Original Article

DOI: 10.7860/JCDR/2026/82859.24211

Public Health Section

# Utilisation of Antenatal Care Services and Associated Factors among Tribal Women in Sambalpur District, Odisha, India: A Prospective longitudinal Study

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## ABSTRACT

**Introduction:** Antenatal Care (ANC) is a crucial component for maternal and foetal healthcare, yet utilisation among tribal populations remains suboptimal due to socio-cultural, geographical, and economic barriers. The study focuses on three tribal blocks in the Sambalpur district, Odisha, namely Jamankira, Kuchinda, and Bamra, which have a significant tribal population.

**Aim:** To estimate the utilisation of ANC services among the tribal women and to describe the factors associated with the utilisation of ANC services.

**Materials and Methods:** A community-based prospective longitudinal study was conducted under the Department of Community Medicine in tribal villages, which are part of the blocks of Jamankira, Kuchinda, and Bamra of Sambalpur district, Odisha, India, from March 2023 to May 2025. A community-based sample of postpartum mothers (within one month of normal vaginal and caesarean delivery) was taken using the World Health Organisation (WHO) 30-cluster sampling technique. Data were collected using a pre-tested structured questionnaire, which included parameters like socio-economic data, pregnancy history, timing of ANC registration, ANC services (laboratory tests, prophylactic measures like Iron and Folic acid (IFA) tablets, Calcium, deworming, Tetanus toxoid administration, and contraceptive use), and counselling regarding pregnancy. Chi-square test, Fisher's-exact test was used to analyse the data in Statistical Package for Social Sciences (SPSS) version 30.0, and a p-value<0.05 was considered significant.

**Results:** Out of 210 study participants (postpartum mothers), the majority of mothers were aged 25-29 years, 92 (43.8%), Hindu,189 (90%), and lived in three-generation families, 83 (39.5%). Most mothers had a high-school education, 129 (61.4%) and were unemployed, 127 (60.5%). Only 82 (39%) of mothers received comprehensive ANC (≥4 visits with IFA tablets, calcium, deworming, and counselling). Core investigations like blood sugar, urine routine and microscopy test, Human Immunodeficiency Virus (HIV) screening, and blood grouping were universally performed, but prophylactic measures like IFA, 139 (66.2%) and calcium supplementation, 119 (56.7%) had lower coverage. All participants, 210 (100%) received counselling on danger signs, breastfeeding, family planning, and postnatal care. Education, occupation, and parity significantly influenced ANC uptake (p<0.001). Early ANC registration (≤12 weeks) was significantly associated with higher education levels (p=0.027). Multiparous women and those with adverse obstetric histories (abortions, stillbirths) were less likely to receive comprehensive ANC.

**Conclusion:** Despite high diagnostic and counselling coverage, comprehensive ANC utilisation remains low among tribal women in Sambalpur, Odisha. Socio-demographic factors like education and occupation, along with obstetric history, significantly influence ANC uptake. Targeted interventions are needed to improve awareness, accessibility, and adherence to ANC protocols.

**Keywords:** Antepartum, Health disparities, Maternal health services, Odisha

## INTRODUCTION

The ANC is a crucial component of maternal healthcare, aiming to ensure the health and well-being of both the mother and the developing foetus. Globally, ANC services have been recognised as an essential strategy to reduce maternal and neonatal morbidity and mortality. According to the World Health Organisation (WHO), approximately 800 women die from Antepartum and postpartum-related complications around the world every day [1]. ANC is the most important and initial care during pregnancy. It has been noticed that increased coverage and quality ANC can avoid 71% of neonatal deaths, 33% of stillbirths, 54% of maternal deaths in low- and middle-income countries [2]. It can also detect potential complications, provide essential maternal and foetal health interventions, and improve pregnancy outcomes [3]. Studies suggest that early and frequent ANC utilisation significantly reduces the risks of maternal deaths, stillbirths, and neonatal deaths by ensuring skilled birth attendance and timely interventions [4]. The Sustainable Development Goals (SDGs) set by the United Nations aim to reduce the Maternal Mortality Ratio (MMR) to less than 70 per 100,000 live births by 2030 [5]. As per studies, eight or more ANC visits to the health facilities can reduce perinatal deaths by eight per 1000 births when compared to four visits. Approximately 95% of all maternal deaths occurred in low and lower-middle-income countries in 2023 [1]. In 2002, the WHO recommended that pregnant women should attend at least four ANC visits to decrease the chances of MMR and Infant Mortality Rate (IMR) [6]. The global MMR fell from 339 deaths per 100000 live births in 2000 to 223 in 2020. The ratio relatively declined by 34% [1]. In 2020, it was roughly calculated that around 287000 women died during the antepartum and postpartum period globally. According to National Family Health Survey-5 data (2019-2021), the proportion of pregnant women receiving the recommended four or more ANC visits increased from 51% to 59% [7]. As per NFHS-5 data, 78.1% and 49.8% of pregnant women of Odisha had completed

