

Individual and community-level factors associated with ovulatory phase knowledge among women of reproductive age in Ethiopia: a multilevel analysis of 2024–25 Ethiopian Demographic and Health Survey data

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Research Article

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Abstract

Background

Correct knowledge of the ovulatory phase is essential for women seeking to manage their fertility, whether to conceive a child or to use it as a contraceptive by abstaining from sexual intercourse on the suspected dates. Comprehensive national evidence regarding ovulatory phase knowledge in Ethiopia using the recent 2024–25 EDHS data remains limited. Therefore, this study investigated the prevalence and hierarchical individual and community-level factors associated with ovulatory phase knowledge among women of reproductive age in Ethiopia.

Methods

Multilevel mixed-effects logistic regression analysis was conducted using the Individual Recode dataset of the 2024–25 Ethiopia Demographic and Health Survey, comprising a weighted sample of 21,395 reproductive-aged women nested in 797 clusters. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were employed to assess the associations between independent variables and ovulatory phase knowledge. Statistical significance was determined at a p-value of less than 0.05. All data analyses were performed using STATA version 17 software.

Results

The prevalence of correct ovulatory phase knowledge among Ethiopian reproductive-age women was 34.73% (95% CI: 33.68–35.78%). Individual-level predictors such as women's aged 30–39 years (AOR: 1.20, 95% CI: 1.03–1.40), secondary or higher education (AOR: 2.04, 95% CI: 1.66–2.51), mobile phone ownership (AOR: 1.20, 95% CI: 1.03–1.39), smartphone ownership (AOR: 1.25, 95% CI: 1.06–1.47), knowledge of any contraceptive methods (AOR: 3.74, 95% CI: 2.01–6.93), gravidity (primigravidity (AOR: 1.37, 95% CI: 1.08–1.73) and multigravidity (AOR: 1.45, 95% CI: 1.16–1.81)), and recent menstruation in the previous six months (AOR: 1.27, 95% CI: 1.09–1.47) were associated with ovulatory phase knowledge. Women with an early sexual debut (< 18 years) had significantly lower odds of possessing ovulatory phase knowledge (AOR: 0.87, 95% CI: 0.75–0.99). Furthermore, significant community-level factors were high media exposure (AOR: 1.34, 95% CI: 1.05–1.70) and regional variations, with women residing in Oromia (AOR: 6.24, 95% CI: 4.33–8.99) and Dire Dawa (AOR: 2.90, 95% CI: 1.92–4.36) exhibiting the highest odds compared to Tigray.

Conclusion

The prevalence of ovulatory phase knowledge among Ethiopian women remains low, with significant determinants including women's age, educational level, mobile phone ownership, smartphone ownership,

knowledge of any contraceptive method, gravidity, recent menstruation within the preceding six months, community media exposure, and regional disparities. Fertility awareness educational interventions among reproductive-aged women should prioritize young women, uneducated individuals, those without access to mobile phones, and those without media exposure.

Introduction

The female monthly sexual cycle, also called the menstrual cycle, comprises two harmonized sub-cycles: the ovarian cycle and the endometrial cycle. The ovarian cycle consists of three phases: the follicular phase (follicular and egg development), the ovulatory phase (release of egg from an ovary), and the luteal phase (after the release of an egg and ends at menses) (1). Normally this cyclic change occurs every 24–38 days (average 28 days) (2). In an average 28-day cycle, ovulation typically occurs 14 days prior to the onset of menses; thus, ovulation occurs at the middle of the cycle on day 14 (1). Synchronously, the endometrial cycle consists of the proliferative phase, the secretory phase, and the menstrual phase (3). Ovulation is a physiologic process characterized by the rupture and release of an egg from the dominant follicle of the ovary. The released egg from the ovary is swept into the fallopian tube, where it has the potential to become fertilized (4). Even perfect confirmation of ovulation via serial transvaginal ultrasonography, serum luteinizing hormone measurement, or laparoscopic follicular visualization is impractical for contraception purposes, whereas physiological indicators such as urine LH surge, cervical mucus changes, and basal body temperature are commonly tracked (5).

Fertile period ranges from 5 days prior to ovulation up to 2 days after ovulation, during which sexual intercourse can result in fertilization. Human sperm can survive in the female reproductive tract up to 5 days, while the unfertilized egg can be viable for a maximum of 2 days after release from the ovary (1). Abstaining from sexual intercourse in the fertile period and practicing sexual intercourse on other days of the cycle is the main benefit of having knowledge about the ovulatory phase. Having knowledge about the ovulatory phase for a woman is important to conceive a child by engaging in sexual intercourse or to practice as a contraceptive by abstaining from sexual intercourse on the expected dates (6). This type of contraceptive is known as the rhythm method or periodic abstinence. It is also considered as the natural family planning that includes basal body temperature, mucus, and sympto-thermal methods (7). The advantage of the rhythm method over the hormonal contraceptives is their complete absence of medical side effects or procedural risks, making them a prepared strategy for women in resource-limited areas or those with religious preferences against modern contraceptives (5). Identifying the fertile window helps a woman to make an informed decision about the timing of sexual intercourse, whether to achieve conception or prevent unintended pregnancy through the fertility awareness method. Correct understanding and abstinence during fertile periods is vital for effectiveness (7). A lack of ovulatory phase knowledge can lead to unintended pregnancies among both married and unmarried couples. The consequences are particularly harsher for unmarried women due to pervasive stigma as a result of premarital pregnancy, which increases the risk of unsafe abortion and related reproductive complications (8, 9).

