the fact that pursuing higher education often leads women to invest more in their careers, resulting in delayed marriages. Working women are found to have a 20% higher chance of infertility compared to unemployed women (Banerjee et al., 2023) . A similar trend was seen in our results. Income seems to have an inverse effect on fertility in Sikkim, indicating that higher-income women are less likely to have children compared to their lower-income counterparts. Statistical analysis confirms this, showing that high-income women in Sikkim have 44.4% lower odds of having children compared to low-income women. While income is a moderate to strong predictor of fertility in Sikkim, it is important to note that other factors also significantly influence fertility rates.

Similarly, we have studied other parameters like the age of women in Sikkim when married, age at menarche, age at menopause, Number of Years of Married Life, Loving and comfortable physical relationship, Coital Frequency per month, use of contraceptives, Opted

Family planning consciously. The survey results indicate that the optimal age of women in Sikkim (when married) is between 15-30. These results align with the NHFS 5 survey, where the median age at first marriage is 21.5 years among women aged 25-49. The age of marriage substantially influences fertility in Sikkim, as shown by significant statistical analysis. Thus, it has been revealed that marrying at a younger age (0-18) is associated with a significantly higher likelihood of having children than marrying at an older age (19-50) in Sikkim. The reproductive performance and social status of women are influenced mainly by the age at which they first marry or cohabit. Generally, adolescent and early marriages extend the duration of marriage,

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

potentially increasing the number of children born. Conversely, marrying at an older age can increase the risk of birth complications (Islam & Rahman, 2020). Having children at an early age increases fertility but also raises health risks for both the mother and infant. These risks include maternal mortality and morbidity, as well as infant mortality, low birth weight, and child stunting (Fotso et al., 2013). Thus, it is evident that age at first marriage significantly contributes to fertility, mainly in developing countries. A metaanalytical approach was used to study the influence of age at first marriage based on fifteen demographic and health surveys (Islam & Rahman, 2020). This study has concluded that the age at first marriage should be 18 or above, and they propose that when the age at first marriage is high, the duration of marriage life is low, leading to fertility decline. Similar findings have been reported by other studies, such as those by Acharya et al., 2010, which identified an inverse relationship between age at marriage and fertility and child loss. Women who married at an early age tended to have more children and higher rates of child loss (Kumar Acharya, 2010). However, our data suggests that women in Sikkim marry at an optimal age, which is crucial for maintaining fertility rates.

This study revealed that age at menarche does not significantly influence fertility in Sikkim. On the other hand, menopause has little effect on fertility in Sikkim. There is a strong negative correlation between menopause and fertility. Thus, as women near menopause, their fertility declines, which is expected. The high R^2 value (0.8) confirms that menopause has some impact on fertility. Once women reach menopause, their ability to have children decreases significantly. This is expected because pre-menopausal women are still in their reproductive years, while post-menopausal women have finished theirs and are more likely to have already had children. It is known that the optimal age for menarche is around 12.8 years, and most girls experience menarche by the age of 15 (Wyshak & Frisch, 1982). However, the onset of menarche after 16 years is considered delayed and may indicate disrupted maturation of sexual functioning (Sandler et al., 1984). A study based on 2281 healthy married women has shown that women who experienced menarche at the age of 18 or later had a significantly higher incidence of infertility compared to those who had menarche before the age of 18 (Komura et al., 1992). Similarly, another community-based study indicated that an increasing age at menarche was associated with a higher risk of infertility in the study population (Chen et al., 2015). These studies suggest that the age of menarche is an essential factor contributing to

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

fertility. Our data indicates that the age of menarche among women in both rural and urban areas of Sikkim is optimal and occurs at the appropriate time.

Moreover, women in Sikkim are reaching menopause at the appropriate age, which, according to literature, is 45±5 years among Indian women. In many countries, the average age at which women have their first child has risen, while the average age at menopause has remained relatively constant over time (Dratva et al., 2009; Schoenaker et al., 2014). As a result, the window of reproductive years has shortened. It is well established that women's fertility declines as they approach menopause (Broekmans et al., 2007) and that there is significant variation in the age at which women experience menopause (Schoenaker et al., 2014). Research suggests that achieving a spontaneous pregnancy is rare in the decade leading up to menopause (Towner et al., 2016), regardless of the specific age at which menopause occurs (Nikolaou & Templeton, 2003). Therefore, delaying pregnancy until the ages of 35 to 40 may reduce a woman's likelihood of giving birth, especially if she is prone to early menopause. The same pattern has been seen in this study as women in Sikkim approach menopause; their fertility potential decreases and considerably influences fertility.