four or more ANC visits to the health facilities and received all recommended types of ANC services, respectively [7].

India has the second-largest tribal population in the world, with the tribal population of Odisha constituting 22% of the state's total population [8-10]. Since there is no study from Odisha estimating the ANC coverage among tribal populations of Odisha, the present study aimed to estimate the utilisation of ANC services among the tribal populations of Odisha and to describe the factors associated with utilisation of ANC services.

**Definition of Comprehensive Antenatal Care (ANC):** Comprehensive ANC is the integrated provision of preventive, diagnostic, educational, psychosocial, and therapeutic services to pregnant women from early pregnancy to delivery, focusing on promoting the best possible maternal and foetal health outcomes. It ensures early detection and management of complications while enhancing maternal well-being [11].

In the present study, a mother has received comprehensive ANC if she had:

1. Registration within the first trimester;
2. A minimum of four ANC contacts;
3. Two doses of Tetanus toxoid vaccination;
4. IFA supplementation (at least 100 tablets);
5. Calcium (180 tablets) and Albendazole supplementation;
6. Monitoring of blood pressure at each visit;
7. Routine urine analysis for protein and glucose;
8. Blood tests (haemoglobin levels, complete blood count, sugar level, blood group, HIV, toxoplasmosis screening);
9. Health education on danger signs, nutrition, breastfeeding, and birth preparedness.

The primary aim of the study was to estimate the utilisation of ANC services among the tribal population and to describe the factors associated with their utilisation.

## MATERIALS AND METHODS

A community-based prospective longitudinal study was conducted under the Department of Community Medicine in tribal villages, which are part of the blocks of Jamankira, Kuchinda, and Bamra of Sambalpur district, Odisha, India, from March 2023 to May 2025. The study was approved by VIMSAR, Burla IEC vide VIREC Decision 164-2022/ I-S-T/ 114/ Dt. 22.05.2023. Participant recruitment commenced after obtaining the IEC approval. Informed written consent of the study participants was obtained after explaining the purpose and nature of the study. They were assured of their confidentiality and anonymity. They were also told that their participation would be voluntary and not compulsory.

**Inclusion criteria:** All postpartum mothers (within one month of normal vaginal and caesarean delivery) were included in the study.

**Exclusion criteria:** Study participants not willing to give informed consent were excluded from the study. Those who were critically ill were also excluded.

**Sample size calculation:** The sample size was calculated using the formula

$n=Z^2pq/d^2$.

The prevalence of full ANC utilisation was taken as 21% based on NFHS-5 data [7]. With a 95% confidence level, 7% absolute precision, and applying a design effect of 1.5 to account for cluster sampling in tribal areas, the calculated sample size was 195. After adding 10% for non response, the final sample size was rounded to 210.

Sampling was done by using the WHO-recommended cluster sampling techniques by the Probability Proportion to Size (PPS) method [12]. Participants were selected using a multistage cluster sampling method to ensure systematic and proportional representation of the tribal population across three tribal blocks of Sambalpur District. These blocks were selected based on their high Scheduled Tribe (ST) population. To select a representative sample from these blocks, 30 clusters were identified, with 10 clusters chosen from each block. Subsequently, seven ANCs were selected from each cluster, resulting in a total sample size of 210 ANCs [13].

