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Original Article

Ovarian Reserve Markers and Menstrual Pattern in Women Presenting with Primary Infertility

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ABSTRACT

Background: Primary infertility requires timely evaluation of ovarian reserve, but advanced fertility testing may not be affordable or immediately available in resource-limited settings. Menstrual-cycle history is a simple clinical tool that may help identify women who require earlier ovarian reserve assessment. Objective: To assess the association between menstrual-cycle pattern and ovarian reserve markers among women presenting with primary infertility. Methods: This prospective observational study included 150 women with primary infertility attending a gynecology and infertility clinic in Islamabad, Pakistan. Menstrual-cycle pattern was categorized as regular, short, long, or irregular. Ovarian reserve was assessed using serum anti-Müllerian hormone, basal follicle-stimulating hormone, and antral follicle count. Diminished ovarian reserve was defined using predefined biochemical or ultrasound-based criteria. Group comparisons and crude secondary analyses were performed using the available aggregated data. Results: The mean age was 29.4 ± 4.8 years, mean infertility duration was 3.7 ± 2.1 years, and mean body mass index was 25.8 ± 3.9 kg/m^2. Diminished ovarian reserve was present in 36 women (24.0%). Women with short cycles had the lowest anti-Müllerian hormone (1.02 ± 0.71 ng/mL), lowest antral follicle count (5.6 ± 2.3 follicles), highest follicle-stimulating hormone (11.4 ± 3.9 IU/L), and highest frequency of diminished ovarian reserve (55.6%). Compared with regular cycles, short cycles showed higher crude odds of diminished ovarian reserve (OR 5.22, 95% CI 2.07–13.17). Conclusion: Short menstrual cycles were associated with an adverse ovarian reserve profile in women with primary infertility. Menstrual history may help prioritize early ovarian reserve testing but should not replace standard biochemical and ultrasound assessment. Keywords: Primary infertility, ovarian reserve, anti-Müllerian hormone, antral follicle count, follicle-stimulating hormone, menstrual cycle, diminished ovarian reserve, Pakistan.

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INTRODUCTION

Primary infertility remains a major reproductive health concern and is a frequent reason for consultation in gynecology and infertility clinics. It is commonly defined as failure to achieve pregnancy after at least 12 months of regular unprotected intercourse in a woman who has never previously conceived. Beyond its biological implications, infertility carries substantial psychological, social, marital, and financial consequences, particularly in settings where childbearing is strongly linked with family expectations and social stability. In Pakistan, delayed fertility consultation, misconceptions regarding infertility, cost-related barriers, and repeated empirical treatment may postpone timely diagnosis, which is especially important when ovarian reserve is already declining.

Ovarian reserve refers to the remaining quantity of recruitable ovarian follicles and provides clinically useful information for fertility counseling, reproductive planning, and expected response to ovarian stimulation. The most widely used markers include serum anti-Müllerian hormone, antral follicle count on ultrasound, and basal follicle-stimulating hormone measured in the early follicular phase. Anti-Müllerian hormone is secreted by granulosa cells of pre-antral and small antral follicles and is considered a relatively stable biochemical marker of the growing follicle pool, while antral follicle count provides an ultrasound-based estimate of recruitable follicles. Basal follicle-stimulating hormone may rise as ovarian feedback decreases, but it is more variable across cycles and may remain normal until ovarian reserve has already declined. Therefore, ovarian reserve assessment is most informative when biochemical markers, ultrasound findings, age, and clinical history are interpreted together rather than relying on a single test (1–7).

Although ovarian reserve testing is clinically valuable, access to advanced fertility investigations is not uniform in resource-limited settings. Serum anti-Müllerian hormone testing may be unaffordable for some patients at the first visit, and standardized antral follicle count reporting may vary according to ultrasound equipment and operator expertise. In contrast, menstrual history is universally available, non-invasive, and cost-free. Cycle length, cycle regularity, bleeding duration, and menstrual flow pattern are routinely obtained during gynecological assessment and may provide early clues regarding ovulatory function and ovarian physiology. Because menstrual cyclicity is regulated by the hypothalamic-pituitary-ovarian axis, changes in cycle pattern may reflect underlying hormonal changes, altered follicular recruitment, or ovulatory dysfunction (8–12).