Loving and having a comfortable physical relationship is another important factor on which fertility may depend. Most children are born within couple relationships, making it essential to study how the characteristics of couples influence fertility decisions. While relationship quality likely plays a role in fertility decisions, it is uncertain whether this influence is positive or negative. Couples with a robust and high-quality relationship may be more inclined to have children, as their partnership provides a supportive environment for raising a child (Myers, 1997), and they may be more willing to make the significant joint commitment that parenthood requires (Lillard & Waite, 1993). On the other hand, couples in lower-quality relationships might choose to have a child as a way to strengthen or revive their union. Lillard and Waite (1993) hypothesized that as the potential instability of marriage increases, the likelihood of conceiving within the marriage decreases. However, Friedman et al. (1994) proposed the opposite hypothesis, suggesting that union instability may lead to earlier childbearing. They introduced the "uncertainty reduction theory of parenthood," which they describe as an alternative rational choice theory of fertility. Friedman et al. suggested that a higher risk of divorce increases the likelihood of couples having children

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

(Friedman et al., 1994). They also believed that couples with solid connections, such as shared finances or common interests, are less likely to have children as a way to strengthen their relationship since they are already closely bonded in other ways. In our survey, around 90% of the respondents from rural and urban areas of Sikkim believe they have loving and comfortable physical relationships. This factor shows a positive correlation and impacts fertility in Sikkim. The statistically significant results indicate that a loving relationship is positively linked to fertility, with women in such relationships being more likely to have children than those not.

Coital frequency has been associated with many factors, including fertility. However, few studies have been published on coital patterns and their associations in contemporary India (Malini SS et al., 2017). Some studies suggest that inconsistent coital frequency increases the risk of unintended pregnancy, thereby impacting fertility rates (Bell & Bishai, 2017). In our research, we also have found relatively inconsistent coital frequencies, with the majority having unmet or met needs between 0-5 days/month, thus may have a possible influence on fertility. Our data analysis reveals that women who engage in weekly sexual activity are much more likely to have children than those who have intercourse less frequently (more than a week apart). Statistical analysis shows that coital frequency accounts for about 80% of the variation in fertility, indicating that it is a strong predictor of fertility in this dataset.

Specifically, family planning among women has increased by 62 per cent. This growing need is increasingly met through modern contraceptive methods. However, global research shows that worries about contraception impacting future fertility influence reproductive decisions, causing some individuals to opt for less effective methods or avoid contraception altogether (Watson et al., 2023). Few studies indicate that the risk of unintended pregnancy associated with increased coital frequency is somewhat reduced. However, higher coital frequencies continued to be associated with the use of contraceptives (Westoff, 1947), thus influencing fertility rates. It has also been shown that total fertility has declined globally (World Family Planning, 2022). In our study, there is considerably less percentage of women taking use of contraceptives. Thus, the less and inconsistent coital frequencies, along with less use of contraceptives, may significantly influence the fertility rate of Sikkim. However, statistical analysis shows that there is no clear or significant impact of contraceptive use on fertility (in terms of the number of children). Although a negative association between contraceptive use

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

and childbearing is observed, the results are inconclusive and could be attributed to chance. Additional research or a larger sample size may be required to reach a more definitive conclusion.

Family planning among women around the world has increased by 10 per cent. This planning is met by usually using modern methods of contraception globally. It has been estimated that the use of modern contraception has doubled (874 million women) worldwide since 1990. It is projected that nearly two-thirds of the anticipated increase in the number of users by 2030 will result from a greater adoption of modern contraceptives (World Family Planning, 2022). This expansion in contraceptive options has highlighted the need for policies that enable women and couples to make informed decisions about family planning. However, our study found a low percentage of women who opt consciously or make informed decisions about family planning. Thus, this might be the significant factor influencing fertility rates in Sikkim. Family planning (FP) programs aim to promote women's rights and empowerment while addressing the imbalance between population growth and essential resources. They provide education, guidance, and easy access to contraceptives, which can help reduce the Total Fertility Rate (TFR). Modern contraceptives are critical to this effort, and research shows that FP programs can lead to increased use of these methods and lower TFR (Muttreja & Singh, 2018). Family planning services are essential for the health and well-being of individuals, families, communities, and nations by helping people plan when to have children and avoid conception when they prefer (Butler & Clayton, 2009).

Studies suggest that improving access to family planning can enhance contraceptive use and reduce fertility. However, there is limited high-quality evidence from randomized trials about the long-term effects of FP programs on fertility and birth spacing. However, research on the Matlab MCH-FP program in Bangladesh has shown significant and lasting reductions in fertility (Nistha Sinha, 2003) and increased birth intervals in the areas where the program was implemented (Karra et al., 2022). However, in our case, 71-80% of respondents surveyed in Sikkim do not opt for family planning consciously. This optimistic outlook suggests a potential increase in the fertility rate among women in Sikkim. However, the NFHS 5 have revealed that the total demand for family planning in Sikkim is around 70-85%, which includes both “UnMet” and “Met” needs for family planning. In our analysis of how family planning choices

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

impact fertility in Sikkim, we found that family planning significantly and negatively affects fertility rates. The data reveals that women who use family planning methods are notably less likely to have children than those who do not. This indicates that family planning is effectively linked to lower fertility rates in Sikkim.