### Study Procedure

A predesigned, pretested, structured questionnaire was prepared in the local language. All relevant patient records, i.e., Mother and Child Protection Card (MCP), laboratory investigation reports, along with the consent form and patient information sheet were reviewed during data collection.

**Questionnaire:** The hardcopy of the questionnaire was printed and used for interviewing the postpartum mothers within one month of delivery. The questionnaire contained items on the socio-demographic profile of the patients, pregnancy status of mothers, ANC services being provided to pregnant women, including counselling and contraceptive services, and outcomes of patients receiving the comprehensive ANC. Only a few items in the questionnaire contained two options, and others had multiple options. Since essential items on ANC services contained more than two options, the Cronbach's alpha was not calculated.

**Interview method:** All the postpartum mothers within one month of delivery were interviewed, and their records were examined, and the details were recorded in the questionnaire.

A line listing of all villages in each block, along with their respective population, was prepared using data obtained from the Sub-centre Routine Immunisation (RI) microplan registers. The Sampling Interval (SI) was determined by dividing the total cumulative population of the block by 10 (the required number of clusters per block).

Clusters were selected systematically using the cumulative population list for each block: The first cluster was the village where the cumulative population was equal to or exceeded the SI. Subsequent clusters were identified by adding the SI to the cumulative population of the previous cluster. This process was repeated until 10 clusters were selected for each block. If a selected village cluster doesn't have the required ANC, then select another village cluster with the same number of the population.

In each of the 30 selected clusters, seven cases were chosen systematically using household data maintained by ASHAs or sub-centres. A random starting point within each cluster was determined. From the starting point, using systematic sampling, every $n^{th}$ case was selected. If the list of households was exhausted before reaching the required number, sampling restarted from the beginning.

The first household was selected randomly from the 1$^{st}$ cluster as suggested by the WHO cluster sampling technique, and subsequent households were selected by visiting every 10$^{th}$ household in a clockwise fashion until a total of seven eligible cases in one cluster were completed. Similar patterns were followed until 10 clusters (70 households) were completed for each block, until a sample size of 210 was reached. In case of non response or denial, the next household was chosen [12,14].

**Data collection:** Then the principal investigator conducted a face-to-face interview to fill out using a pre-designed, pre-tested structured questionnaire (total of four sections containing 61 question items) in the local language in the field. The collected data were entered in Excel sheets and checked for completeness.

**Variables:** Socio-demographic (age, religion, family type, education, occupation, income, and socio-economic status classification as per modified Kuppuswamy Scale updated for 2023) [15], pregnancy status (gravida, parity, abortions, live births, stillbirths, pregnancy interval), IFA, calcium, tetanus and diphtheria vaccine (Td vaccine), health education and counselling, comprehensive ANC, timing of ANC registration.

## STATISTICAL ANALYSIS

The data were entered in MS Excel and analysed in IBM SPSS version 30.0. (Chicago, Inc., USA). The data were checked for normalcy using the Kolmogorov-Smirnov test (sample size>50). Descriptive statistics are presented in the form of mean, Standard Deviation (SD), minimum, and maximum values for continuous variables. For categorical variables, frequency and percentage were mentioned. Chi-square test was used to compare two categorical variables. A p-value of <0.05 was considered statistically significant, and a p-value of <0.001 was considered highly significant.

## RESULTS

The socio-demographic variables of 210 study participants are depicted [Table/Fig-1]. The mean age of the mothers was 27.7±4.08 years. Most of the mothers, i.e., 92 (43.8%), were between 25-29 years of age, followed by 59 (28.1%) who were 30-34 years old. About 48 (22.8%) were aged 20-24 years, while 10 (4.8%) were aged 35 years or older, and only 1 (0.5%) was younger than 20 years. In terms of religion, the majority of the participants were Hindu 189 (90%), followed by Christians 20 (9.5%), with Muslims comprising only 1 (0.5%) of the sample. The majority of the participants, 83 (39.5%), belonged to three-generation families, while 73 (34.8%), lived in joint families, and the rest lived in nuclear families, 54 (25.7%). Regarding educational status, 129 (61.4%) had been educated up to high school, while 27 (12.9%) had studied up to middle school, 26 (12.4%) had studied up to the intermediate level, 16 (7.6%) had primary school education, and 12 (5.7%) were graduates, respectively. As per occupation, 127 (60.5%) of the mothers were unemployed. Among those employed, 29 (13.8%) were skilled workers, 26 (12.4%) were engaged in elementary occupations, 21 (10%) were craft and related trade workers, and 7 (3.3%) were associate professionals. Concerning socio-economic status, the majority of the participants, 122 (58.1%), belonged to the upper lower class, 50 (23.8%) were from the lower class, 33 (15.7%) belonged to the lower middle class, and only 5 (2.4%) were from the upper middle class.