Worldwide, the prevalence of knowledge regarding the ovulatory phase varies across different countries, with the majority of women lacking proper information. Even in developed countries the prevalence showed that less than almost two-thirds of the women knew the timing of ovulation, 59% in UK (10) and 60.6% in USA (11). There was also gap in knowledge of ovulatory phase in LMICs such as 21.2% in India(12) and 24.1% in Haiti(13). The prevalence of ovulatory phase knowledge in sub-Saharan African countries ranges from 38 to 43%, with 42.3% in Ghana (14), 39.8% in Sierra Leon (15), and 38.1% in Kenya (16). It reduces significantly to 21% to 25% in countries such as 21.83% in Somalia(17), 22% in Papua New Guinea (18), and 25% in Nigeria (19). A pooled prevalence analysis of 29 sub-Saharan countries showed 8.3% of reproductive age women have correct ovulatory phase knowledge (20). Preceding studies done in Ethiopia using 2016 EDHS data showed that the prevalence of ovulatory phase knowledge was 23.58% (21–24). Prior studies across different countries showed that correct knowledge of the ovulatory phase is influenced by individual level and community level factors. Previously done studies showed that ovulatory phase knowledge was influenced by factors such as older age (11, 14), higher educational attainment (13, 16, 17, 25), mobile phone ownership (18), place of residence (13, 16), knowledge of any contraceptive method (12, 18), gravidity of none (15), and media exposure (26, 27). In LMICs, reproductive health outcomes and health literacy are shaped not only by individual-level factors like age and educational status but also by community-level factors such as community-level media, community-level literacy, regional health care access creates distinctive information dissemination and healthcare utilization. Because individual behaviours are nested within those community contexts, evaluating health knowledge determinants requires a multilevel analytical approach that accounts for hierarchical data structure. In LMICs like Ethiopia, unplanned pregnancies and unmet needs for family planning remain a main public health challenge (28, 29). Previous national study did not account for recent regional administrative restructuring (21–24). Therefore, this study utilizes recent, nationally representative 2025–25 Ethiopian Demographic and Health Survey (EDHS) to conduct multilevel analysis. By simultaneously evaluating individual and community-level factors, this study aims to determine the updated national prevalence and identify hierarchical predictors of ovulatory phase knowledge among reproductive aged women, providing evidence based insights to guide targeted reproductive health policies and educational interventions in Ethiopia.

Methods and Materials

Study Design

We conducted a cross-sectional study design using secondary data from the 2024–2025 Ethiopian Demographic and Health Survey (EDHS).

Data Source and Population

The EDHS is a nationally representative survey designed to provide health and demographic indicators at national, regional, and urban-rural levels. Data were accessed from the official DHS program repository

available at (<https://dhsprogram.com/Countries/Country-Main.cfm?ctry>). The survey utilized two stage stratified cluster sampling design. In the first stage, primary sampling units (clusters) were selected with probability proportional to size. In the second stage, households were systematically selected from each cluster across urban and rural strata within Ethiopia’s 12 regional states and 2 city administrations (Fig. 1).

Overall, the survey encompassed 21,241 households in 797 clusters, interviewing 21,395 women aged 15–49 and 12,485 men aged 15–59. Employing a two-stage cluster sampling method across urban and rural areas within Ethiopia’s 14 regions, the EDHS 2024/25 focused on child and maternal health topics using household, woman, man, and biomarker questionnaires. We utilized the Individual Record dataset (IR file) for this study. The study used a weighted sample of 21,395 reproductive-age women for analysis

Figure 1: Map showing the regions of Ethiopia (2026)

Study variables and measurements

Dependent variable

The dependent variable in this study was women’s knowledge of the ovulatory phase. In the EDHS questionnaire, respondents were asked, “When is the ovulation time?”. Response options included: “during her period”, “after the period has ended”, “in the middle of the cycle”, “before the period begins”, “at any time”, and “don’t know”. In accordance with standard menstrual physiology, respondents who correctly answered “in the middle of the cycle” were classified as having correct knowledge of the ovulatory phase and coded as 1. Respondents who selected any of the other options were classified as having incorrect knowledge and coded as 0 (14, 17, 26)