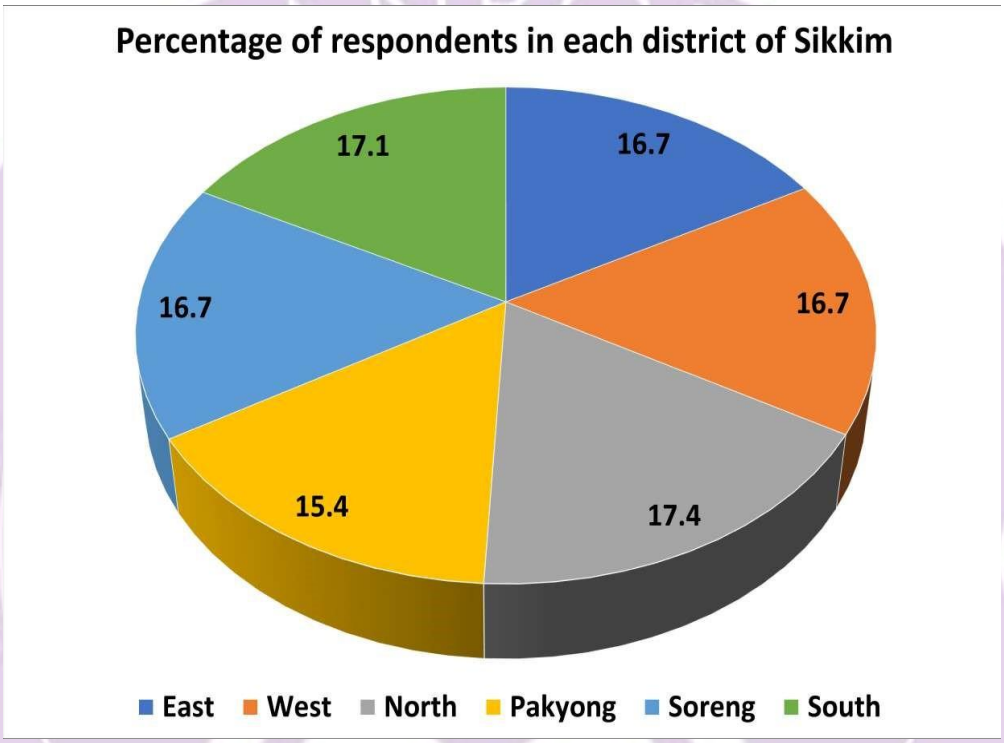
Conclusion:

The survey results provide a comprehensive overview of Sikkim's sociodemographic and economic features across both urban and rural regions. The data highlight the representation of ST and OBC groups, particularly the Lepcha and Rai populations, in these areas. Hinduism and Buddhism dominate the religious landscape, and nuclear families are the most common household structure. Significant differences in housing conditions exist between urban and rural areas, with urban respondents primarily living in pucca houses, while rural respondents are more evenly distributed among pucca, semi-pucca, and kuccha houses. There are also disparities in income and education levels, with urban residents generally having higher income levels and more years of schooling than their rural counterparts. These insights underscore the need for tailored policies and initiatives that address the distinct needs of urban and rural communities in Sikkim, promoting inclusive and sustainable development.

