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Individual and community-level factors associated with ovulatory cycle knowledge among women in Ghana: a multilevel analysis of recent demographic and health survey data

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Abstract

Background Knowledge of the ovulatory cycle plays a crucial role in reducing the incidence of unintended pregnancies and promoting women's reproductive health. However, there exists a paucity of research on the determinants associated with ovulatory cycle knowledge specifically within the context of Ghana. Therefore, the objective of this study was to investigate the individual and community-level factors that influence knowledge of the ovulatory cycle among women of reproductive age in Ghana.

Methods The study utilized data from the 2022 Ghana Demographic and Health Survey, which included a representative sample of 6,839 women of reproductive age. Using a multilevel logistic regression model, the study aimed to identify factors influencing knowledge of the ovulatory cycle. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were employed to assess the associations between explanatory variables and knowledge of the ovulatory cycle. Statistical significance was determined at a p-value threshold of less than 0.05. All data analyses were performed using STATA version 17 software.

Results The prevalence of knowledge regarding the ovulatory cycle among Ghanaian women was 42.3% (95% CI: 41.1-43.5%). In the multivariable mixed-effects logistic regression model, factors associated with knowledge of the ovulatory cycle included women aged 30–39 (AOR: 1.62, 95% CI: 1.54–2.73) and 40–49 (AOR: 1.51, 95% CI: 1.39–1.66), women's educational attainment (AOR: 1.62, 95% CI: 1.55–2.59), household wealth index (AOR: 1.51, 95% CI: 1.10–2.25), and partner's education level (AOR: 1.59, 95% CI: 1.20–2.11). Additionally, community-level factors such as community level literacy (AOR: 4.5, 95% CI: 2.22–9.25), and residing in the Eastern (AOR: 0.36, 95% CI: 0.19–0.68) and Oti (AOR: 0.26, 95% CI: 0.13–0.53) regions were significantly associated with knowledge of the ovulatory cycle.

Conclusion The prevalence of ovulatory cycle knowledge among Ghanaian women was low, with significant determinants including age, women's education, wealth, partner's education, community literacy rates, and regional

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disparities. These findings highlight the importance of targeted educational interventions to improve reproductive health literacy, especially in underserved communities and regions with lower educational attainment in Ghana.

Keywords Ovulatory cycle knowledge, Reproductive age women, Ghana, Multilevel analysis

Background

The ovulatory cycle, marked by the release of a mature egg from the ovary, is a vital phase in a woman's menstrual cycle. This cycle is divided into the follicular phase, where the ovarian follicles mature; ovulation, when the egg is released; and the luteal phase, where the uterine lining thickens in preparation for possible implantation [1]. Understanding the ovulatory cycle is crucial for effective family planning and reproductive health management [2], as knowledge of this cycle is essential not only for conception but also for using natural family planning methods (NFPMs) like the rhythm method, cervical mucus method, symptom-thermal approach, and basal body temperature method to avoid pregnancy [3, 4].

Globally, knowledge of the ovulatory cycle remains low, even in high-income countries. In the United States, only about 32.8% [5] of women have accurate knowledge, while in Haiti, it is around 24.1% [6] and in India, 85% are unaware of the correct knowledge [7]. In Africa, studies indicate that a significant proportion of women lack adequate understanding of their fertile window. For instance, a study conducted in Ghana found that only 36.3% of women had accurate knowledge of their ovulatory period. In comparison, studies in other African countries reveal varying levels of knowledge: 21.8% in Uganda, 23.6% in Ethiopia, 26.9% in Mali, and 43.6% in Togo. These findings highlight the diversity in awareness about natural family planning methods across the continent [8]. This gap in knowledge is influenced by factors such as education [6, 9], age [10, 11], marital status [12], place of residence [13], and media exposure [14, 15]. The lack of comprehensive sexual education and access to reproductive health services further exacerbates the issue, particularly among young women and adolescents [16, 17].

This problem is particularly acute in Africa, where the high prevalence of early pregnancies among adolescents and young women contributes to elevated rates of unintended pregnancies [17] and associated social and health challenges [13]. These early pregnancies are linked to adverse outcomes such as maternal and neonatal mortality, school dropouts, and prolonged labor. Moreover, unsafe abortions, often resulting from unintended pregnancies, contribute substantially to maternal deaths [18].