Independent variables

See Table 1

Table 1
Description and categorization of study variables, EDHS 2024–25

Study variables	
Independent variables	Individual-level variables
	• Age (15–29, 30–39, and 40–49)
	• Women’s education level (no formal education, primary education, and secondary and higher)
	• Religion (Orthodox, Protestant, Muslim and others)
	• Women employment (Not employed and Employed)
	• Household wealth index (poor, middle, and rich)
	• Women media exposure (Yes, No)
	• Women's mobile phone ownership (Yes, No)
	• Women's smart mobile phone ownership (Yes, No)
	• Women's early sexual debut (before age 18) (Yes, No)
	• Women’s marital autonomy (Yes, No)
	• History of pregnancy loss (Yes, No)
	• Knowledge of any contraceptive method (Yes, No)
	• Gravidity (Nulligravida, Primigravida, Multigravida)
	• Marital status (Unmarried, Married)
	• Menstruated in the last 6 month (Yes, No)
	Community-level variables
	• Residence (urban and rural)
	• Region (Tigray, Afar, Amhara, Oromia, Somali, Benishangul-Gumuz, Central Ethiopia, Sidama, South West Ethiopia, South Ethiopia, Gambella, Harari, Addis Ababa, Dire Dawa)
	• Community-level poverty (low, high)
	• Community-level literacy (low, high)
	• Community-level media exposure (low, high)

Data management and statistical analysis

Data extraction, cleaning, recoding, and analysis were performed using Stata version 17.0. Sampling weights and complex survey design parameters (primary sampling unit and clusters) were applied to compute accurate national point estimates, frequencies, and percentages. Descriptive analysis was done using frequency and percentage distributions. Bivariate multilevel logistic regression was initially conducted to screen potential explanatory variables, with $p < 0.25$ for multivariable modelling. Given the hierarchical structure of DHS data, four sequential multilevel mixed-effect logistic regression models were fitted. Model 0 (Null Model) contained no explanatory variables to quantify baseline random inter-cluster variation of ovulatory phase knowledge. Model I included individual-level factors only, while Model II incorporated community-level factors only. The final model (Model III) simultaneously integrated both individual and community-level factors to provide a comprehensive analysis of their associations with knowledge of the ovulatory phase. Both fixed and random parameters were estimated across all models. Fixed-effect associations were reported as adjusted odds ratios (AOR) with 95% Confidence Interval (CI), considering statistical significant at $p < 0.05$. Cluster-level heterogeneity and inter-cluster variations were evaluated using random parameters, including Median odds ratio (MOR), Proportional change in variance (PCV), and Interclass correlation coefficient (ICC). Model fitness and comparison were evaluated using Log-likelihood and Deviance, with lower deviance values indicating superior overall model fit.

Results

Socio-Demographic Characteristics of Respondents

A total of 21,395 reproductive-aged women were involved in the analysis; more than half (57.5%) were aged between 15–29 years, with a mean age of 28.51 ± 9.56 years. Nearly two-thirds (65.4%) of the participants were rural residents, 33.4% respondents came from economically disadvantaged households, 67.5% participants had attained at least primary education, 34.9% individuals reported access to mass media. Furthermore, 48.69% of the respondents owned a mobile phone, and 18.0% owned a smart mobile phone. Regarding reproductive characteristics, 61.3% participants were married, 10.3% had a history of pregnancy loss, 40.8% had an early sexual debut before age 18 years, 40.8% had marital autonomy, and 96.6% had knowledge of any contraceptive method. Moreover, 55.4% were multigravida (Table 2).

Table 2
Characteristics of study participants, EDHS 2024–25 (n = 21,395)

Variables	Categories	Weighted Frequency	Percentage
Individual-level variables			
Age	15–29	12,306	57.5
	30–39	5,596	26.2
	40–49	3,493	16.3
Women's education level	No formal education	6,947	32.5
	Primary education	8,403	39.3
	Secondary and higher	6,045	28.2
Religion	Orthodox	9,228	43.1
	Protestant	5,438	25.5
	Muslim	6,231	29.1
	Others	498	2.3
Women employment	Not employed	10,670	49.9
	Employed	10,725	50.1
Household wealth index	Poor	7,152	33.4
	Middle	4,043	18.9
	Rich	10,200	47.7
Women media exposure	Yes	7,465	34.9
	No	13,930	65.1
Women's mobile phone ownership	Yes	10,454	48.9
	No	10,941	51.1
Women's smart mobile phone ownership	Yes	3,863	18.0
	No	17,532	82.0
Women's early sexual debut (before age 18)	Yes (Before 18)	8,974	41.9
	No (18 + years)	12,421	58.1
Women's marital autonomy	Yes	8,718	40.8

Variables	Categories	Weighted Frequency	Percentage
Individual-level variables			
	No	12,677	59.2
History of pregnancy loss	No	19,190	89.7
	Yes	2,205	10.3
Knowledge of any contraceptive method	Yes	20,666	96.6
	No	729	3.4
Gravidity	Nulligravida	7,074	33.1
	Primigravida	2,465	11.5
	Multigravida	11,856	55.4
Marital status	Unmarried	8,280	38.7
	Married	13,115	61.3
Menstruated in the last 6 month	Yes	16,150	75.5
	No	5,245	24.5
Community-level variables			
Residence	Urban	7,411	34.6
	Rural	13,984	65.4
Region	Tigray	1,212	5.7
	Afar	184	0.9
	Amhara	5,177	24.2
	Oromia	8,176	38.2
	Somali	635	3.0
	Benishangul-Gumuz	222	1.0
	Central Ethiopia	899	4.2
	Sidama	1,011	4.7
	South West Ethiopia	654	3.0
	South Ethiopia	1,510	7.1
	Gambella	94	0.4