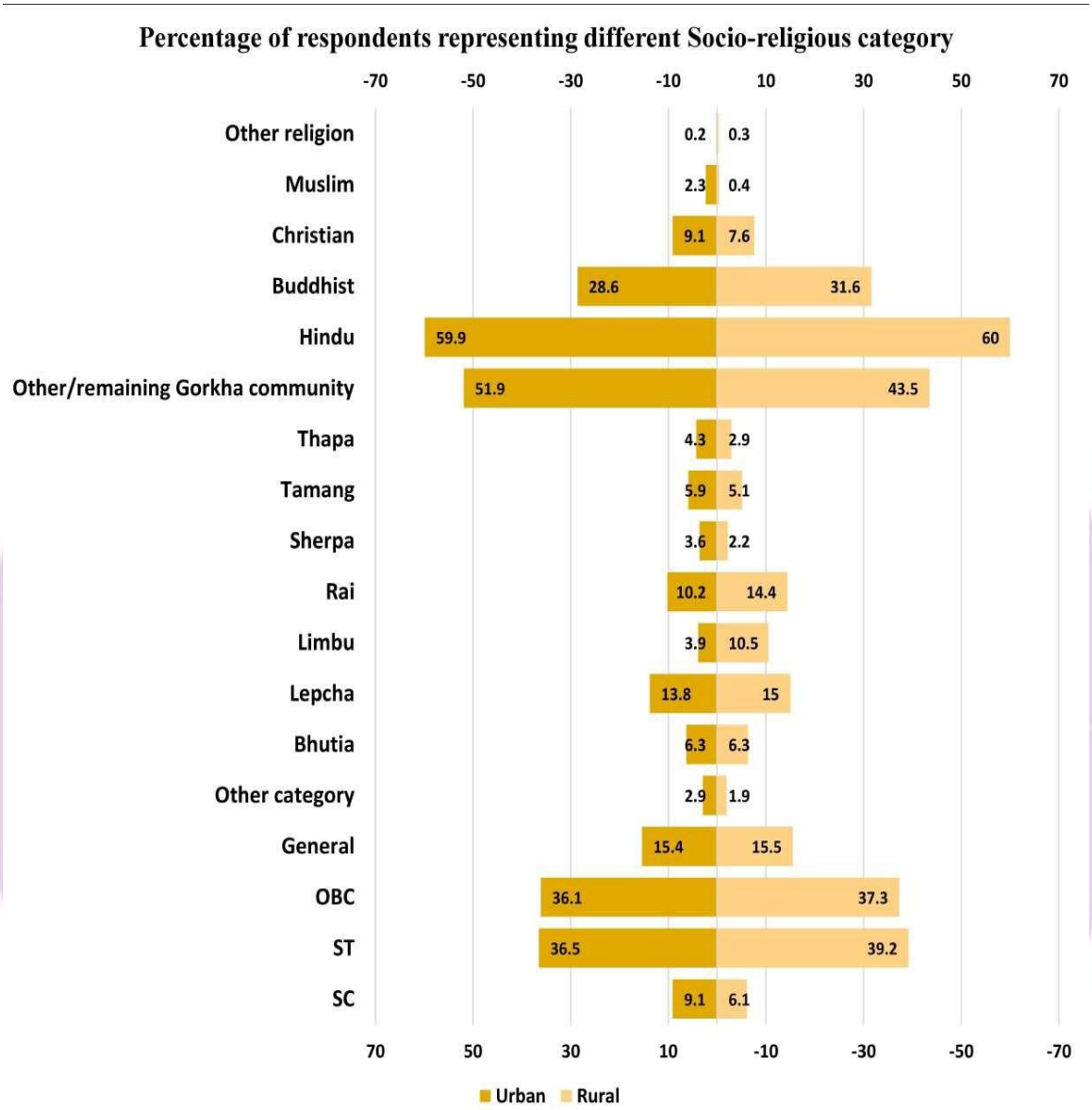
In addition to these broad sociodemographic patterns, the analysis of fertility rates in Sikkim highlights various factors that influence reproductive behaviour. Urban women tend to have lower fertility compared to rural women, reflecting broader social and economic contrasts between these regions. Caste, while present in the demographic landscape, plays a minimal role in influencing fertility, whereas education significantly impacts childbearing, with more educated women generally having fewer children. Income levels also affect fertility, as women with higher incomes tend to have smaller families, suggesting that financial stability influences family size. The age of marriage is another crucial factor, with younger women more likely to have children, while the number of years spent married strongly correlates with childbearing, indicating that longer marriages typically result in more children. Biological factors, such as the age at menopause, play a role in fertility, though social factors like the presence of a loving relationship and frequency of coitus also positively impact the likelihood of having children. On the other hand, the use of family planning methods effectively reduces fertility, underscoring their importance in controlling reproductive outcomes.

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

In conclusion, the fertility patterns in Sikkim are shaped by a complex interplay of social, economic, and biological factors. Tailored policies that address disparities in education, income, and access to family planning, particularly in rural areas, are essential for promoting balanced and sustainable population growth in the state.



GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025



GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

Table 1. Frequency and Percentage Distribution of various parameters like education, income, types of houses, and agricultural land owned.

Percentage of respondents with different Education Levels (Years of Schooling)						
	Urban		Rural		Total	
Categories	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Illiterate	222.0	11.3	28.0	6.3	250.0	10.4
Class X	1159.0	59.1	235.0	53.3	1394.0	58.0
Graduation	515.0	26.3	161.0	36.5	676.0	28.1
Post-graduation	65.0	3.3	17.0	3.9	82.0	3.4
Total	1961.0	100.0	441.0	100.0	2402.0	100.0
Percentage of resp	ondents with Monthly Family Income (in Rs)					
	Urban		Rural		Total	
Categories	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Up to 5K	22	5	371	18.9	393	16.4
5K to 10K	36	8.2	518	26.4	554	23.1
10K to 20K	178	40.4	613	31.3	791	32.9
20K to 50K	196	44.4	394	20.1	590	24.6
50K to 1L	9	2	56	2.9	65	2.7
>1L	0	0	9	0.5	9	0.4
Total	441	100	1961	100	2402	100
Percentage of resp	ondents living in different Types of Houses					
	Urban		Rural		Total	
Categories	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Kuccha	10	2.12	267	13.6	277	11.5
Semi Pucca	77	17.5	680	34.7	757	31.5
Pucca	354	80.3	1,014	51.7	1,368	57
Total (%)	441	100	1,961	100	2,402	100
Percentage of resp	ondents owned Agricultural Land.					

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

	Urban		Rural		Total	
Categories	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
No	234	53.1	418	21.3	652	27.1
Yes	207	46.9	1,543	78.7	1,750	72.9
Total (%)	441	100	1,961	100	2,402	100

Table. 2. Frequency and Percentage Distribution of various marital and reproductive factors.