The relationship between menstrual pattern and ovarian reserve is clinically important but not linear. Short menstrual cycles may reflect a shortened follicular phase and may occur when the follicular pool declines, particularly with advancing reproductive age or occult diminished ovarian reserve. Previous studies have reported associations between ovarian reserve biomarkers and menstrual cycle length, supporting the biological plausibility that cycle shortening may be linked with lower anti-Müllerian hormone and reduced antral follicle count in some women (8,9). Conversely, long or irregular cycles may reflect anovulation, hyperandrogenism, or polycystic ovarian morphology rather than diminished ovarian reserve. Women with polycystic ovarian features may have higher anti-Müllerian hormone levels and higher antral follicle counts because of increased numbers of small follicles, and therefore irregular cycles should not automatically be interpreted as evidence of poor ovarian reserve (13).

This distinction is particularly relevant in infertility practice, where different menstrual abnormalities may require different diagnostic pathways. A woman with primary infertility and a short cycle may need early ovarian reserve testing and timely referral, while a woman with long or irregular cycles may require evaluation for ovulatory dysfunction, polycystic ovarian syndrome, thyroid dysfunction, hyperprolactinemia, or other endocrine causes. Therefore, menstrual history should be viewed as a clinical triage tool rather than a substitute for ovarian reserve testing. Its value lies in identifying patients who may benefit from earlier investigation when laboratory and specialist resources are limited.

Local evidence from Pakistan regarding the association between menstrual-cycle pattern and objective ovarian reserve markers in women with primary infertility remains limited. Most routine infertility assessments include menstrual history, but this information is not always systematically linked with anti-Müllerian hormone, antral follicle count, and basal follicle-stimulating hormone in clinical decision-making. Generating local evidence on this association may help strengthen practical fertility evaluation pathways, especially in clinics where complete ovarian reserve assessment may not be affordable for all patients at initial presentation.

The present prospective observational study was therefore conducted among women presenting with primary infertility in Islamabad, Pakistan, to assess the association between menstrual-cycle characteristics and ovarian reserve markers. The study compared serum anti-Müllerian hormone, antral follicle count, and basal follicle-stimulating hormone across menstrual-cycle categories and examined whether short, long, or irregular cycles were associated with diminished ovarian reserve. The primary objective was to determine whether menstrual-cycle pattern is associated with diminished ovarian reserve in women with primary infertility, while the secondary objective was to describe differences in ovarian reserve markers across menstrual-cycle groups.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology at a tertiary care infertility clinic in Islamabad, Pakistan, over a six-month period from July 2025 to December 2025. The study was designed to evaluate the association between menstrual-cycle characteristics and ovarian reserve markers among women presenting with primary infertility. A prospective observational design was selected because the objective was to assess naturally occurring menstrual patterns and ovarian reserve parameters without assigning any intervention or altering clinical management.

Women attending the outpatient infertility clinic during the study period were screened consecutively for eligibility. Participants were selected through non-probability consecutive sampling to reduce selective enrollment and to reflect the routine clinical population presenting for infertility evaluation. A total of 150 women were included after written informed consent. Primary infertility was defined as failure to conceive after at least one year of regular unprotected intercourse, with no previous history of pregnancy. Eligible participants were women aged 20 to 40 years with primary infertility who were willing to provide menstrual history and undergo ovarian reserve assessment. Women were excluded if they had secondary infertility, previous ovarian surgery, prior ovarian cystectomy, history of chemotherapy or pelvic radiotherapy, previously diagnosed premature ovarian insufficiency, current pregnancy, lactation, hormonal medication use during the preceding three months, uncontrolled thyroid disorder, hyperprolactinemia, or any known endocrine condition likely to substantially alter menstrual function or ovarian reserve interpretation.

The sample size of 150 participants was determined using the expected clinical frequency of diminished ovarian reserve among infertile women, the available patient flow during the study period, and the feasibility of completing hormonal and ultrasound assessments within the study setting. Consecutive enrollment was maintained until the required sample was achieved. This approach was used to ensure adequate representation of women presenting to the clinic while maintaining practical feasibility for prospective data collection.