Variables	Categories	Weighted Frequency	Percentage
Individual-level variables			
	Harari	69	0.3
	Addis Ababa	1,435	6.7
	Dire Dawa	117	0.6
Community-level poverty	Low	12,830	60.0
	High	8,565	40.0
Community-level literacy	Low	8,077	37.8
	High	13,318	62.2
Community-level media exposure	Low	8,695	40.6
	High	12,700	59.4

Prevalence of ovulatory phase knowledge

The overall national prevalence of correct ovulatory phase knowledge among Ethiopian women of reproductive age was 34.73% (95% CI: 33.68–35.78%) (Fig. 2).

Figure 2: Proportion of reproductive age women with knowledge of ovulatory phase in Ethiopia, EDHS 2024-25 (N = 21,395)

The random effect analysis result

The random-effect parameters and model goodness of fit metrics across the four sequential models are presented in Table 3. In the null model (Model 0); the Interclass Correlation Coefficient (ICC) was 21.98%, indicating that nearly 22% of the overall variance in ovulatory phase knowledge was attributed to differences between clusters, while the remaining 78.02% of the variation was driven by individual-level factors within the clusters. The Median Odds Ratio (MOR) in the null model was 2.51. This indicates that if a woman were randomly selected from a community with a higher likelihood of ovulatory phase knowledge, she would have 2.51 times higher odds of possessing ovulatory phase knowledge compared to a woman randomly selected from a community with a lower likelihood. Incorporating individual and community-level predictors in the combined model reduced community-level variability from 0.927 to 0.529 and brought the ICC down to 13.87%. The Proportional Change in Variance (PCV) in model III indicated that 42.93% of the variability in ovulatory phase knowledge was explained by combined individual and community-level factors. Finally, Model III was selected as the best-fitted Model as it produced the lowest deviance (Table 3).

Table 3
The random effect and model fitness statistics

Random Parameters	Null model	Model I	Model II	Model III
Community-level variance	0.927	0.849	0.504	0.529
Log likelihood	-12308.95	-11917.16	-12147.84	-11800.45
Deviance	24617.91	23834.32	24295.67	23600.89
MOR	2.51	2.41	1.97	2.00
PCV (%)	Reference	8.41%	45.63%	42.93%
ICC (%)	21.98%	20.51%	13.29%	13.87%
MOR: Median odds ratio, PCV: Proportional change in variance, ICC: Inter class correlation coefficient				

The fixed effect analysis

In the final multivariable multilevel model (Model III), both individual and community-level factors were significantly associated with knowledge of the ovulatory phase among Ethiopian women of reproductive age. At the individual level, older age, secondary or higher education level, mobile phone ownership, smartphone ownership, early sexual debut, knowledge of any contraceptive method, higher gravidity, and recent menstruation in the preceding six months were significant determinants. At the community-level, geographic region and community-level media exposure were identified as statistically significant predictors of ovulatory phase knowledge (Table 4).

As shown in Table 4, multilevel multivariable logistic regression analysis showed that women aged 30–39 years had 1.20 times higher odds of possessing ovulatory phase knowledge compared to those aged 15–29 years (AOR: 1.20, 95% CI: 1.03–1.40). Women who completed secondary education or higher showed 2.04 times higher odds of possessing ovulatory phase knowledge compared to women with no formal education (AOR: 2.04, 95% CI: 1.66–2.51). Women who owned a mobile phone had 1.20 times higher odds (AOR: 1.20, 95% CI: 1.03–1.39), and those who owned a smartphone had 1.25 times higher odds (AOR: 1.25, 95% CI: 1.06–1.47) of knowing the ovulatory phase compared to those without these devices. Conversely, women with an early sexual debut (< 18 years) had 13% lower odds of possessing ovulatory phase knowledge compared to those with a later debut (AOR: 0.87, 95% CI: 0.75–0.99). Knowledge of any contraceptive method was strongly associated with ovulatory phase knowledge, with knowledgeable women showing 3.74 times higher odds compared to those with no contraceptive knowledge (AOR: 3.74, 95% CI: 2.01–6.93). Regarding gravidity, primigravida (AOR: 1.37, 95% CI: 1.08–1.73) and multigravida women (AOR: 1.45, 95% CI: 1.16–1.81) showed higher odds of ovulatory phase knowledge compared to nulligravida women. Women who had menstruated in the preceding six months had 1.27 times higher odds of knowing the ovulatory phase compared to those who had not menstruated (AOR: 1.27, 95% CI: 1.09–1.47).