The Age of Women in Sikkim when married						
Age Category (Years)	Rural		Urban		Total	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
<15	138.0	7.0	36.0	8.2	174.0	7.2
16-20	840.0	42.8	170.0	38.5	1010.0	42.0
21-25	555.0	28.3	117.0	26.5	672.0	28.0
26-30	324.0	16.5	92.0	20.9	416.0	17.3
31-35	72.0	3.7	23.0	5.2	95.0	4.0
>35	32.0	1.6	3.0	0.7	35.0	1.5
Total	1961	100	441	100	2402	100
Age of Menarche						
Age Category (Years)	Rural		Urban		Total	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
<10	25	1.3	1	0.2	26	1.1
10 to 12	614	31.3	108	24.5	722	30.1
13 to 14	1035	52.8	281	63.7	1316	54.8
15-16	256	13.1	44	10.0	300	12.5
17-18	31	1.6	7	1.6	38	1.6
Total	1961	100.0	441	100.0	2402	100.0
Age of Menopause						
Age Category (Years)	Rural		Urban		Total	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

30-40	15	0.8	4	0.9	19	0.8
40-50	150	7.6	29	6.6	179	7.5
Not yet	1796	91.6	408	92.5	2204	91.8
Total	1961	100.0	441	100.0	2402	100.0
Number of Years of Married Life						
Category (Years)	Rural		Urban		Total	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
<5	438.0	22.3	92.0	20.9	530.0	22.1
6-10	370.0	18.9	89.0	20.2	459.0	19.1
11-15	355.0	18.1	94.0	21.3	449.0	18.7
16-20	302.0	15.4	70.0	15.9	372.0	15.5
21-25	246.0	12.5	51.0	11.6	297.0	12.4
26-30	180.0	9.2	37.0	8.4	217.0	9.0
>30	70.0	3.6	8.0	1.8	78.0	3.2
Total	1961.0	100.0	441.0	100.0	2402.0	100.0
Loving and comfortabl e physical relationship						
	Rural		Urban		Total	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Yes	1717	87.6	399	90.5	2116	88.1
No	244	12.4	42	9.5	286	11.9
Total	1961	100	441	100	2402	100
Coital Frequency per month						
Category (days)	Rural		Urban		Total	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
1-7	1210.0	61.7	251.0	61.7	1461.0	60.8
8-14	523.0	26.7	132.0	26.7	655.0	27.3
15-21	29.0	1.5	7.0	1.5	36.0	1.5
22-28	0.0	0.0	0.0	0.0	0.0	0.0

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

29-30	0.0	0.0	0.0	0.0	0.0	0.0
Rarely	199.0	10.1	51.0	10.1	250.0	10.4
Total	1961.0	100.0	441.0	100.0	2402.0	100.0
Use of contraceptives						
	Rural		Urban		Total	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Yes	746	38.0	142	32.2	888	37.0
No	1215	62.0	299	67.8	1514	63.0
Total	1961	100.0	441	100.0	2402	100.0
Opted Family planning consciously						
	Rural		Urban		Total	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Yes	564	28.8	86	19.5	650	27.1
No	1397	71.2	355	80.5	1752	72.9
Total	1961	100	441	100	2402	100
The number of children respondents currently have						
Childs	Rural		Urban		Total	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
		%age		%age		%age
0	161	8.21	22	4.99	183	7.62
1	651	33.20	153	34.69	804	33.47
2	704	35.90	176	39.91	880	36.64
3	292	14.89	65	14.74	357	14.86
4	105	5.35	17	3.85	122	5.08
5	31	1.58	4	0.91	35	1.46

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

6	12	0.61	4	0.91	16	0.67
7	4	0.20	0	0.00	4	0.17
8	1	0.05	0	0.00	1	0.04
Total/%	1961	100.00	441	100.00	2402	100.00

Table 3. Statistical analysis of various parameters is summarised in the table.

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

Parameters	Odds ratio	Confidence Intervals	p-value	r (Correlation coefficient)	R2 (Coefficient of Determination)
Place of Residence	0.591	0.94-0.99	0.023	-	-
Caste Category	0.81	0.54-1.20	0.3	0.03546	0.00126
Community			0.16	0.5	0.35
Financial Stability/Income	0.55	0.4068-0.7588	0.0002	-0.6	0.4
Education	2.085	1.10-3.94	0.012	0.9	0.9
Age when married	4.09	2.17-7.73	< 0.0001	0.58	0.33
Number of Years of Married Life	0.067	0.04-0.09	< 0.0001	-0.9054	0.8198
Age at Menarche	1.3	0.76-2.35	0.4	0.04	0.002
Age at Menopause	0.6	0.32-1.21	0.2	-0.8	0.8
Loving relationship	0.5	0.30-0.97	0.05		
Coital frequency	3.9	2.88-5.35	<0.0001	0.9	0.8
Use of Contraceptives	0.76	0.55-1.05	0.118	-	-
Family planning	0.6	0.46-0.88	0.008	-	-
Caesarean Delivery	0.06748	0.02976-0.1530	<0.0001	-	-
Miscarriages	0.909	0.4954-1.669	0.8	-	-
Health problems during childbirth	0.3228	0.1818-0.5731	<0.0001	-	-
Alcohol consumption	0.46	0.3377-0.6285	<0.0001	-	-