Despite modern contraceptives being widely used, with a contraceptive prevalence rate of 25% among women aged 15–49 (20% using modern methods) [19], high discontinuation rates due to side effects like obesity, hypertension, and cancer persist [15], while the use of traditional methods has slightly declined from 8% in 1988 to 5% in 2017 [19]. For example, in Ghana, the discontinuation rate is approximately 25%, with many women not adopting alternative methods, due to factors such as limited access to healthcare services [20], lack of awareness about other options, cultural and religious beliefs [21], concerns about potential side effects of other methods, and a general mistrust in modern medical practices [22]. This has led to increased risks of unwanted pregnancies and related health issues [16], highlighting the importance of promoting Natural Family Planning Methods (NFPMs). Endorsed by the Centers for Disease Control and Prevention (CDC), NFPMs are effective and pose minimal health risks [17]. The relatively low CPR indicates a gap in effective contraceptive use, which could be partly due to insufficient knowledge about the ovulatory cycle [22]. Understanding individual and community-level factors that influence this knowledge, is crucial for improving contraceptive use.

Despite the benefits of NFPMs, knowledge of the ovulatory period remains limited, especially in low- and middle-income countries (LMICs) [8, 23]. To address these challenges, it is imperative to assess and enhance the knowledge of the ovulatory cycle among reproductive women in Ghana. This involves identifying both individual and community-level determinants that influence this knowledge. By doing so, health planners, policymakers, and medical professionals can develop targeted strategies to improve reproductive health education and interventions, thereby reducing the incidence of unintended pregnancies and improving overall reproductive health outcomes. This study aimed to explore the determinants of knowledge of the ovulatory cycle among women of reproductive age in Ghana using data from recent Ghana Demographic and Health Surveys (GDHS).

Methods and materials

Study design

We employed a cross-sectional study design utilizing data from the GDHS 2022.

Data source and study setting

The study utilized data from the nationally representative 2022 Ghana Demographic and Health Survey available at (https://dhsprogram.com/data/dataset_admin/index.cfm). The survey encompassed 18,450 households in 618 clusters, interviewing 15,014 women aged 15–49 and 7,044 men aged 15–59. Employing a two-stage cluster sampling method across urban and rural areas within

Ghana's 16 regions, the GDHS 2022 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 included a weighted sample of 6,839 reproductive-age women for analysis. Comprehensive sampling procedures are detailed in the complete GDHS 2022 report.

Study variables and measurements
Outcome variable
The primary outcome variable in this study was women's knowledge of the ovulatory cycle. Within the DHS survey, women of reproductive age were asked, 'When is the ovulation time?' Response options included: 'during her period', 'after the period ended', 'middle of the cycle', 'before the period begins', 'at any time', and 'don't know'. For clarity and accuracy, we have recoded the outcome variable such that respondents who selected 'middle of the cycle' were classified as possessing correct knowledge and assigned a code of '1'. Responses indicating other times were categorized as incorrect knowledge and coded as '0' [8, 10]. Independent variables (Table 1).

Data management and statistical analysis
Descriptive analysis was conducted using frequency and percentage distributions to examine both the demographic characteristics of respondents and their knowledge regarding ovulatory cycle. Next, we conducted bivariate multilevel logistic regression to identify variables significantly associated with knowledge of ovulatory cycle, using a significance threshold of $p < 0.25$. We assessed multicollinearity using the variance inflation factor (VIF) for all significant variables identified in the bivariate analysis.