Concerning community-level factors, women residing in communities with high media exposure showed 1.34 higher odds of having ovulatory phase knowledge compared to women from communities with low media exposure (AOR: 1.34, 95% CI: 1.05–1.70). Using the Tigray region as a reference, women living in Afar (AOR: 2.03, 95% CI: 1.36–3.04), Amhara (AOR: 2.26, 95% CI: 1.67–3.04), Oromia (AOR: 6.24, 95% CI: 4.33–8.99), Central Ethiopia (AOR: 1.84, 95% CI: 1.30–2.59), Sidama (AOR: 2.18, 95% CI: 1.43–3.32), South West Ethiopia (AOR:1.58, 95% CI: 1.08–2.32), South Ethiopia (AOR: 1.62, 95% CI: 1.03–2.54), Harari (AOR:1.87, 95% CI: 1.21–2.90, Addis Ababa (AOR: 2.10, 95% CI: 1.55–2.83) and Dire Dawa (AOR: 2.90, 95% CI: 1.92–4.36) had shown significantly higher odds of having ovulatory phase knowledge (Table 4).

Table 4

Multilevel analysis of factors associated with knowledge of ovulatory phase among reproductive-age women in Ethiopia, EDHS 2024–25 (N = 21,395)

Categories		Null Model	Model I	Model II	Model III
Age	15–29 years		Ref		Ref
	30–39 years		1.21* [1.04,1.41]		1.20* [1.03,1.40]
	40–49 years		1.09[0.89,1.32]		1.07[0.88,1.31]
Women's education level	No formal education		Ref		Ref
	Primary education		1.05[0.90,1.23]		1.04[0.89,1.22]
	Secondary and higher		2.04* [1.67,2.50]		2.04* [1.66,2.51]
Religion	Orthodox		Ref		Ref
	Protestant		1.18[0.93,1.50]		1.14[0.86,1.51]
	Muslim		1.31[1.03,1.65]		1.23[0.96,1.59]
	Others		1.06[0.62,1.80]		1.03[0.60,1.78]
Women employment	Not employed		Ref		Ref
	Employed		0.91[0.77,1.07]		0.89[0.76,1.05]
Household wealth index	Poor		Ref		Ref
	Middle		1.04[0.83,1.29]		0.96[0.76,1.21]
	Rich		1.18[0.95,1.47]		1.03[0.80,1.33]
Women media exposure	No		Ref		Ref
	Yes		0.99[0.84,1.17]		0.96[0.81,1.13]
Women's mobile phone ownership	No		Ref		Ref
	Yes		1.18* [1.01,1.37]		1.20* [1.03,1.39]
Women's smart mobile phone ownership	NO		Ref		Ref
	Yes		1.26* [1.07,1.49]		1.25* [1.06,1.47]
Key: Ref: reference group; *p-value < 0.05					

Categories		Null Model	Model I	Model II	Model III
Women's early sexual debut (before age 18)	No		Ref		Ref
	Yes		0.87* [0.75,0.99]		0.87* [0.75,0.99]
Women's marital Autonomy	No		Ref		Ref
	Yes		0.87[0.67,1.13]		0.89[0.68,1.15]
History of pregnancy loss	No		Ref		Ref
	Yes		0.98[0.82,1.17]		0.97[0.82,1.16]
Knowledge of any contraceptive method	No		Ref		Ref
	Yes		4.33* [2.36,7.92]		3.74* [2.01,6.93]
Contraceptive use	Not currently using		Ref		Ref
	Modern		1.01 [0.84,1.21]		0.99 [0.83,1.19]
	Traditional		0.89 [0.56,1.40]		0.87 [0.56,1.37]
Gravidity	Nulligravida		Ref		Ref
	Primigravida		1.37* [1.08,1.73]		1.37* [1.08,1.73]
	Multigravida		1.45* [1.16,1.81]		1.45* [1.16,1.81]
Marital Status	Unmarried		Ref		Ref
	Married		1.19 [0.90,1.59]		1.19 [0.90,1.58]
Menstruated in the last 6 month	No		Ref.		Ref.
	Yes		1.27* [1.10,1.47]		1.27* [1.09,1.47]
Residence	Urban			Ref	Ref
	Rural			0.82 [0.66,1.01]	0.98 [0.78,1.24]
Region	Tigray			Ref	Ref
Key: Ref: reference group; *p-value < 0.05					

Categories		Null Model	Model I	Model II	Model III
	Afar			2.17* [1.55,3.02]	2.03* [1.36,3.04]
	Amhara			2.18* [1.63,2.90]	2.26* [1.67,3.04]
	Oromia			6.01* [4.38,8.25]	6.24* [4.33,8.99]
	Somali			0.80 [0.49,1.30]	0.94 [0.53,1.69]
	Benishangul-Gumuz			1.26 [0.87,1.82]	1.26[0.86,1.87]
	Central Ethiopia			1.89* [1.429,2.508]	1.84* [1.30,2.59]
	Sidama			2.28* [1.66,3.13]	2.18* [1.43,3.32]
	South West Ethiopia			1.63* [1.17,2.28]	1.58* [1.08,2.32]
	South Ethiopia			1.66* [1.14,2.40]	1.62* [1.03,2.54]
	Gambella			1.187 [0.81,1.72]	1.01[0.65,1.57]
	Harari			2.21* [1.49,3.26]	1.87* [1.21,2.90]
	Addis Ababa			2.35* [1.76,3.12]	2.10* [1.55,2.83]
	Dire Dawa			3.17* [2.18,4.60]	2.90* [1.92,4.36]
Community-level poverty	Low			Ref	Ref
	High			0.943 [0.73,1.20]	1.04[0.78,1.39]
Community-level literacy	Low			Ref	Ref
	High			1.26* [1.01,1.58]	1.13[0.89,1.42]
Key: Ref: reference group; *p-value < 0.05					