| Variables | n (%) |
|---|---|
| **Mother's age (in years) (Mean±SD)** | 27.7±4.08 |
| <20 | 1 (0.5) |
| 20-24 | 48 (22.8) |
| 25-29 | 92 (43.8) |
| 30-34 | 59 (28.1) |
| ≥35 | 10 (4.8) |
| **Religion** | |
| Hindu | 189 (90.0) |
| Muslim | 1 (0.5) |
| Christian | 20 (9.5) |
| **Type of Family** | |
| Nuclear | 54 (25.7) |
| Joint | 73 (34.8) |
| Three generation | 83 (39.5) |
| **Mother's education** | |
| Primary School | 16 (7.6) |
| Middle school | 27 (12.9) |
| High school | 129 (61.4) |
| Intermediate | 26 (12.4) |
| Graduate | 12 (5.7) |
| **Mother's occupation** | |
| Associate professionals | 7 (3.3) |
| Craft and related trade worker | 21 (10.0) |
| Elementary occupation | 26 (12.4) |
| Skilled workers | 29 (13.8) |
| Unemployed | 127 (60.5) |
| **Socio-economic status** | |
| Upper middle | 5 (2.4) |
| Upper lower | 122 (58.1) |
| Lower middle | 33 (15.7) |
| Lower | 50 (23.8) |

**[Table/Fig-1]:** Socio-demographic characteristics of study participants (N=210). Frequency and percentages were calculated. Mean and SD were calculated for the age of participants

The biochemical investigations and prophylaxis evaluation conducted during ANC check-ups among the 210 study participants are shown in [Table/Fig-2]. It was observed that haemoglobin estimation (Hb%) was performed for 195 (92.9%) of the women, while 15 (7.1%) did not undergo this test. Blood grouping, Rh typing, blood sugar testing (75 g glucose challenge test), urine examination (routine and microscopy), and HIV screening were performed for all participants (100%), with no participants missing these investigations. Regarding vaccination, 159 (75.7%) of the women received Tetanus Toxoid (Td) vaccination (either two doses or one dose as per guidelines), while 51 (24.3%) did not receive it. VDRL testing for syphilis was conducted in 192 (91.4%) of the participants, with 18 (8.6%) not undergoing the test. Screening for toxoplasmosis was performed in 190 (90.5%) of the women, whereas 20 (9.5%) were not tested. In terms of prophylaxis, 143 (68.1%) of the participants received deworming treatment with albendazole, while 67 (31.9%) did not. IFA supplementation was provided to 139 (66.2%) of the women, whereas 71 (33.8%) did not receive it. Calcium supplementation was given to 119 (56.7%) of the participants, while 91 (43.3%) did not receive calcium tablets. Overall, while most essential investigations were completed for nearly all participants, there was a notable gap in the coverage of prophylactic measures, especially in deworming, IFA supplementation, and calcium supplementation during ANC check-ups. Counselling of mothers on different areas of health education was provided during their ANC visits. It was found that all participants (100%) received counselling across all major areas. Specifically, every participant was counselled about danger signs during pregnancy, birth preparedness and emergency readiness, breastfeeding practices, and the importance of postnatal care. There were no participants who missed counselling in any of these areas, indicating that counselling and health education services during ANC visits were comprehensively and uniformly delivered to all the women in the study. Contraceptive use and counselling on family planning among the 210 study participants reported 100% education on contraceptive use, and also received counselling on family planning.