Using multilevel logistic regression (MLLR), we developed four models to explore associations between individual and community-level factors and knowledge of the ovulatory cycle. The first model (Model 0) was a null model, showing variance in knowledge of the fertility period without explanatory variables. Model I included individual-level factors, while Model II focused on community-level factors. The final model (Model III) integrated both individual and community-level factors to provide a comprehensive analysis of their associations with knowledge of the ovulatory cycle. All four multilevel logistic regression models incorporated both fixed and random effects [24]. The fixed-effect model illustrated the relationship between the explanatory variables and the outcome variable, while the random effects quantified the extent of variation in the outcome variable based on Primary Sampling Units (PSUs). To determine random effects, we calculated the intra-community correlation (ICC) using the formula $ICC = \delta a^2 / (\delta a^2 + \delta b^2)$, where δa^2 and δb^2 represent community-level and individual-level variances, respectively. The individual-level variance (δb^2) was a fixed value equal to $\pi^2/3$. Median Odds Ratio (MOR) and Proportional Change in Variance (PCV) were calculated to assess model fit and neighborhood variance changes across models. Goodness of fit was measured using Deviance (-2LL), and model comparisons were conducted using the Likelihood Ratio (LR) test. All data analyses were performed using STATA version 17 software.

Results
Background characteristics of respondents
Among the 6,839 reproductive age women surveyed, approximately half (51.8%) were aged 15–29, with a mean age of 31.5 ± 4.1 years. A significant proportion, comprising 2,916 individuals (42.6%), resided in urban areas, while 3,680 respondents (53.8%) came from economically disadvantaged households. Furthermore, a substantial majority, 3,839 participants (56.6%), had attained secondary education or higher and 1,358 individuals (19.9%) reported access to mass media (Table 2).

Table 1 Summary of dependent and independent variables in the study on factors associated with knowledge of the ovulatory cycle among reproductive-age women in Ghana, 2022

Study variables	
Dependent variable	**Individual-level variables**
Knowledge of ovulatory cycle (correct, incorrect)	• Age (15–29, 30–39, and 40–49)
	• Women's education level (no formal education, primary education, and secondary and higher)
	• Religion (Christians, Islam, no religion, and others)
	• Women employment(not working and working)
	• Partner's education level (no formal education, primary education, and secondary and higher education)
	• Household wealth index (poor, middle, and rich)
	Community-level variables
	• Place of residence (urban and rural)
	• Region (Western, Central, Greater Accra, Volta, Eastern, Ashanti, Western North, Ahafo, Bono, Bono East, Oti, Northern, Savannah, North East, Upper East, Upper West)
	• Community-level poverty (low, high)
	• Community-level literacy (low, high)
	• Community-level media exposure (low, high)

Table 2 Distribution of the study population by socio-demographic characteristics in Ghana DHS, 2022 (*n*=6,839)

Variables	Categories	Weighted Frequency		Percentage
The Individual-level variables				
Age	15–29	3,544		51.8
	30–39	2,661		38.9
	40–49	634		9.3
Women's education level	No formal education	1,871		27.4
	Primary education	1,096		16
	Secondary and higher	3,839		56.6
Religion	Christians	3,889		56.8
	Islam	2,106		30.8
	No religion	151		2.2
	Others	693		10.2
Women employment	Not working	1,556		22.8
	Working	5,283		77.2
Partner's education level	No formal education	1,727		30
	Primary education	622		10.8
	Secondary and higher education	3,407		59.2
Household wealth index	Poor	3,680		53.8
	Middle	1,267		18.5
	Rich	1,892		27.7
Community-level variables				
Place of residence	Urban	2,916	42.6	
	Rural	3,923	57.4	
Region	Western	330		4.8
	Central	411		6
	Greater Accra	351		5.1
	Volta	301		4.4
	Eastern	346		5.1
	Ashanti	455		6.7
	Western North	339		5
	Ahafo	348		5.1
	Bono	319		4.7
	Bono East	474		6.9
	Oti	468		6.8
	Northern	652		9.5
	Savannah	591		8.6
	North East	592		8.7
	Upper East	445		6.5
	Upper West	417		6.1
Community-level poverty	Low	3,680		53.8
	High	3,159		46.2
Community-level literacy	Low	2,967		43.4
	High	3,872		56.6
Community-level media exposure	Low	5,481		80.1
	High	1,358		19.9

Reproductive characteristics of respondents

In this analysis, 4,475 women (65.4%) were married, 2,340 (34.2%) had a history of pregnancy termination, and 6,508 (95.2%) had multiple pregnancies. Additionally, 4,964 (72.6%) were using traditional methods of contraception (Table 3).