Categories		Null Model	Model I	Model II	Model III
Community-level media exposure	Low			Ref	Ref
	High			1.43* [1.13,1.80]	1.34* [1.05,1.70]
Key: Ref: reference group; *p-value < 0.05					

Discussion

Correct knowledge of the ovulatory phase is essential for women of reproductive age seeking to either achieve intended conception or effectively utilize fertility awareness-based contraceptive methods. In this study, we evaluated the national prevalence and multi-level determinants of ovulatory phase knowledge among Ethiopian women of reproductive age using data from the 2024–25 Ethiopian Demographic and Health Survey (EDHS). After adjusting for sampling weights and complex study design, the national prevalence of ovulatory phase knowledge among Ethiopia reproductive aged women was 34.73% (95% CI: 33.68–35.78%).

The national prevalence observed in this study (34.73%) represents a notable increase compared to the 23.56% reported in an earlier Ethiopian study using the 2016 Ethiopian DHS dataset (30). This upsurge trend over time may be attributed to the expansion of telecommunications infrastructure(31), increased mass media coverage, and rising ownership of basic mobile phones and smartphones among reproductive-aged women, which can facilitate greater access to digital health tracking tools and reproductive health information. Compared to DHS analyses from other low and middle-income countries (LMICs), our estimated prevalence is higher than figures reported in Somalia (21.8%) (17), Papua New Guinea (22.0%) (18), Haiti (21.1%) (13), and Nigeria (25.0%) (19). Conversely, it remains lower than estimates reported in Kenya (38.1%) (16), Sierra Leone (39.8%)(15), Ghana (42.3%) (14), Comoros (47.5%) (26), Cameroon (48.1%) (26), Gabon (50.4%) (26), and the Democratic Republic of Congo (57.1%) (26). These cross country variation likely stem from differences in study timing, health system infrastructure, exposure to family planning programs, and regional socio-demographic contexts.

Following multivariable multilevel analysis, older maternal age, higher educational attainment, mobile phone and smartphone ownership, knowledge of any contraceptive method, higher gravidity, recent menstruation within the preceding six months, geographic region, and community-level media exposure were identified as independent determinants of ovulatory phase knowledge.

Women aged 30–39 years demonstrated higher odds of possessing correct ovulatory phase knowledge compared to younger women aged 15–29 years. This finding aligns with evidence from studies conducted in Ghana (14) and the United States(11) suggesting that accumulated life experiences and prolonged exposure to maternal and reproductive health services over time enhance fertility literacy. Women’s educational attainment was another key individual-level predictor, with secondary or higher

education significantly increasing the likelihood of ovulatory phase knowledge. This is consistently supported by literature from Ghana (14, 25), Haiti(13), Kenya (16), Sierra Leone (15), India (12), Somalia (20), and previous local studies (30). This suggests that formal education enhances health literacy and helps women to better understand menstrual physiology and ovulation timing.

Furthermore, mobile phone and smart mobile phone ownership significantly elevated the odds of ovulatory phase knowledge, a pattern consistent with the findings from Papua New Guinea (18). Personal digital devices act as direct conduits for health information, enabling self-directed learning and access to cycle-tracking technologies.

Reproductive characteristics also played a crucial role. Women with knowledge of any contraceptive method, higher gravidity, and recent menstruation (within the last 6 months) exhibited higher odds of ovulatory phase knowledge. Similar associations between these reproductive characteristics and ovulatory phase knowledge have been documented in Sierra Leone (15), India (12), and Papua New Guinea (18). This demonstrates that knowledge of any contraceptive method and higher gravidity experience offers contact with family planning providers during antenatal or postnatal care, coupled with an active awareness of one's own menstrual cycle, reinforces reproductive health knowledge.

Our findings demonstrated that women with an early sexual debut (< 18 years) had significantly lower odds of possessing ovulatory phase knowledge compared to those with a later debut. This knowledge deficit impairs women's ability to identify their fertile period, thereby increasing the risk of adolescent unintended pregnancy and its related complications. Therefore, fertility awareness educational interventions should prioritize adolescent-aged girls.

Regarding community-level factors, residing in communities with high media exposure was associated with increased odds of ovulatory phase knowledge compared to those living in low-exposure communities. This aligns with findings reported in Kenya (16) and India (12). High community media exposure creates a supportive environment for diffusing reproductive knowledge information to individuals within the clusters. Finally, using the Tigray region as the reference, women living in most other regions of Ethiopia exhibited significantly higher odds of possessing correct ovulatory phase knowledge. This pronounced regional variation likely reflects the lingering impact of severe conflict in the northern Ethiopia, which may lead to disruption of community level reproductive health service delivery.