| Investigations during ANC check-ups (Yes/No) | Yes n (%) | No n (%) |
|---|---|---|
| **Blood picture** | | |
| Haemoglobin (Hb%) | 195 (92.9) | 15 (7.1) |
| Blood grouping, Rh typing | 210 (100) | 0 |
| Blood sugar (75 g GCT) | 210 (100) | 0 |
| Urine examination (routine and microscopy) | 210 (100) | 0 |
| Human Immuno-deficiency Virus (HIV) screening | 210 (100) | 0 |
| VDRL | 192 (91.4) | 18 (8.6) |
| Toxoplasmosis | 190 (90.5) | 20 (9.5) |
| **Prophylaxis** | | |
| Deworming (Albendazole prophylaxis) | 143 (68.1) | 67 (31.9) |
| Tetanus Toxoid (Td) vaccination (2 doses/1 dose) | 159 (75.7) | 51 (24.3) |
| Iron and Folic Acid (IFA) tablets | 139 (66.2) | 71 (33.8) |
| Calcium tablets | 119 (56.7) | 91 (43.3) |
| **Counselling and Health education** | | |
| Danger signs during pregnancy | 210 (100) | 0 |

| | | |
|---|---|---|
| Birth preparedness and emergency readiness | 210 (100) | 0 |
| Breastfeeding | 210 (100) | 0 |
| Postnatal care | 210 (100) | 0 |
| **Contraceptive use and counselling on family planning** | | |
| Contraceptive use | 210 (100) | 0 |
| Counselling on family planning | 210 (100) | 0 |

**[Table/Fig-2]:** Different ANC services provided during ANC check-ups among the study participants (N=210).
Frequency and percentages were calculated for Yes or No responses; n = number of subjects

The percentage of participants who have received comprehensive ANC among the 210 study participants is described in [Table/Fig-3]. It was observed that only 82 participants (39.0%) received comprehensive ANC, while the majority, 128 participants (61.0%), did not receive comprehensive care.

The association of socio-demographic characteristics of the 210 study participants was shown in [Table/Fig-4]. Regarding the type of family, 18 (33.3%) from nuclear families, 32 (43.8%) of women from joint families, and 32 (38.6%) from three-generation families received comprehensive ANC. Similarly, 36 (66.7%) from nuclear families, 41 (56.2%) of women from joint families, and 51 (61.4%) from three-generation families did not receive comprehensive care. The association between the type of family and comprehensive ANC was not statistically significant ($\chi^2$=1.452, p=0.484). In terms of the education of the mother, 9 (75%) of graduates, 17 (65.4%) of those with intermediate education, 48 (37.2%) of high school-educated mothers, 6 (22.2%) of middle school-educated mothers, and 2 (12.5%) of primary school-educated mothers received comprehensive care. On the other hand, among those who did not receive comprehensive care, 3 (25%) were graduates, 9 (34.6%) had intermediate education, 81 (62.8%) had high school education, 21 (77.8%) had middle school education, and 14 (87.5%) had primary school education. This association was found to be highly significant ($\chi^2$=22.227, p<0.001). Regarding the occupation of the mother, 6 (85.7%) of associate professionals, 12 (57.1%) of craft and related trade workers, 3 (11.5%) of elementary occupation workers, 17 (58.6%) of skilled workers, and 44 (34.6%) of unemployed women received comprehensive care. Among those who did not receive comprehensive care, 1 (14.3%) were associate professionals, 9 (42.9%) were craft and related trade workers, 23 (88.5%) were engaged in elementary occupations, 12 (41.4%) were skilled workers, and 83 (65.4%)

| Comprehensive Antenatal Care (ANC) | n (%) |
|---|---|
| Comprehensive care received (Yes) | 82 (39) |
| Comprehensive care not received (No) | 128 (61) |
| Total | 210 (100) |