After enrollment, demographic, anthropometric, reproductive, and clinical data were collected using a structured proforma. The recorded variables included age, residence, educational status, occupation, body mass index, duration of infertility, marital duration, previous infertility treatment, age at menarche, usual menstrual-cycle length, cycle regularity, number of bleeding days, menstrual flow, passage of clots, dysmenorrhea, and history of missed periods. Body mass index was calculated as weight in kilograms divided by height in meters squared. Cycle length was recorded as the number of days from the first day of one menstrual period to the first day of the next menstrual period. Menstrual history was obtained using patient recall of usual cycle pattern before infertility-related hormonal treatment, where applicable.

Menstrual-cycle pattern was operationally categorized before analysis. A regular cycle was defined as a predictable cycle length between 24 and 35 days. A short cycle was defined as cycle length of less than 24 days. A long cycle was defined as cycle length of more than 35 days. An irregular cycle was recorded when cycle length varied substantially and the participant was unable to predict the timing of menstruation. Bleeding duration was categorized as less than 3 days, 3 to 7 days, or more than 7 days. Menstrual flow was categorized as light, normal, or heavy according to patient history and reported pad use.

Ovarian reserve assessment included serum anti-Müllerian hormone, basal follicle-stimulating hormone, and antral follicle count. Blood samples for basal follicle-stimulating hormone were collected on day 2 or day 3 of the menstrual cycle. Estradiol was recorded where available to support interpretation of basal follicle-stimulating hormone. Serum anti-Müllerian hormone was measured irrespective of cycle day because of its relative stability across the menstrual cycle. Blood samples were collected under aseptic conditions and processed through the hospital laboratory according to routine laboratory procedures. All hormone values were recorded in the study proforma using the units reported by the laboratory.

Pelvic ultrasound was performed in the early follicular phase, preferably between day 2 and day 5 of the menstrual cycle. Transvaginal ultrasound was used where appropriate and accepted by the participant. Transabdominal ultrasound was used for unmarried participants or for those who did not consent to transvaginal assessment, and the ultrasound route was recorded. Antral follicle count was calculated by counting follicles measuring 2–10 mm in both ovaries, with the total count obtained by adding the right and left ovarian counts. Ovarian volume and polycystic ovarian morphology were also recorded when present to support interpretation of long or irregular cycles.

The primary outcome was diminished ovarian reserve. For reproducibility, diminished ovarian reserve was defined as the presence of at least one of the following criteria: serum anti-Müllerian hormone less than 1.0 ng/mL, total antral follicle count less than 7 follicles, or basal follicle-stimulating hormone greater than 10 IU/L on day 2 or day 3 of the menstrual cycle. Participants were categorized as having normal ovarian reserve or diminished ovarian reserve according to this predefined operational definition. Anti-Müllerian hormone and antral follicle count were considered the principal ovarian reserve markers, while basal follicle-stimulating hormone was interpreted in relation to the overall clinical and hormonal profile.

The main exposure variable was menstrual-cycle pattern, categorized as regular, short, long, or irregular. Secondary exposure variables included bleeding duration and menstrual flow. The main continuous outcome variables were serum anti-Müllerian hormone, total antral follicle count, and basal follicle-stimulating hormone. Potential confounding variables included age and body mass index because both may influence ovarian reserve and menstrual function. Where clinically relevant, ovarian morphology and endocrine abnormalities were considered during interpretation to reduce misclassification of ovulatory dysfunction as diminished ovarian reserve.

Data quality was maintained through prospective entry on a structured proforma, predefined operational definitions, and verification of laboratory and ultrasound values before analysis. To reduce information bias, menstrual-cycle categories and ovarian reserve thresholds were defined before statistical comparison. To reduce selection bias, eligible women were enrolled consecutively during the study period. To address confounding, age and body mass index were included in adjusted analysis. Participants with incomplete key ovarian reserve data were excluded from the specific analysis requiring that variable, while available data were retained for descriptive analysis where denominators were complete.