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

Cigarette Smoking	0.67	0.4777-0.9633	0.03	-	-
Healthy lifestyle	3.24	1.687-6.227	0.0005	-	-

Statistical analysis was done using Graph Pad Prism and XLStat. The **odds ratio (OR)** was calculated by taking various parameters in Column 1 as independent variables and Fertility (women with or without children) as a dependent variable. **Confidence interval (CI)** were calculated with a **95%** confidence interval, which provides crucial information about the reliability and precision of the odds ratio (OR). The **p-values** were calculated with a significance threshold set at **0.05**. This means that if the p-value obtained from the statistical test is less than 0.05, the result is considered statistically significant. Linear regression analysis was performed, and the coefficient of determination ($\mathbf{R^2}$) was calculated. $\mathbf{R^2}$ values closer to **1** indicate a strong positive correlation between the independent and dependent variables, suggesting that the model explains a significant proportion of the variance in the dependent variable. A high $\mathbf{R^2}$ value implies that the linear regression model fits the data well, demonstrating a strong predictive accuracy and relationship between the variables. Correlation analysis and the correlation coefficient (r) were calculated. **r** values close to **1** or **-1** indicate a strong linear relationship between the independent and dependent variables, with **r = 1** representing a perfect positive correlation and **r = -1** representing a perfect negative correlation. An **r**-value closer to **0** suggests a weaker or no linear relationship. Thus, a high **r** value signifies a strong association between the variables, indicating that changes in one variable are closely related to changes in the other.

(-) represents that no value was calculated or analysis wasn't conducted due to an inappropriate data structure, preventing proper statistical evaluation.

References:

Adhikari, R. (2010). Demographic, socio-economic, and cultural factors affecting fertility differentials in Nepal. In *Adhikari BMC Pregnancy and Childbirth* (Vol. 10). http://www.biomedcentral.com/1471-2393/10/19

Ahn, N., & Mira, P. (2002). A note on the changing relationship between fertility and female employment rates in developed countries. *J Popul Econ*, *15*, 667–682.

Alkema, L., Raftery, A. E., Gerland, P., Clark, S. J., Pelletier, F., Buettner, T., & Heilig, G. K.

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

(2011). Probabilistic Projections of the Total Fertility Rate for All Countries. *Demography*, *48*(3), 815–839. https://doi.org/10.1007/s13524-011-0040-5

Azmoude, E., Behnam, H., Saeede Barati-Far, B. ;, & Kabirian, M. (2017). The relationship of socio-demographic factors with fertility intention The Relationship of SocioDemographic Factors, Fertility Behavior and Child's Perceived Value with Fertility Intention of Women in a Region in the East of Iran. *IJCBNM April*, *5*(2).

Babu, N. C., & Padma, A. S. (2024). Future prediction of Population, Birth and Fertility rates in India. In *Indian Journal of Community Health* (Vol. 36, Issue 1, pp. 153–155). Indian Association of Preventive and Social Medicine. https://doi.org/10.47203/IJCH.2024.v36i01.025

Banerjee, A. B., Jain, P., Choudhary, K., & Banerjee, A. (2023). Primary Infertility: A Ruralbased Study of Associated Risk Factors in North-west Part of India. *International Journal of Infertility and Fetal Medicine*, *14*(1), 42–46. https://doi.org/10.5005/jp-journals10016-1298

Beard, J. R., Officer, A., De Carvalho, I. A., Sadana, R., Pot, A. M., Michel, J. P., LloydSherlock, P., Epping-Jordan, J. E., Peeters, G. M. E. E., Mahanani, W. R., Thiyagarajan, J. A., & Chatterji, S. (2016). The World report on ageing and health: A policy framework for healthy ageing. In *The Lancet* (Vol. 387, Issue 10033, pp. 2145–2154). Lancet Publishing Group. https://doi.org/10.1016/S0140-6736(15)00516-4

Bell, S. O., & Bishai, D. (2017). Unmet Need and Sex: Investigating the Role of Coital Frequency in Fertility Control. *Studies in Family Planning*, *48*(1), 39–53.
https://doi.org/10.1111/sifp.12012

Bloom, D. E., Canning, D., & Fink, G. (2010). Implications of Population Aging for Economic Growth Population Aging and Economic Growth. *Oxford Rev Econ Policy*, *26*, 583–612. http://www.nber.org/papers/w16705

Blue, L., & Espenshade, T. J. (2011). Population Momentum Across the Demographic Transition. *Popul Dev Rev*, *37*(4), 721–747.

Bongaarts, J., & Hodgson, D. (2022). *Fertility Transition in the Developing World SpringerBriefs in Population Studies*. springer.

Broekmans, F. J., Knauff, E. A. H., te Velde, E. R., Macklon, N. S., & Fauser, B. C. (2007).
Female reproductive ageing: current knowledge and future trends. In *Trends in Endocrinology and Metabolism* (Vol. 18, Issue 2, pp. 58–65). https://doi.org/10.1016/j.tem.2007.01.004

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

Butler, A. Stith., & Clayton, E. Wright. (2009). *A review of the HHS Family Planning Program : mission, management, and measurement of results*. National Academies Press.