Prevalence of knowledge of the fertility period

The prevalence of knowledge regarding the ovulatory cycle among women of reproductive age in Ghana was 42.3% (95% CI: 41.1-43.5%) (Fig. 1).

The random effect analysis result

The Interclass Correlation Coefficient (ICC) in the null model indicated that 29.8% of the variability in

Table 3 Reproductive characteristics of respondents in Ghana DHS 2022 (*n* = 6,839)

Variables	Categories	Weighted Frequency	Percentage
History of pregnancy loss	No	4,499	65.8
	Yes	2,340	34.2
Parity	Primi-gravida	331	4.8
	Multi-gravida	6,508	95.2
Contraceptive use	Traditional method	4,964	72.6
	Modern method	1,875	27.4
Current marital status	Never in union	748	10.9
	Married	4,475	65.4
	Living with partner	1,281	18.7
	Separated	335	4.9
Nature of marriage	Monogamy	4,693	81.5
	Polygamy	1,063	18.5
Couple fertility desire	Concordant	2,498	44
	Discordant	3,186	56

Proportion of knowledge about the ovulatory cycle
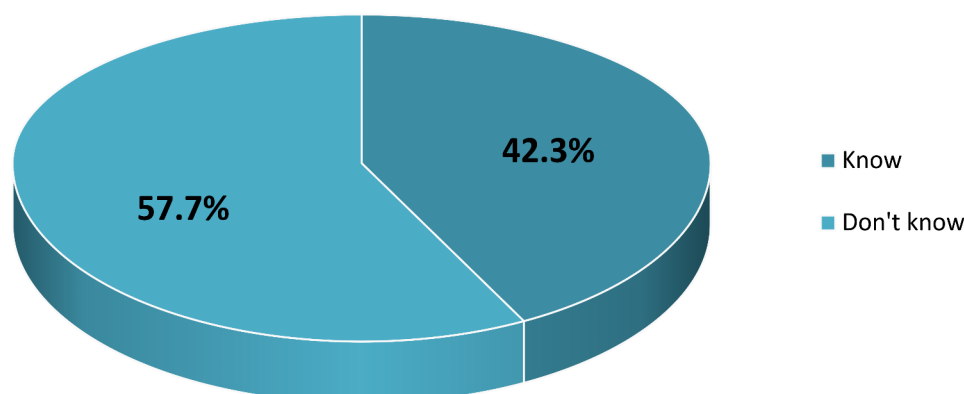
Fig. 1 Proportion of knowledge about the ovulatory cycle

knowledge of the ovulation period was attributed to differences between clusters, with the remaining variation occurring within clusters. Incorporating individual and community-level predictors in the combined model reduced community-level variability to 25.4%. Multilevel modeling demonstrated superiority over single-level regression, supported by a nonzero ICC in the null model. The Median Odds Ratio (MOR) of 3.52 in the null model highlighted variability in ovulation cycle knowledge between clusters. The Proportional Change in Variance (PCV) indicated that 39% of the variability in ovulation cycle knowledge could be explained by combined individual and community-level factors. Model comparison using Deviance favored Model III, which exhibited the lowest deviance (Table 4).

The fixed effect analysis result

In the multivariable mixed-effects logistic regression model, women's age, women's educational status, household wealth index, and partner's education level were found to be significant individual factors influencing knowledge of ovulatory cycle among Ghanaian women of reproductive age. Additionally, community-level factors such as literacy rates and regional variations were identified as statistically significant contributors to this knowledge.

As illustrated in Table 3, the multilevel multivariable logistic regression analysis revealed that women aged 30–39 (AOR: 1.62, 95% CI: 1.54–2.73) and 40–49 (AOR: 1.51, 95% CI: 1.39–1.66) had significantly higher odds of good knowledge compared to their counterparts aged 15–29. Women from higher-income households were 1.51 times more likely to have knowledge about the

Table 4 The random effect analysis result (measures of variations)

Parameter	Null model	Model I	Model II	Model III
Community-level variance	1.84	1.41	1.33	1.12
Log likelihood	-4011.6	-3699.4	-3299.4	-3046.3
Deviance	8023.2	7398.8	6598.8	6092.6
MOR	3.52	3.08	2.97	2.74
PVC (%)	Reference	23	28	39
ICC (%)	29.8	26.4	24.6	25.4