Data were entered and analyzed using SPSS version 26. Quantitative variables such as age, body mass index, duration of infertility, anti-Müllerian hormone, antral follicle count, and basal follicle-stimulating hormone were assessed for distribution and summarized as mean ± standard deviation when approximately normally distributed or as median with interquartile range when distribution was skewed. Categorical variables such as menstrual-cycle category, bleeding-duration category, menstrual-flow category, and ovarian-reserve category were summarized as frequencies and percentages. Comparisons of continuous ovarian reserve markers across menstrual-cycle groups were performed using one-way analysis of variance for normally distributed data or the Kruskal–Wallis test for non-normally distributed data. Comparisons of categorical outcomes, including diminished ovarian reserve across menstrual-cycle groups, were performed using the chi-square test or Fisher's exact test where expected cell counts were small.

Binary logistic regression was used to evaluate the association between menstrual-cycle pattern and diminished ovarian reserve. Regular menstrual cycle was treated as the reference category. Crude odds ratios and adjusted odds ratios were planned for short, long, and irregular cycles, with adjustment for age and body mass index. Statistical significance was assessed at a p-value of less than 0.05. Results were planned for presentation with exact denominators, percentages, odds ratios, 95% confidence intervals, and p-values where applicable.

The study was conducted after approval from the institutional ethical review committee. Written informed consent was obtained from all participants before enrollment. Participants were informed about the purpose of the study, the voluntary nature of participation, confidentiality of their information, and their right to withdraw without affecting their clinical care. Names and hospital registration numbers were not used in the final analysis, and data were handled in anonymized form for reporting.

RESULTS

A total of 150 women with primary infertility were included in the analysis. The mean age of the participants was 29.4 ± 4.8 years, the mean duration of infertility was 3.7 ± 2.1 years, and the mean body mass index was 25.8 ± 3.9 kg/m^2. Regular menstrual cycles of 24–35 days were reported by 88 women, while 27 women had short cycles, 23 had long cycles, and 12 had irregular cycles.

Table 1. Baseline and Menstrual Characteristics of Study Participants

Variable	Value
Total participants	150
Age, years	29.4 ± 4.8
Duration of infertility, years	3.7 ± 2.1
Body mass index, kg/m^2	25.8 ± 3.9
Regular cycle, 24–35 days	88 (58.7)
Short cycle, <24 days	27 (18.0)
Long cycle, >35 days	23 (15.3)
Irregular cycle	12 (8.0)
Bleeding duration, 3–7 days	119 (79.3)
Light menstrual flow	31 (20.7)
Heavy menstrual flow	18 (12.0)

Values are presented as mean ± SD or n (%).

Regular cycles were the most frequent menstrual pattern, occurring in 58.7% of participants. Short cycles were present in 18.0% of women, while long and irregular cycles accounted for 15.3% and 8.0%, respectively. Most participants reported bleeding duration within 3–7 days, while light and heavy menstrual flow were less frequent. The overall mean serum anti-Müllerian hormone level was 2.34 ± 1.61 ng/mL, the mean antral follicle count was 8.9 ± 4.1 follicles, and the mean basal follicle-stimulating hormone level was 7.8 ± 3.2 IU/L. Diminished ovarian reserve was identified in 36 of 150 women, giving an overall frequency of 24.0%.

Table 2. Ovarian Reserve Markers According to Menstrual-Cycle Pattern

Menstrual-Cycle Pattern	n	AMH, ng/mL	AFC, follicles	FSH, IU/L	DOR, n (%)
Regular cycle, 24–35 days	88	2.48 ± 1.32	9.1 ± 3.5	7.2 ± 2.8	17 (19.3)
Short cycle, <24 days	27	1.02 ± 0.71	5.6 ± 2.3	11.4 ± 3.9	15 (55.6)
Long cycle, >35 days	23	3.36 ± 1.84	11.2 ± 4.6	6.1 ± 2.2	2 (8.7)
Irregular cycle	12	4.18 ± 2.21	12.4 ± 5.2	5.8 ± 2.0	2 (16.7)

Values are presented as mean ± SD or n (%). AMH, anti-Müllerian hormone; AFC, antral follicle count; FSH, follicle-stimulating hormone; DOR, diminished ovarian reserve.