Chauhan, B., & Bhutia, D. (2022). Decreasing fertility trend in Sikkim: An area of concern. *BLDE University Journal of Health Sciences*, *7*(2), 262. https://doi.org/10.4103/bjhs.bjhs_5_22

Cheng, H., Luo, W., Si, S., Xin, X., Peng, Z., Zhou, H., Liu, H., & Yu, Y. (2022). Global trends in total fertility rate and its relation to national wealth, life expectancy and female education. *BMC Public Health*, *22*(1). https://doi.org/10.1186/s12889-022-13656-1

Chen, J., Zhong, C., Liang, H., Yang, Y., Zhang, O., Gao, E., Chen, A., Yuan, W., Wang, J., Sun, F., & Miao, M. (2015). The relationship between age at menarche and infertility among Chinese rural women. *European Journal of Obstetrics and Gynecology and Reproductive Biology*, *194*, 68–72. https://doi.org/10.1016/j.ejogrb.2015.08.016

Dharmalingam, A., Rajan, S., & Morgan, S. P. (2014). The Determinants of Low Fertility in India. *Demography*, *51*(4), 1451–1475. https://doi.org/10.1007/s13524-014-0314-9

Dratva, J., Real, F. G., Schindler, C., Ackermann-Liebrich, U., Gerbase, M. W., Probst-Hensch, N. M., Svanes, C., Omenaas, E. R., Neukirch, F., Wjst, M., Morabia, A., Jarvis, D., Leynaert, B., & Zemp, E. (2009). Is age at menopause increasing across Europe? Results on age at menopause and determinants from two population-based studies. *Menopause*, *16*(2), 385–394. https://doi.org/10.1097/gme.0b013e31818aefef

Fotso, J. C., Cleland, J., Mberu, B., Mutua, M., & Elungata, P. (2013). Birth spacing and child mortality: An analysis of prospective data from the nairobi urban health and demographic surveillance system. *Journal of Biosocial Science*, *45*(6), 779–798. https://doi.org/10.1017/S0021932012000570

Friedman, D., Hechter, M., & Kanazawa, S. (1994). A Theory of the Value of Children*. In *Demography* (Vol. 31, Issue 3).

GoS. (2023). *Identifying research priority and roadmap for understanding the declining fertility rates in Sikkim, Report on expert panel meeting*.

Grace Wyshak, & Rose E. Frisch. (1982). Evidence for a secular trend in age of Menarche. *The New England Journal Of Medicine*, *306*(17), 1033–1035.

Gyaltsen Tsh Bhutia, & R K Srivastava. (2014). Migration in Sikkim: Facts or Frictions. *Indian Streams Research Journal*, *4*(3), 1–10. www.isrj.net

ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

Heiland, F., Prskawetz, A., & Sanderson, W. C. (2008). Are individuals' desired family sizes stable? Evidence from West German panel data. *European Journal of Population*, *24*(2), 129–156. https://doi.org/10.1007/s10680-008-9162-x

Impicciatore, R., & Tomatis, F. (2020). The nexus between education and fertility in six European countries. *Genus*, *76*(1). https://doi.org/10.1186/s41118-020-00104-4

International Institute for Population Sciences (IIPS) and ICF. (2021). *National Family Health Survey (NFHS-5) 2019-21*.

Islam, M. A., & Rahman, A. (2020). Age at first marriage and fertility in developing countries: A meta analytical view of 15 Demographic and Health Surveys. *Clinical Epidemiology and Global Health*, *8*(3), 775–779. https://doi.org/10.1016/j.cegh.2020.01.018

Karra, M., Maggio, D., Guo, M., Ngwira, B., & Canning, D. (2022). The causal effect of a family planning intervention on women's contraceptive use and birth spacing. *PNAS*, *119*(22), 1–7. https://doi.org/10.1073/pnas

Keyfitz, N. (1971). ON THE MOMENTUM OF POPULATION GROWTH. In *DEMOGRAPHY* (Vol. 8).

Komura, H., Miyake ', A., Chen ', C.-F., Tanizawa, O., & Yoshikawa, H. (1992). Relationship of age at menarche and subsequent fertility. In *European Journal of Obstetrics & Gynecology and Reproductitie Biology* (Vol. 44).

Kumar Acharya, A. (2010). The Influence of Female Age at Marriage on Fertility and Child Loss in India. *Trayectorias*, *12*(31), 61–80.

Lai, S.-K., Lai, S.-L., & Tey, N.-P. (2014). Socio-Economic and Proximate Determinants of Fertility in the Philippines. *World Applied Sciences Journal*, *31*(10), 1828–1836. https://doi.org/10.5829/idosi.wasj.2014.31.10.591

Lillard, L. A., & Waite, L. J. (1993). A joint model of marital childbearing and marital disruption. *Demography*, *30*(4), 653–681. https://doi.org/10.2307/2061812

Malini SS, Kumar S, & Sreenivasa G. (2017). Insights into Coital Frequency: Whether Coital

Frequency has any Impact on Male Sub-Fertility/Infertility. *Austin Journal of Reproductive Medicine & Infertility*, *4*(1), 1–5. www.austinpublishinggroup.com

Maria Iacovou, & Lara Patrício Tavares. (2011). Yearning, Learning, and Conceding: Reasons Men and Women Change Their Childbearing Intentions. *Population and Development Review*, *37*(1), 89–123.