Strengths and limitations of the study

A major strength of this study is the use of recent, nationally representative survey data from the EDHS 2024–25, which provide large sample size and ensures the generalizability of our findings to women of reproductive-age across Ethiopia. Additionally, employing a multilevel modelling approach appropriately accounted for the hierarchical structure of DHS data, allowing for concurrent estimation of individual and community level variance without affecting independence assumptions.

Despite these strengths, there are limitations. First, the cross-sectional nature of DHS data precludes establishing causal relationships between the identified factors and ovulatory phase knowledge. Second, knowledge was assessed using a single self-reported survey item, “When is the ovulation time?”, which may not fully capture the complete scope of fertility awareness, such as 6-days fertile window or physiological body signs like cervical mucus changes. Additionally, the outcome relied on self-reported survey responses, which may be susceptible to recall or social desirability bias. Furthermore, secondary DHS dataset restrictions prevented the inclusion of cultural belief variables that might influence fertility awareness.

Conclusions

The overall national prevalence of correct ovulatory phase knowledge among Ethiopian women of reproductive age was 34.73%. Both individual and community-level factors, such as older maternal age, secondary or higher education attainment, mobile phone ownership, smartphone ownership, early sexual debut, knowledge of any contraceptive method, higher gravidity, recent menstruation in the preceding six months, geographic region, and community-level media exposure, significantly shape ovulatory phase knowledge across the country. Despite the improvement in prevalence, a lot of work should be done to address the determinants in order to increase the ovulatory phase knowledge in Ethiopia.

Implications of the findings

Despite the improvement regarding correct ovulatory phase knowledge among Ethiopian reproductive-aged women in recent years, increasing from 23.56% to 34.73%, a substantial national knowledge gap persists, with nearly two-thirds of the women lacking correct ovulatory phase knowledge. This finding provides important public health and policy implications for reproductive health programming in Ethiopia.

Awareness creation interventions should prioritize younger, uneducated, digitally disconnected women with a lack of access to mobile phones. Public health intervention programs should include educational content to effectively address literacy and technology barriers. Expanding digital interventions such as SMS text messaging and mobile applications that consider Ethiopian cultural and language contexts, offer a good way to deliver ovulatory phase related education directly to women. Additionally, improving community media access such as community radio broadcasting, health post educational campaigns, and routine health extension workers counselling can help to disseminate reproductive health information and enhance fertility awareness. Future media should consider young women audiences with low levels of education and without mobile phone access. Finally, ovulatory phase and fertility period counselling should be routinely integrated into existing family planning, post-abortion care, and antenatal care services. This integration will help women to make informed decisions regarding the timing of sexual intercourse, whether to achieve intended conception or prevent unintended pregnancy.

Abbreviations

AOR Adjusted Odds Ratio

CI Confidence Interval

DHS Demographic and Health Survey

EDHS Ethiopian Demographic and Health Survey

ICC: Inter class correlation coefficient

LMICs: Low and Middle Income Countries

MOR: Median odds ratio

PCV: Proportional change in variance

Declarations

Ethical approval and consent to participate

All procedures adhered to applicable guidelines and regulations. This study, involving a secondary analysis of publicly accessible survey data from the MEASURE DHS program, did not necessitate ethical approval or participant consent. Permission to download and utilize the data was obtained from <http://www.dhsprogram.com>. The datasets used do not contain personal identifiers such as names or addresses of individuals or households.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

HTW and ABB contributed to study design, data extraction, cleaning, recoding, analysis and interpretation. HTW wrote the original draft and ABB made significant revisions.

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Data Availability

The original dataset utilized and analysed in this research can be obtained from the DHS website at <https://dhsprogram.com/Countries/Country-Main.cfm?ctry>