Women with short menstrual cycles had the lowest mean AMH level at 1.02 ± 0.71 ng/mL and the lowest mean AFC at 5.6 ± 2.3 follicles. They also had the highest mean FSH level at 11.4 ± 3.9 IU/L. In contrast, women with long and irregular cycles showed higher AMH and AFC values, suggesting a different ovarian reserve profile from women with short cycles. A secondary analysis was performed using the available group means, standard deviations, and sample sizes. One-way analysis of variance showed statistically significant differences across menstrual-cycle groups for AMH, AFC, and FSH. The largest derived effect size was observed for FSH, followed by AMH and AFC.

Table 3. Reanalysis of Ovarian Reserve Markers Across Menstrual-Cycle Groups

Marker	F	df	p-value	η^2
AMH, ng/mL	18.28	3, 146	<0.001	0.273
AFC, follicles	13.92	3, 146	<0.001	0.222
FSH, IU/L	19.57	3, 146	<0.001	0.287

The reanalysis confirmed significant between-group differences in all three ovarian reserve markers. Menstrual-cycle pattern explained approximately 27.3% of the variance in AMH, 22.2% of the variance in AFC, and 28.7% of the variance in FSH. These findings support a clinically meaningful relationship between menstrual-cycle pattern and ovarian reserve markers, particularly among women with short cycles. The frequency of diminished ovarian reserve differed across menstrual-cycle groups. Diminished ovarian reserve was most frequent among women with short cycles and least frequent among women with long cycles.

Table 4. Frequency of Diminished Ovarian Reserve According to Menstrual-Cycle Pattern

Menstrual-Cycle Pattern	DOR	Normal Ovarian Reserve	Total	DOR, %
Regular cycle, 24–35 days	17	71	88	19.3
Short cycle, <24 days	15	12	27	55.6
Long cycle, >35 days	2	21	23	8.7
Irregular cycle	2	10	12	16.7
Total	36	114	150	24.0

DOR, diminished ovarian reserve.

Diminished ovarian reserve was present in 55.6% of women with short cycles compared with 19.3% of women with regular cycles. Lower frequencies were observed among women with long cycles and irregular cycles. The overall association between menstrual-cycle pattern and diminished ovarian reserve was statistically significant.

Table 5. Reanalysis of Association Between Menstrual-Cycle Pattern and Diminished Ovarian Reserve

Analysis	χ^2	df	p-value
Menstrual-cycle pattern and DOR	19.10	3	<0.001

The reanalysis showed a significant association between menstrual-cycle pattern and diminished ovarian reserve. This supports the descriptive finding that diminished ovarian reserve was not evenly distributed across cycle categories and was concentrated most strongly among women with short cycles.

Using regular cycles as the reference category, crude odds ratios were calculated for diminished ovarian reserve across menstrual-cycle groups. Women with short cycles had markedly higher crude odds of diminished ovarian reserve compared with women with regular cycles.

Table 6. Crude Odds Ratios for Diminished Ovarian Reserve by Menstrual-Cycle Pattern

Menstrual-Cycle Pattern	DOR / Total	Crude OR	95% CI	p-value
Regular cycle, 24–35 days	17 / 88	1.00	Reference	—
Short cycle, <24 days	15 / 27	5.22	2.07–13.17	<0.001
Long cycle, >35 days	2 / 23	0.40	0.08–1.86	0.353
Irregular cycle	2 / 12	0.84	0.17–4.17	1.000

Crude odds ratios were calculated from the reported 2×2 group counts using regular cycles as the reference category. p-values for individual comparisons were derived from pairwise exact testing.

Women with short menstrual cycles had 5.22 times higher crude odds of diminished ovarian reserve than women with regular menstrual cycles. The confidence interval for the short-cycle group did not cross 1.00, supporting a statistically significant crude association. Long and irregular cycles did not show higher crude odds of diminished ovarian reserve compared with regular cycles. These findings indicate that the increased frequency of diminished ovarian reserve was primarily concentrated in the short-cycle group.