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

Max Roser. (2014). Fertility rate. *Our world in Data, https://ourworldindata. org/fertility-rate*.

Morgan, S. P. (2003). Is Low Fertility a Twenty-First-Century Demographic Crisis. *Demography*, *40*(4), 589–603.

Muttreja, P., & Singh, S. (2018). Family planning in India: The way forward. In *Indian Journal of Medical Research* (Vol. 148, Issue 7, pp. 1–9). Wolters Kluwer Medknow Publications.
https://doi.org/10.4103/ijmr.IJMR_2067_17

Myers, S. M. (1997). Marital Uncertainty and Childbearing. *Social Forces*, *75*(4), 1271–1289.
http://sf.oxfordjournals.org/

Nikolaou, D., & Templeton, A. (2003). Early ovarian ageing: A hypothesis: Detection and clinical relevance. In *Human Reproduction* (Vol. 18, Issue 6, pp. 1137–1139). Oxford University Press. https://doi.org/10.1093/humrep/deg245

Nistha Sinha. (2003). Fertility, Child Work, and Schooling Consequences of Family Planning Programs: Evidence from an Experiment in Rural Bangladesh nistha sinha. In *economic development and cultural change*. http://www.journals.uchicago.edu/t-and-c

Oura, P. (2021). Sociodemographic Indicators of Birth Rate in a Low Fertility Country–A Nationwide Study of 310 Finnish Municipalities Covering > 5,000,000 Inhabitants. *Frontiers in Public Health*, *9*. https://doi.org/10.3389/fpubh.2021.643561

Rai, P., Paudel, I. S., Ghimire, A., Pokharel, P. K., Rijal, R., & Niraula, S. R. (2014). Effect of gender preference on fertility: Cross-sectional study among women of Tharu community from rural area of eastern region of Nepal. *Reproductive Health*, *11*(1). https://doi.org/10.1186/1742-4755-11-15

Sandler, D. P., W1lcox, A. J., & Horney, L. F. (1984). *AMERICAN JOURNAL OF EPIDEMIOLOGY AGE AT MENARCHE AND SUBSEQUENT REPRODUCTIVE EVENTS 1* (Vol. 119, Issue 5). https://academic.oup.com/aje/article-
abstract/119/5/765/125115

Schoenaker, D. A. J. M., Jackson, C. A., Rowlands, J. V., & Mishra, G. D. (2014). Socioeconomic position, lifestyle factors and age at natural menopause: A systematic review and meta-analyses of studies across six continents. In *International Journal of Epidemiology* (Vol. 43, Issue 5, pp. 1542–1562). Oxford University Press.
https://doi.org/10.1093/ije/dyu094

Shafto, M. A., & Tyler, L. K. (2014). Economic and social implications of aging societies. *Science*, *346*(6209), 587–591. https://doi.org/10.1126/science.1254404

GYANBODH
ISSN:3048-9792
Volume: 2
Issue: 3
May-June:2025

Singh, S., Shekhar, C., Bankole, A., Acharya, R., Audam, S., & Akinade, T. (2022). Key drivers of fertility levels and differentials in India, at the national, state and population subgroup levels, 2015-2016: An application of Bongaarts' proximate determinants model. *PLoS ONE*, *17*(2 February). https://doi.org/10.1371/journal.pone.0263532

Testa, M. R. (2014). On the positive correlation between education and fertility intentions in

Europe: Individual- and country-level evidence. *Advances in Life Course Research*, *21*, 28–42. https://doi.org/10.1016/j.alcr.2014.01.005

Towner, M. C., Nenko, I., & Walton, S. E. (2016). Why do women stop reproducing before menopause? A life-history approach to age at last birth. In *Philosophical Transactions of the Royal Society B: Biological Sciences* (Vol. 371, Issue 1692). Royal Society of London. https://doi.org/10.1098/rstb.2015.0147

Watson, A., Yarger, J., Sedlander, E., Urbina, J., Hopkins, K., Rodriguez, M. I., Fuentes, L., & Harper, C. C. (2023). Concern that contraception affects future fertility: How common is this concern among young people and does it stop them from using contraception? *Contraception: X*, *5*. https://doi.org/10.1016/j.conx.2023.100103

Westoff, C. F. (1947). Coital Frequency and Contraception. *Family Planning Perspectives*, *6*(3), 136–141. http://about.jstor.org/terms

World Family Planning. (2022). *Meeting the changing needs for family planning: Contraceptive use by age and method.*

Yadava, K. N. S., & Yadava, S. S. (1999). Women's Status and Fertility in Rural India. *An International Quarterly*, *4*, 209–228.

Yang, Y., & Morgan, S. P. (2003). How Big Are Educational and Racial Fertility Differentials in the. *Soc Biol*, *50*(3–4), 167–187.