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Figures

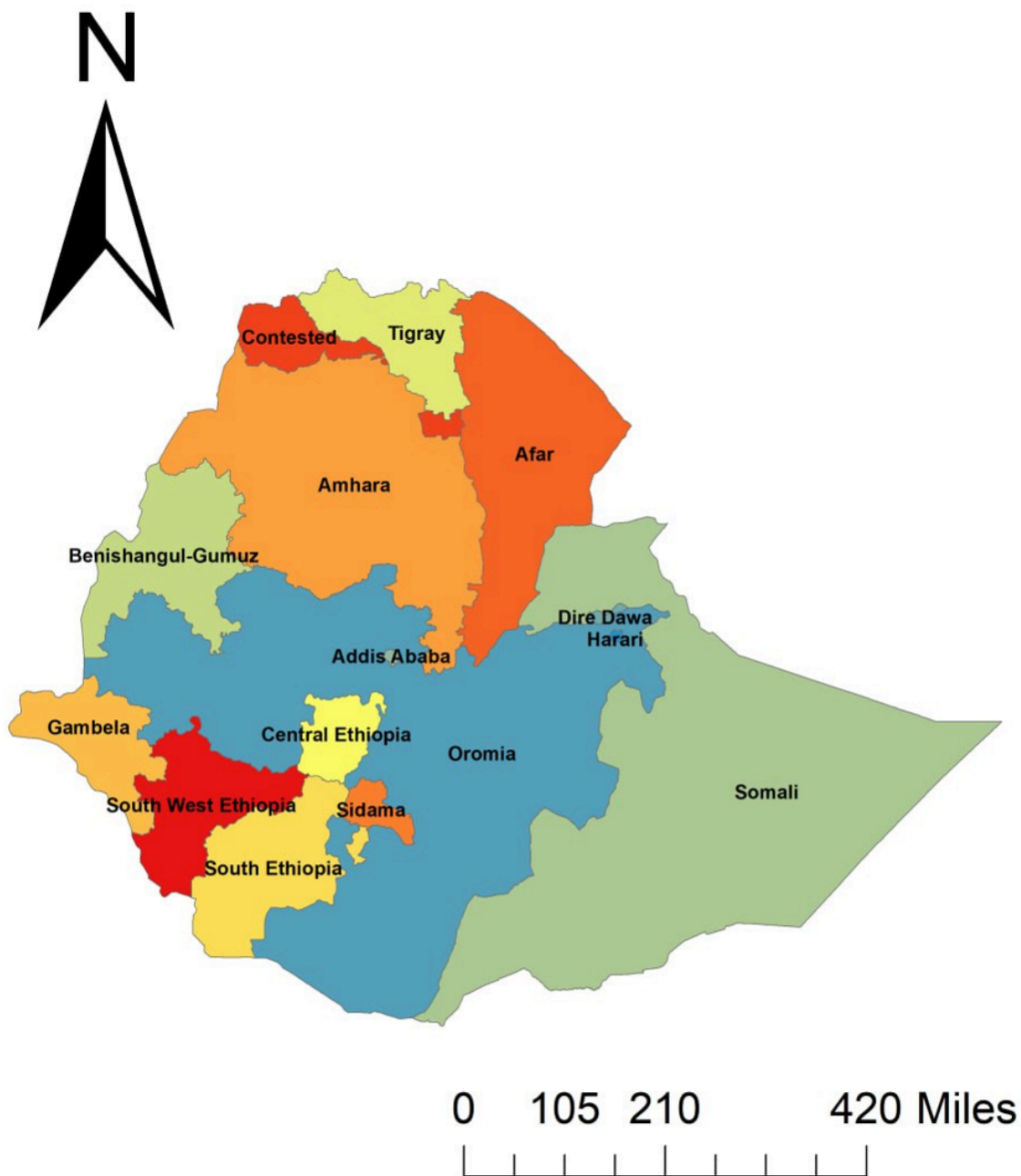


Figure 1: Map showing the regions of Ethiopia (2026)

Figure 1

Map showing the regions of Ethiopia (2026)

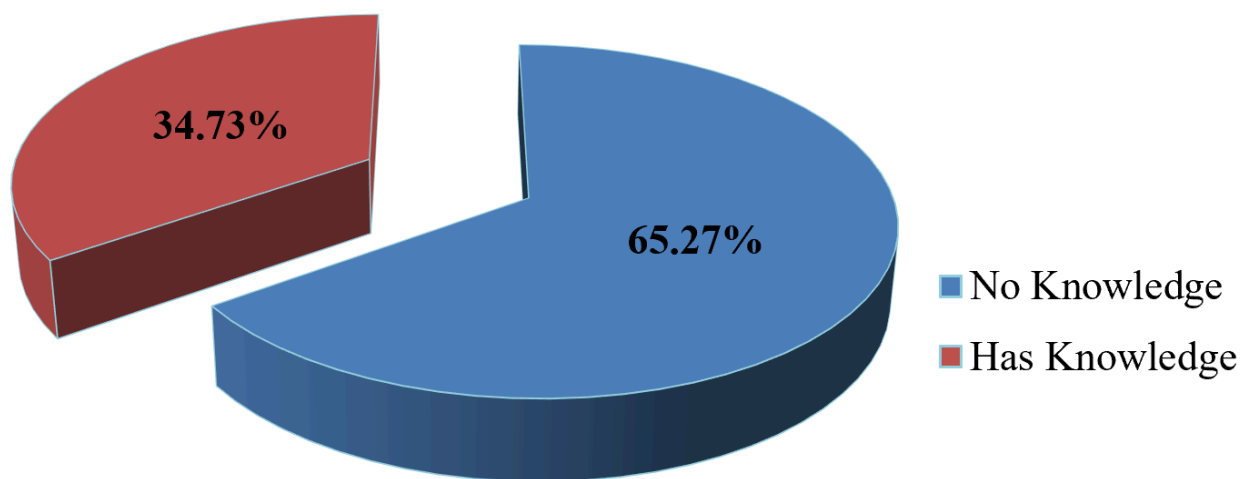


Figure 2

Proportion of reproductive age women with knowledge of ovulatory phase in Ethiopia, EDHS 2024-25 (N=21,395)