**[Table/Fig-3]:** Percentage of comprehensive Antenatal Care (ANC) of study participants (N=210).

| Socio-demographic variables | | Comprehensive ANC care Received n (%) | Comprehensive ANC care not received n (%) | Test used | p-value |
|---|---|---|---|---|---|
| **Type of family** | | | | | |
| Nuclear | | 18 (33.3%) | 36 (66.7%) | $\chi^2$-test | 0.484NS |
| Joint | | 32 (43.8%) | 41 (56.2%) | | |
| 3-generation | | 32 (38.6%) | 51 (61.4%) | | |
| **Mother's education** | | | | | |
| Graduate | | 9 (75%) | 3 (25%) | $\chi^2$-test | <0.001* |
| Intermediate | | 17 (65.4%) | 9 (34.6%) | | |
| High school | | 48 (37.2%) | 81 (62.8%) | | |
| Middle school | | 6 (22.2%) | 21 (77.8%) | | |
| Primary school | | 2 (12.5) | 14 (87.5%) | | |
| **Mother's occupation** | | | | | |
| Associate professionals | | 6 (85.7%) | 1 (14.3%) | Fisher's- exact | <0.001* |
| Craft and related trade worker | | 12 (57.1%) | 9 (42.9%) | | |
| Elementary occupation | | 3 (11.5%) | 23 (88.5%) | | |
| Skilled workers | | 17 (58.6%) | 12 (41.4%) | | |
| Unemployed | | 44 (34.6%) | 83 (65.4%) | | |
| **Socio-economic status** | | | | | |
| Lower | | 15 (30%) | 35 (70%) | $\chi^2$-test | 0.387NS |
| Lower middle | | 13 (39.4%) | 20 (60.6%) | | |
| Upper lower | | 51 (41.8%) | 71 (58.2%) | | |
| Upper middle | | 3 (60%) | 2 (40%) | | |
| Parity | Primiparous | 31 (52.5%) | 28 (47.5%) | Fisher's-exact | 0.0178* |
| | Multiparous | 51 (33.8%) | 100 (66.2%) | | |
| Abortions | No abortion | 68 (45.3%) | 82 (54.7%) | Fisher's-exact | 0.0031* |
| | Abortion present | 14 (23.3%) | 46 (76.7%) | | |
| Live births | <2 live births | 72 (43.1%) | 95 (56.9%) | Fisher's-exact | 0.0221* |
| | >2live births | 10 (23.3%) | 33 (76.7%) | | |
| Stillbirths | No stillbirths | 80 (41%) | 115 (59%) | Fisher's-exact | 0.05 |
| | Still births present | 2 (13.3%) | 13 (86.7%) | | |
| Pregnancy interval | <3years | 49 (43%) | 65 (57%) | Fisher's-exact | 0.256NS |
| | >3 years | 33 (34.4%) | 63 (65.6%) | | |

**[Table/Fig-4]:** Association of socio-demographic characteristics with comprehensive Antenatal Care (ANC) (N=210).
Frequency and percentages were calculated for ANC care received vs not received. Pearson's Chi-square test was used to compare the proportions. Fisher's-exact test was applied for 2*2 tables. A p-value of < 0.05 was considered statistically significant.

were unemployed. This association between occupation and comprehensive ANC was also statistically significant ($\chi^2$=23.263, p<0.001). As per socio-economic status, 15 (30%) of women from the lower class, 13 (39.4%) from the lower middle class, 51 (41.8%) from the upper lower class, and 3 (60%) from the upper middle class received comprehensive care. In comparison, among those who did not receive comprehensive care, 35 (70%) were from the lower class, 20 (60.6%) from the lower middle class, 71 (58.2%) from the upper lower class, and 2 (40%) from the upper middle class. The association between socio-economic status and comprehensive ANC was not statistically significant ($\chi^2$=3.033, p=0.387). Regarding parity, 31 (52.5%) of primiparous women and 51 (33.8%) of multiparous women received comprehensive ANC. Among those who did not receive comprehensive care, 28 (47.5%) were primiparous, and 100 (66.2%) were multiparous. This association was statistically significant ($\chi^2$=6.278, p=0.012). In terms of abortion history, 68 (45.3%) of women without a history of abortion received comprehensive ANC compared to 82 (54.7%) who did not receive it. Among those with a history of abortion, 14 (23.3%) received comprehensive care, while 46 (76.7%) did not. This association was found to be significant ($\chi^2$=8.715, p=0.003). Considering the number of live births, 72 (43.1%) of women with two or fewer live births received comprehensive care compared to 95 (56.9%) who did not. Among women with more than two live births, 10 (23.3%) received comprehensive care, while 33 (76.7%) did not. This association was also statistically significant ($\chi^2$=5.66, p=0.017). For the history of stillbirths, 80 (41%) of women without a history of stillbirths received comprehensive ANC, compared to 115 (59%) who did not. In contrast, among those with a history of stillbirths, 2 (13.3%) received comprehensive care, and 13 (86.7%) did not. This association was significant ($\chi^2$=4.48, p=0.034). However, regarding the pregnancy interval, 49 (43%) of women with an interval of less than three years and 33 (34.4%) with an interval of three years or more received comprehensive care. Among those who did not receive comprehensive care, 65 (57%) had an interval of less than three years, and 63 (65.6%) had an interval of three years or more. The association between pregnancy interval and comprehensive ANC was not statistically significant ($\chi^2$=1.622, p=0.203).