MOR: Median odds ratio, PVC: Proportional change in variance, ICC: Inter class correlation, LLR: Likelihood Ratio

ovulation period compared to their counterparts (AOR: 1.51, 95% CI: 1.10–2.25). Women who had completed secondary education or higher showed 1.62 times greater odds of possessing adequate knowledge of the ovulation period compared to those with primary education or less (AOR = 1.62, 95% CI: 1.55–2.59). Women whose partners had primary education had 1.59 times higher odds of knowing about the ovulation period compared to those without formal education (AOR = 1.59, 95% CI: 1.20–2.11).

Regarding community-level factors, women from communities with high levels of literacy had 4.5 times the odds of knowing about the ovulation period compared to those from communities with low levels of literacy (AOR = 4.5, 95% CI: 2.22–9.25). Women from the Eastern (AOR = 0.36, 95% CI: 0.19–0.68) and Oti (AOR = 0.26, 95% CI: 0.13–0.53) regions had lower odds of possessing good knowledge compared to those in the Western region. Conversely, women from Bono East (AOR = 2.03, 95% CI: 1.04–3.95) and Savannah (AOR = 4.42, 95% CI: 1.99–9.81) regions had higher odds of knowledge about ovulatory cycle compared to their counterparts in the Western region (Table 5).

Discussion
In this study, we examined knowledge of ovulatory cycle and its associated factors among reproductive-age women in Ghana using the recent nationally representative dataset. Based on the findings of the present study, 42.3% (95% CI: 41.1-43.5%) of Ghanaian women were knowledgeable about the ovulatory cycle. Our finding is consistent with the study conducted in Togo (43.6%) [8]. The result is higher than other studies in Ethiopia (23.6%) [25], Nigeria (25%) [26], Kenya (38.1%) [11], and 29 African countries (15.5%) [8]. On the other hand, the result of this study is lower than studies in Democratic Republic of Congo (57.1%), Gabon (50.4%), and Cameroon (48.1%) [8]. This variation could stem from differences in study period, methodology, maternal service quality, and the demographics of the study populations. Moreover, factors such as higher education levels among women and girls, urbanization, increased empowerment of women, greater participation in the workforce, and improved

access to reproductive healthcare services may also contribute to these differences.

In the multivariable mixed-effects logistic regression model, women's age, women's educational status, household wealth index, partner's education level, community-level literacy, and region were significantly associated with knowledge of the ovulatory period among Ghanaian women of reproductive age.

In the current study, women aged 30–39 and 40–49 had significantly higher odds of possessing good knowledge compared to their counterparts aged 15–29. This observation aligns with findings from studies conducted in Ethiopia [11, 25] and Kenya [11] indicating that women in later stages of their reproductive years tend to have a more accurate awareness of their fertility period compared to those in earlier stages. Age likely explains this relationship, as older women benefit from greater exposure and experience with reproduction [27]. Future research should delve into how age-related exposure and reproductive experience contribute to knowledge disparities and consider longitudinal studies to assess changes over time.

Women with secondary education and higher demonstrated better knowledge of the ovulatory cycle compared to those with no formal education. This finding aligns with studies conducted in various contexts [8, 10, 11, 25]. Partner's education, as an interpersonal factor, significantly influences ovulatory cycle knowledge. Our study found that women whose partners had primary education were more likely to know about the ovulation period compared to those whose partners had no formal education. This result aligns with previous research, highlighting the importance of interpersonal factors in enhancing reproductive health knowledge [10, 12]. This outcome could be attributed to formal education offering improved opportunities for women and her partner to understand the science of the reproductive system. To clarify the impact of education on reproductive knowledge, future studies should include more detailed analysis of educational content and its delivery methods. Moreover, investigating the role of partner education in influencing women's reproductive knowledge can offer insights into how to design more effective educational interventions.