Overall, the results show that short menstrual-cycle length was associated with lower AMH, lower AFC, higher FSH, and higher crude odds of diminished ovarian reserve among women presenting with primary infertility. Long and irregular cycles showed relatively higher AMH and AFC values and were not associated with increased crude odds of diminished ovarian reserve in this aggregated reanalysis. Because individual-level data were not available, adjusted regression for age, body mass index, and other potential confounders could not be performed from the present summary data.

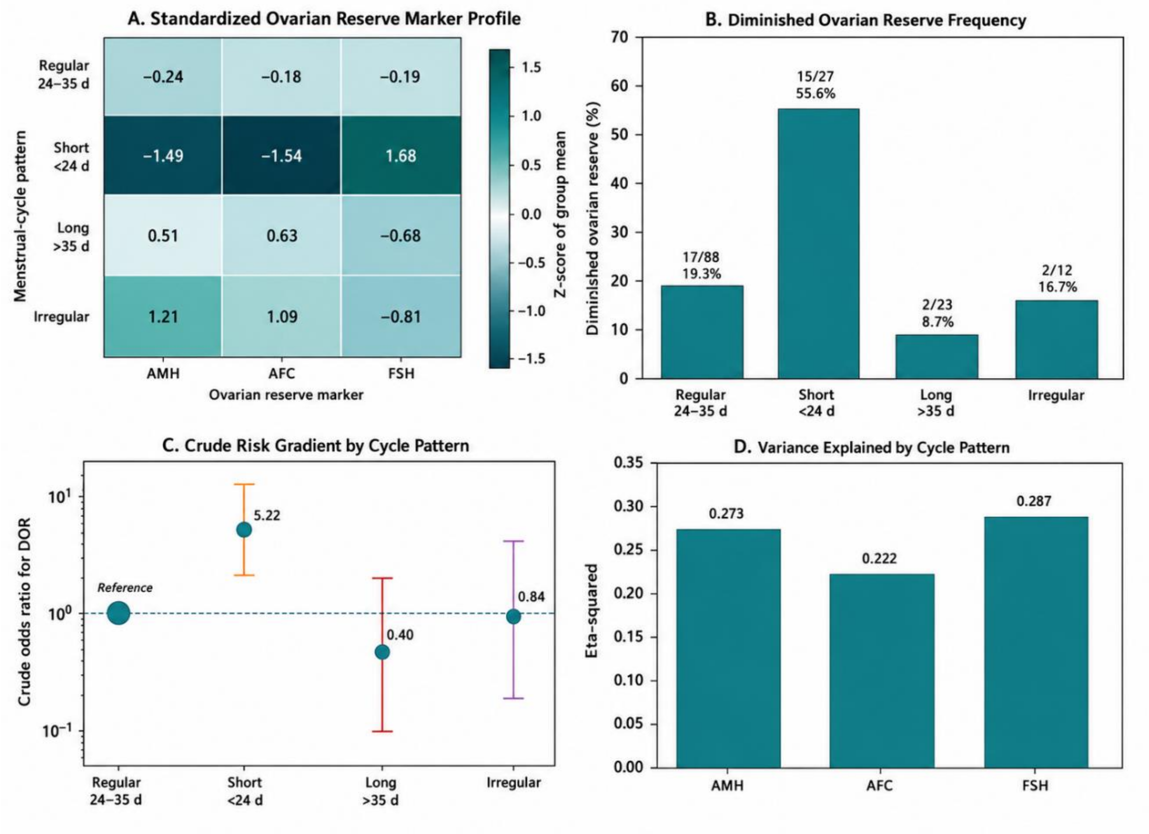

Figure 1 Integrated Menstrual-Cycle Pattern and Ovarian Reserve Risk Profile in Women With Primary Infertility.