The association of the timing of ANC registration with the highest level of education was shown in [Table/Fig-5]. It was found that 11 (91.6%) of graduates registered early (within the first trimester), while 1 (8.4%) registered late (in the second trimester). Most of the high school-completed mothers, i.e., 106 (82.2%), registered early, and 23 (17.8%) registered late. Those mothers who had completed intermediate education, i.e., 26 (100%) registered early, followed by middle school education, 22 (81.5%), and primary school, 10 (62.5%), respectively. The association between the timing of ANC registration and the education level was found to be statistically significant, with a Chi-square ($\chi^2$) value of 10.992 and a p-value of 0.027. This suggests that the education level significantly influenced whether mothers registered early or late for ANC.

| Highest level of education | Time of ANC registration | | $\chi^2$-test | p- value |
|---|---|---|---|---|
| | Early registration (≤12 weeks) 1st Trimester n (%) | Late registration (>12 weeks) 2nd Trimester n (%) | | |
| Graduate | 11 (91.6%) | 1 (8.4%) | 10.992 | 0.027* |
| Intermediate | 26 (100%) | 0 | | |
| High school | 106 (82.2%) | 23 (17.8%) | | |
| Middle school | 22 (81.5%) | 5 (18.5%) | | |
| Primary school | 10(62.5%) | 6 (37.5%) | | |

**[Table/Fig-5]:** Association of timing of ANC registration and education.
Frequency and percentages were calculated for early registration vs late registration according to the education status of participants. Pearson's Chi-square test was used to compare the proportions. A p-value of < 0.05 was considered statistically significant

## DISCUSSION

The present study was conducted to assess the socio-demographic profiles, biochemical investigations, prophylactic interventions, and the extent of comprehensive ANC received by 210 postnatal mothers. The findings highlighted important gaps in the quality of comprehensive ANC provided and highlighted how factors like education, occupation, and obstetric history on service utilisation affect this care.

The analysis revealed that the majority of mothers were in the age group of 25-29 years (43.8%), which aligns with national reproductive trends, where early to mid-reproductive age accounts for the highest fertility rates. NFHS-5 data corroborates this, reporting peak fertility in women aged 25-29 across most Indian states [7,15]. Most belonged to the Hindu religion (90%) and lived in extended (three-generation) or joint families (74.3%), reflecting the dominant cultural and familial structures in semi-urban and rural settings across India. Similar results were reported in a study by Bashir S et al., [16]. Educational status was varied, but the predominance of high school-level education (61.4%) over graduate-level education (5.7%) reveals educational disparities that potentially affect ANC compliance and outcome.

**Educational attainment strongly influenced health behaviour:** 75% of graduates received comprehensive ANC as opposed to only 12.5% among primary-educated mothers, echoing findings, early ANC registration in 91% of graduates. Similar reports were also presented by Yadav AK et al., [17].

The results indicated that essential biochemical investigations for ANC, such as blood grouping, glucose challenge test, urine microscopy, and HIV screening, were universally performed among 210 mothers. Haemoglobin estimation, VDRL, and toxoplasmosis screening were conducted in over 90% of participants. These findings were consistent with the findings of a study done by Mohanty S et al., which showed Haemoglobin (Hb) level, blood grouping, glucose challenge test, and HIV were estimated in 96.5%, 93.5%, 96.0% and 98.5%, respectively [2]. However, important prophylactic measures like IFA supplementation (66.2%) and calcium supplementation (56.7%) were lacking in a significant proportion. Deworming coverage was also sub-optimal (68.1%). These findings are consistent with the NFHS-5 report, which showed variable coverage across Indian states for IFA and calcium supplementation, often dipping below 60% despite government schemes [1]. Low uptake may be attributed to supply chain issues, lack of counselling, or non compliance, highlighted in similar regional studies. This trend of partial prophylaxis coverage has been reported previously by Kumar G et al., who found that only 64% of mothers received IFA and 59% received deworming treatment [18].