Table 5 Multilevel analysis of factors associated with knowledge of ovulatory cycle among reproductive-age women in Ghana, 2022 (*N* = 6,839)

Categories	Null Model	Model I	Model II	Model III
Age		Ref		Ref
15–29				
30–39		1.63[1.54–2.73]*		1.62[1.54–2.73]*
40–49		1.51[1.40–1.66]*		1.51[1.39–1.66]*
Education		Ref		Ref
No education				
Primary		0.81[0.62–1.04]		0.82[0.64–1.06]
Secondary and higher		1.32[1.22–2.58]*		1.62[1.55–2.59]*
History of pregnancy loss				
No		Ref		Ref
Yes		0.91[0.78–1.05]		0.91[0.79–1.06]
Parity				
Primi-gravida		Ref		Ref
Multi gravida		0.76[0.50–1.16]		0.79[0.52–1.20]
Contraceptive use				
Traditional method		Ref		Ref
Modern method		0.94[0.80–1.10]		0.95[0.81–1.11]
Nature of marriage				
Monogamy		Ref		Ref
Polygamy		1.46[0.97–1.81]		1.47[0.96–1.83]
Couple fertility desire				
Concordant		Ref		Ref
Discordant		1.05[0.91–1.21]		1.03[0.89–1.19]
Women employment				
Not working		Ref		Ref
Working		0.84[0.71–1.01]		0.86[0.71–1.02]
Household wealth index				
Poor		Ref		Ref
Middle		0.98[0.78–1.22]		1.00[0.79–1.27]
Rich		1.12[1.01–2.02]*		1.51[1.10–2.25]*
Partner's education level				
No formal education		Ref		Ref
Primary education		1.50[1.14–1.99]*		1.59[1.20–2.11]*
Secondary and higher education		0.93[0.74–1.15]		0.98[0.78–1.21]
Community-level poverty				
Low			Ref	Ref
High			0.95[0.81–1.13]	0.85[0.68–1.21]
Community-level literacy				
Low			Ref	Ref
High			1.14[0.99–1.31]	4.5[2.22–9.25]*
Community-level media exposure				
Low			Ref	Ref
High			0.78[0.64–0.96]*	0.99[0.79–1.23]
Residence				
Urban			Ref	Ref
Rural			1.12[0.94–1.35]	1.06[0.81–1.38]
Region				
Western			Ref	Ref
Central			1.20[0.82–1.75]	0.66[0.36–1.22]
Greater Accra			0.62[0.42–0.91]*	1.02[0.56–1.85]
Volta			0.80[0.51–1.25]	0.76[0.39–1.48]
Eastern			0.72[0.48–1.07]	0.36[0.19–0.68]*
Ashanti			0.70[0.49–1.02]	1.16[0.65–2.07]

Table 5 (continued)

Categories	Null Model	Model I	Model II	Model III
Western North			0.71[0.43–1.16]	0.94[0.47–1.89]
Ahafo			0.88[0.52–1.47]	0.63[0.30–1.31]
Bono			0.65[0.40–1.05]	0.63[0.31–1.27]
Bono East			0.51[0.32–0.80]*	2.03[1.04–3.95]*
Oti			0.65[0.40–1.05]	0.26[0.13–0.53]*
Northern			0.44[0.29–0.68]*	0.77[0.41–1.43]
Savannah			0.47[0.28–0.80]*	4.42[1.99–9.81]*
North East			0.36[0.20–0.62]*	0.64[0.32–1.28]
Upper East			0.88[0.56–1.37]	0.55[0.28–1.06]
Upper West			1.03[0.64–1.68]	1.33[0.66–2.66]

Key: Ref: reference group; *p-value < 0.05

Consistent to previous studies [10, 25], our analysis revealed that women from higher-income households were more likely to have knowledge about the ovulation period compared to their counterparts. This might be due to higher-income households having better access to educational resources and healthcare services, thereby enhancing awareness and understanding of reproductive health topics [28]. Policymakers should focus on improving educational and healthcare access in lower-income communities to reduce disparities. Additionally, evaluating how income levels impact reproductive health education can help tailor support to those most in need.