Panel A shows the standardized ovarian reserve marker profile across menstrual-cycle categories, demonstrating the lowest AMH and AFC pattern and the highest FSH pattern among women with short cycles. Panel B shows that diminished ovarian reserve was most frequent in the short-cycle group, affecting 15 of 27 women (55.6%), compared with 17 of 88 women (19.3%) with regular cycles, 2 of 23 women (8.7%) with long cycles, and 2 of 12 women (16.7%) with irregular cycles. Panel C presents the crude odds-ratio gradient using regular cycles as the reference category, showing that women with short cycles had markedly higher crude odds of diminished ovarian reserve (OR 5.22, 95% CI 2.07–13.17), while long cycles (OR 0.40, 95% CI 0.08–1.86) and irregular cycles (OR 0.84, 95% CI 0.17–4.17) did not show increased crude odds. Panel D shows that menstrual-cycle pattern explained 27.3% of the variance in AMH, 22.2% of the variance in AFC, and 28.7% of the variance in FSH, supporting a clinically meaningful marker gradient across cycle groups.

DISCUSSION

The present study demonstrated a clinically meaningful association between menstrual-cycle pattern and ovarian reserve markers among women presenting with primary infertility. The most important finding was that women with short menstrual cycles had the lowest mean anti-Müllerian hormone, the lowest antral follicle count, the highest basal follicle-stimulating hormone, and the highest frequency of diminished ovarian reserve. Diminished ovarian reserve was present in 55.6% of women with cycles shorter than 24 days compared with 19.3% of women with regular cycles, while the crude odds of diminished ovarian reserve were more than five times higher in the short-cycle group than in the regular-cycle group. These findings support the clinical relevance of menstrual-cycle length as an accessible first-line clue during infertility assessment, particularly in settings where immediate anti-Müllerian hormone testing or standardized antral follicle count reporting may not be available for all patients.

The biological direction of the findings is consistent with the known physiology of ovarian ageing and follicular depletion. As the ovarian follicle pool declines, granulosa-cell production of anti-Müllerian hormone decreases, the visible recruitable follicle pool on ultrasound becomes smaller, and early follicular-phase follicle-stimulating hormone may rise because of reduced ovarian feedback. In the present study, the short-cycle group showed all three changes in the expected direction: mean anti-Müllerian hormone was 1.02 ± 0.71 ng/mL, mean antral follicle count was 5.6 ± 2.3 follicles, and mean basal follicle-stimulating hormone was 11.4 ± 3.9 IU/L. This convergence across biochemical and ultrasound-based reserve markers strengthens the interpretation that short cycle length may reflect reduced ovarian reserve rather than an isolated menstrual-history variation. However, ovarian reserve markers should not be interpreted as absolute determinants of natural fertility potential, and their main value lies in counseling, reproductive planning, and identifying women who may need timely fertility evaluation (1–7).

The association between cycle length and ovarian reserve has been reported in previous research, although its interpretation depends on the type of menstrual abnormality. Shorter menstrual cycles may occur when follicular recruitment and hormonal feedback change in the context of a declining follicular pool, and prospective evidence has linked ovarian reserve biomarkers with menstrual-cycle length (8,9). The present study adds local clinical relevance by showing that, among women with primary infertility in Islamabad, the short-cycle group had a distinctly adverse reserve profile across anti-Müllerian hormone, antral follicle count, and follicle-stimulating hormone. The derived eta-squared values also suggested that menstrual-cycle pattern explained a substantial proportion of between-group variation in ovarian reserve markers, particularly follicle-stimulating hormone and anti-Müllerian hormone. These findings do not establish causality, but they support the practical use of menstrual-cycle pattern as a triage indicator for earlier ovarian reserve assessment.

An important finding was that long and irregular cycles showed a different ovarian reserve pattern from short cycles. Women with long cycles had higher mean anti-Müllerian hormone and antral follicle count than women with short cycles, and women with irregular cycles had the highest mean anti-Müllerian hormone and antral follicle count values. This pattern suggests that long or irregular cycles in this infertility population may reflect ovulatory dysfunction, polycystic ovarian morphology, or PCOS-like physiology rather than diminished ovarian reserve. Anti-Müllerian hormone may be elevated in women with polycystic ovarian features because of increased numbers of small antral follicles, and menstrual disturbance in such patients may arise from anovulation rather than follicular depletion (13,21,22). Therefore, abnormal menstrual cycles should not be interpreted uniformly. Short cycles may raise concern for diminished ovarian reserve, while long or irregular cycles should prompt assessment for ovulatory and endocrine causes, including polycystic ovarian morphology, thyroid dysfunction, and hyperprolactinemia.