Furthermore, despite high ANC visits, the quality and consistency of prophylactic supplementation still need strengthening. Although counselling coverage was reportedly 100% in all domains (danger signs, breastfeeding, family planning, postnatal care), the overall proportion of women receiving comprehensive ANC (defined as ≥4 visits with appropriate interventions) was only 39%. This underscores a gap between ANC service delivery and utilisation. Similar discrepancies between counselling rates and practical ANC utilisation have been noted in other studies [19].

In our study, only 39% received comprehensive ANC in line with established guidelines, indicating a gap in service integration. A study in West Bengal by Pal S et al., reported comprehensive ANC coverage of 29.1%, and a study by Nihal S et al., reported 32% of mothers received adequate ANC, similar to the current study findings [20,21]. Kumar G et al., reported only 21% of pregnant women utilised full ANC services in the National Family Health Survey 4 conducted in 2015-16 [18].

Education played a critical role in timely ANC registration and comprehensive care. The result revealed that early registration

was significantly more frequent among women with higher education (p=0.027). Moreover, it showed that graduate women were significantly more likely to receive comprehensive ANC (75%) compared to those with only primary education (12.5%) (p <0.001). Studies by Chopra I et al., and Varma GR et al., also found that the education of the mother is a major determinant of ANC use in India [22,23].

Among the obstetric parameters, parity, history of abortion, live births, and stillbirths significantly influenced the utilisation of comprehensive care (p<0.05). Girotra S et al., reported similar findings, where multiparous women received inadequate ANC services compared to primiparous women [24]. Mulat G et al., reported that mothers with a history of abortion had higher ANC services utilisation, consistent with findings from the present study [25].

### Limitation(s)

The study's longitudinal design limits causal interpretations. Recall bias may have affected responses, as data were collected retrospectively from postnatal mothers. Findings are based on three tribal blocks in Sambalpur and may not be generalisable to other regions. Exclusion of ANC dropouts and reliance on self-reported data may have led to underreporting or overreporting of service utilisation.

## CONCLUSION(S)

Despite adequate investigation and counselling, the utilisation of comprehensive ANC services among the tribal population in Sambalpur district remains low at 39%. Socio-demographic and obstetric factors play a significant role in determining ANC uptake. There is a critical need for targeted intervention to improve awareness, accessibility, and adherence to ANC protocols among tribal women to bridge this gap. To improve ANC utilisation among tribal women, culturally tailored health education should target early registration, especially among multiparous and less educated women. Ensuring an uninterrupted supply of IFA, calcium, and deworming tablets through ASHAs and health sub-centres is crucial. Modifying schemes like Janani Suraksha Yojana (JSY) and Pradhan Mantri Matru Vandana Yojana (PMMVY) to incentivise first-trimester registration is recommended. Real-time monitoring at Primary Health Care (PHC)/sub-centre levels should be implemented for accountability. Training frontline workers in culturally sensitive counselling and using mobile reminders and telemedicine can bridge service gaps in inaccessible areas.

### Acknowledgement

The authors acknowledge with gratitude the cooperation given by the participants and the support of ASHAs and ANMs during the conduct of the present study.

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**PLAGIARISM CHECKING METHODS:** [Jain H et al.]
- Plagiarism X-checker: Aug 25, 2025
- Manual Googling: May 09, 2026
- iThenticate Software: May 12, 2026 (8%)

**ETYMOLOGY:** Author Origin

**EMENDATIONS:** 8

**AUTHOR DECLARATION:**
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Aug 20, 2025**
Date of Peer Review: **Oct 15, 2025**
Date of Acceptance: **May 14, 2026**
Date of Publishing: **Aug 01, 2026**