Concerning community-level factors, women from communities with high levels of literacy had higher odds of knowledge about ovulatory cycle compared to those from communities with low levels of literacy. The study conducted in Kenya [11] has reported findings that align with our results. This might be because higher literacy rates generally signify improved access to education, including reproductive health education, which enhances understanding of biological processes such as ovulation. Moreover, increased literacy rates are frequently associated with higher socioeconomic status, which grants women better access to healthcare services and resources, thereby contributing to their knowledge of reproductive health [29]. Future research should investigate how literacy rates influence reproductive health knowledge and explore strategies to integrate reproductive health education into broader literacy and education programs.

Women from the Eastern and Oti regions had lower odds of good knowledge about the ovulation period compared to those in the Western region, whereas women from the Bono East and Savannah regions had higher odds. One possible reason for these differences could be that the Eastern region, known for its diverse rural areas, faces challenges such as limited access to education and healthcare, which may impede comprehensive reproductive health education. In contrast, the Bono East region's farming communities benefit from health programs that integrate reproductive education with agricultural services, potentially improving knowledge about ovulation [30]. Similarly, the Savannah region focuses on agro-pastoral livelihoods and enhances health literacy through both governmental and non-governmental initiatives, likely increasing awareness of ovulation compared to the Western region. To better address regional disparities, targeted interventions should be developed to cater to specific regional needs, considering factors such as local infrastructure, healthcare access, and educational resources. Evaluating the effectiveness of region-specific programs can guide future efforts in improving reproductive health knowledge across diverse areas.

Strengths and limitations of the study
The study benefitted from extensive national survey data, ensuring sufficient statistical power to determine the genuine impact of independent variables. Additionally, the application of sampling weights during analysis bolstered the reliability of estimates and standard errors. Moreover, the investigation encompassed the assessment of knowledge of ovulatory cycle at both individual/household and community levels, facilitating exploration of hierarchical or clustered influences on outcomes. Nevertheless, a limitation stems from the study's reliance on cross-sectional data, precluding the establishment of causal relationships between knowledge of ovulatory cycle and the identified independent variables. Furthermore, the use of self-reported information in DHS data introduces potential recall bias. Additionally, the study did not assess the effectiveness or failure rates of the contraceptive method, which limits our findings and should be addressed in future research.

Conclusions
The prevalence of ovulatory cycle knowledge among Ghanaian women was low, with significant determinants including women's age, women's education status, wealth index, partner's education, community- level literacy, and regional disparities. These findings highlight

the importance of targeted educational interventions to improve reproductive health literacy, especially in underserved communities and regions with lower educational attainment in Ghana. To enhance education levels, especially for women and girls, factors such as urbanization, women's empowerments, and improved access to reproductive health-care services, including family planning, are crucial. Educating comprehensively on reproductive health could effectively reduce unintended pregnancies. Future research should address overlooked independent variables using primary data sources.

Implications of the findings

We recommend that policymakers design and implement a targeted educational program to improve ovulatory cycle knowledge among Ghanaian women, particularly those aged 15–49, with lower educational attainment, and those in lower-income areas. This program should include community workshops, localized materials, and region-specific media campaigns, with progress tracked through annual surveys and shifts in contraceptive use rates. Addressing the low ovulatory cycle knowledge, which impacts the 36% contraceptive prevalence rate, could help meet the 60% total demand for family planning and increase contraceptive use closer to this demand. For healthcare workers, this underscores the importance of incorporating ovulatory cycle education into family planning services to enhance contraceptive use and adherence, ultimately aiding in meeting the total demand for family planning.

Abbreviations
AOR	Adjusted Odds Ratio
CI	Confidence Interval
DHS	Demographic and Health Survey
GDHS	Ghana Demographic and Health Survey
ICC	Intra Class Correlation
IUDs	Intra uterine devices
LLR	Log-Likelihood Ratio
MOR	Median odds ratio
NFPMs	Natural family planning methods
PVC	Proportional Change in Variance

Author contributions
BKL, ABB, SML, and KUM conducted data collection, analysis, interpretation, and proposal preparation. BKL, HTW, KUM, and ABB contributed to study design, data cleaning, and analysis. BKL wrote the original draft and all contributors made significant revisions. All authors have reviewed and approved the final manuscript.

Data availability
The original dataset utilized and analyzed in this research can be obtained from the DHS website at https://dhsprogram.com/data/dataset_admin/index.cfm.

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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