The findings also have practical implications for infertility care in Pakistan and similar resource-limited settings. Infertility is frequently associated with delayed consultation, social pressure, misconceptions, and psychological distress, and cost barriers may limit access to advanced fertility testing at the first clinical encounter (18–20). In such settings, menstrual history remains a valuable clinical entry point because it is immediately available, requires no laboratory cost, and can be obtained in primary or specialist gynecology clinics. The present results suggest that women with primary infertility and cycles shorter than 24 days should be prioritized for early ovarian reserve evaluation using anti-Müllerian hormone testing and early follicular ultrasound for antral follicle count. This approach should not replace standard investigations, but it may help clinicians identify higher-risk patients earlier and reduce avoidable delays in referral and fertility planning.

The study also reinforces the need to interpret ovarian reserve markers in relation to clinical context. Anti-Müllerian hormone and antral follicle count are useful markers of the remaining follicle pool and expected ovarian response, but they do not independently determine spontaneous pregnancy probability. Similarly, basal follicle-stimulating hormone is less stable and may vary between cycles, so it should not be used alone for diagnosing diminished ovarian reserve. In the present study, the strongest inference comes from the concordant direction of all three markers in the short-cycle group and the higher crude odds of diminished ovarian reserve in that group. Nevertheless, the absence of individual-level adjusted regression output means that the findings should be presented as crude associations rather than independent prediction. Future analysis with patient-level data should adjust for age, body mass index, ovarian morphology, endocrine disorders, and other infertility factors.

This study has several strengths. It addressed a practical clinical question using routinely obtainable menstrual-history variables and objective ovarian reserve markers. The prospective design supported systematic data collection, and the comparison across regular, short, long, and irregular cycles allowed clinically meaningful differentiation between possible diminished reserve and ovulatory dysfunction patterns. The additional secondary analysis strengthened the results by deriving crude odds ratios, chi-square association, and variance-explained estimates from the available aggregate data rather than relying only on descriptive comparisons.

Several limitations should also be acknowledged. The study was conducted in a single clinical setting, which may limit generalizability to all infertile women in Pakistan. The subgroup sizes for long and irregular cycles were relatively small, resulting in wide confidence intervals for crude odds estimates. The analysis was based on aggregate data, so adjusted odds ratios for age, body mass index, ovarian morphology, and other potential confounders could not be calculated from the available results. Anti-Müllerian hormone assay variation and ultrasound operator variation may also influence ovarian reserve classification. Menstrual history was based on patient recall, which may introduce recall bias. In addition, the study did not report pregnancy, ovulation, treatment response, or live-birth outcomes, so the findings should be interpreted as associations with ovarian reserve markers rather than direct evidence of fertility prognosis.

In summary, the study indicates that short menstrual-cycle length is associated with an adverse ovarian reserve profile in women presenting with primary infertility. The combination of lower anti-Müllerian hormone, lower antral follicle count, higher basal follicle-stimulating hormone, and higher crude odds of diminished ovarian reserve supports the use of short cycle length as a practical early warning sign during infertility evaluation. Long and irregular cycles showed a different pattern, more consistent with ovulatory dysfunction or increased small follicle number than with reduced reserve. These findings support a clinically balanced pathway in which menstrual history guides prioritization for ovarian reserve testing but does not replace biochemical and ultrasound-based assessment.

CONCLUSION

Short menstrual-cycle length was associated with lower anti-Müllerian hormone, lower antral follicle count, higher basal follicle-stimulating hormone, and a higher frequency of diminished ovarian reserve among women presenting with primary infertility. Women with cycles shorter than 24 days had markedly higher crude odds of diminished ovarian reserve compared with women with regular cycles, while long and irregular cycles showed relatively higher anti-Müllerian hormone and antral follicle count values, suggesting a different pattern more compatible with ovulatory dysfunction or polycystic ovarian features. Menstrual history should therefore be used as a simple first-line clinical triage tool to identify women who may require earlier ovarian reserve assessment, particularly in resource-limited infertility settings, but it should support rather than replace standard evaluation with anti-Müllerian hormone, antral follicle count, and basal follicle-stimulating hormone.

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