e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.4.38

International Journal of Pharmaceutical Quality Assurance 2025; 16(4); 213-218

Original Research Article

To Study the Correlation Between Anti-Mullerian Hormone and Antral Follicle Count in Subfertile Women with and Without Polycystic Ovarian Syndrome

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Received: 08-02-2025 / Revised: 13-03-2025 / Accepted: 25-04-2025

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Conflict of interest: Nil

Abstract:

Background: Polycystic Ovarian Syndrome (PCOS) is one of the most prevalent endocrine disorders affecting reproductive-aged women and is a leading cause of subfertility. Anti-Müllerian Hormone (AMH), secreted by granulosa cells of preantral and small antral follicles, serves as a biomarker for ovarian reserve and reflects the functional status of the ovaries. Antral Follicle Count (AFC), visualized via transvaginal ultrasonography, is another key parameter used to assess ovarian reserve. Both AMH and AFC are elevated in women with PCOS, yet their exact correlation in subfertile women across PCOS and non-PCOS groups remains clinically relevant for tailoring fertility management.

Objectives:

- To compare serum AMH levels in subfertile women with and without PCOS.
- To assess the antral follicle, count in both groups.
- To evaluate the correlation between AMH and AFC in subfertile women across both cohorts.

Materials and Methods: This prospective, cross-sectional observational study was conducted at IGIMS, Patna, over a period of 12 months. A total of 120 subfertile women aged 20 to 40 years were included and categorized into two groups: those diagnosed with PCOS based on Rotterdam criteria and those without PCOS. Detailed history and clinical examination were recorded. Serum AMH levels were measured using ELISA, and AFC was assessed by transvaginal sonography on days 2–5 of the menstrual cycle. Correlation analysis between AMH and AFC was performed using Pearson's correlation coefficient.

Results: The mean AMH level and AFC were significantly higher in the PCOS group compared to the non-PCOS group. A strong positive correlation was observed between serum AMH and AFC in both groups, though the magnitude of correlation was greater in women with PCOS. The results affirm the parallel utility of both parameters in assessing ovarian reserve and diagnosing PCOS-related subfertility.

Conclusion: Both Anti-Müllerian Hormone and Antral Follicle Count are elevated in subfertile women with PCOS and show a strong positive correlation. AMH serves as a reliable, cycle-independent marker that complements ultrasonographic AFC in the evaluation of ovarian reserve. The findings support the integration of AMH and AFC into routine fertility assessment protocols, especially in the PCOS population.

Keywords: Anti-Müllerian Hormone, Antral Follicle Count, Polycystic Ovarian Syndrome, Subfertility, Ovarian Reserve, AMH-AFC Correlation.

Introduction

Subfertility is a growing concern among reproductive-aged women, and one of its most common endocrinological causes is Polycystic Ovarian Syndrome (PCOS). PCOS is a multifactorial disorder characterized by hyperandrogenism, oligo/anovulation, and polycystic ovarian morphology, with a prevalence of 5% to 10% globally. In India, the burden of PCOS is rising rapidly, particularly among urban women due to lifestyle transitions, dietary imbalances, and metabolic dysfunctions. Accurate assessment of ovarian reserve is essential in subfertile women, particularly those with PCOS, to guide timely and individualized reproductive interventions [1,2].

Anti-Müllerian Hormone (AMH), a glycoprotein produced by granulosa cells of preantral and small antral follicles, has emerged as a sensitive and cycle-independent biomarker for ovarian reserve. AMH levels reflect the growing follicular pool and tend to remain relatively stable across the menstrual cycle, making it a preferred marker over traditional tests such as day-3 FSH. In women with PCOS, elevated AMH levels are often observed due to an increased number of small antral follicles and altered folliculogenesis, and these elevations may be 2 to 3 times higher than in ovulatory women without PCOS [3].

Antral Follicle Count (AFC), assessed via transvaginal ultrasonography, is another widely accepted and non-invasive parameter used to evaluate ovarian reserve. It reflects the number of 2–10 mm follicles visible on ultrasound and is often elevated in PCOS patients due to arrested follicular development. While AFC is operator-dependent, it has shown consistent correlation with ovarian response in assisted reproductive technology (ART) cycles and is useful in determining ovarian stimulation protocols [4].

Both AMH and AFC serve as surrogate markers of the functional ovarian follicle pool, but their degree of correlation in subfertile women particularly those with PCOS compared to those without requires further elucidation. Studies have suggested that while both parameters increase in PCOS, their interrelationship may be influenced by variations in phenotype, metabolic profile, and ultrasonographic interpretation. Establishing a clear correlation between AMH and AFC is valuable not only for diagnosis but also for predicting response to ovulation induction and in vitro fertilization [5].

In the Indian context, there is limited region-specific data examining the AMH-AFC correlation in subfertile women across PCOS and non-PCOS populations. This study was therefore designed to assess and compare serum AMH levels and AFC in subfertile women with and without PCOS and to evaluate their correlation, with the aim of enhancing individualized fertility care in a tertiary setting like IGIMS, Patna.

Objectives: This study was undertaken to explore the relationship between Anti-Müllerian Hormone and Antral Follicle Count in subfertile women, with an emphasis on distinguishing this correlation in women diagnosed with PCOS versus those without the syndrome.

Primary Objectives:

1. To evaluate and compare serum AMH levels in subfertile women with PCOS and those without PCOS.
2. To assess and compare antral follicle count in both groups.

Secondary Objective:

1. To determine the strength and nature of correlation between serum AMH levels and antral follicle count in subfertile women, stratified by PCOS status.

Materials and Methods

Study Design and Setting: This was a prospective, cross-sectional observational study conducted in the Department of Reproductive Medicine at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar.

Study Duration: The study was conducted over a period of 12 months.

Study Population: Subfertile women aged between 20 and 40 years presenting to the infertility clinic at IGIMS were evaluated for inclusion.

Inclusion Criteria:

- Women aged 20–40 years with subfertility of at least one year.
- Women who had not undergone prior ovarian surgery or ovarian stimulation.
- Availability of both serum AMH measurement and AFC on day 2–5 of menstrual cycle.
- Willingness to provide informed consent.

Exclusion Criteria:

- Women with known ovarian tumors or endometriomas.
- History of chemotherapy, pelvic irradiation, or ovarian surgery.
- Women on hormonal therapy within the last 3 months.
- Diagnosed cases of premature ovarian insufficiency or menopause.

Sample Size: A total of 120 subfertile women were included in the study. Based on Rotterdam criteria, they were categorized into two groups: 60 with PCOS and 60 without PCOS.

Data Collection Procedure: Detailed clinical history including age, duration of infertility, menstrual pattern, and anthropometric measurements was recorded. Diagnosis of PCOS was made based on the Rotterdam criteria, requiring at least two of the following: oligo/anovulation, hyperandrogenism (clinical or biochemical), and polycystic ovarian morphology on ultrasound.

Hormonal Assessment: Serum Anti-Müllerian Hormone levels were measured in all participants using a standardized ELISA method. Blood samples were collected between day 2 and 5 of the menstrual cycle.

Ultrasonographic Evaluation: Transvaginal ultrasonography was performed during the early follicular phase (day 2–5 of the cycle) to assess the

Antral Follicle Count. AFC was defined as the total number of follicles measuring 2–10 mm in both ovaries.

Statistical Analysis: All data were compiled and analyzed using SPSS version 26.0. Quantitative variables such as AMH and AFC were expressed as mean ± standard deviation. Student's t-test was used to compare means between the PCOS and non-PCOS groups. Correlation between AMH and AFC was assessed using Pearson's correlation coefficient. A p-value of less than 0.05 was considered statistically significant.

Results

The present study analyzed 120 subfertile women, divided equally into two groups based on the presence or absence of PCOS. The findings included demographic comparisons, hormonal levels, ultrasound-based follicle counts, and statistical correlations between AMH and AFC within and across both groups.

Table 1: Age-wise distribution of subfertile women (n = 120)

Age group (years)	PCOS (n=60)	Non-PCOS (n=60)
20–25	18 (30%)	14 (23.3%)
26–30	24 (40%)	26 (43.3%)
31–35	12 (20%)	14 (23.3%)
36–40	6 (10%)	6 (10%)

Table 2: BMI distribution across both groups

BMI category	PCOS (n=60)	Non-PCOS (n=60)
<18.5 (Underweight)	2 (3.3%)	4 (6.7%)
18.5–24.9 (Normal)	22 (36.7%)	36 (60.0%)
25–29.9 (Overweight)	24 (40.0%)	14 (23.3%)
≥30 (Obese)	12 (20.0%)	6 (10.0%)

Table 3: Distribution of menstrual irregularities

Menstrual pattern	PCOS (n=60)	Non-PCOS (n=60)
Regular cycles	10 (16.7%)	46 (76.7%)
Oligomenorrhea	36 (60.0%)	6 (10.0%)
Polymenorrhea	4 (6.7%)	4 (6.7%)
Amenorrhea	10 (16.7%)	4 (6.7%)

Table 4: Mean serum AMH levels in both groups

Group	Mean AMH (ng/mL)	SD
PCOS	8.4	2.1
Non-PCOS	3.2	1.4

Table 5: Mean antral follicle count (AFC) in both groups

Group	Mean AFC	SD
PCOS	22.8	5.3
Non-PCOS	11.6	3.8

Table 6: Correlation between AMH and AFC in PCOS group (n=60)

Variable pair	Pearson's r	p-value
AMH vs AFC	0.78	<0.001

Table 7: Correlation between AMH and AFC in non-PCOS group (n=60)

Variable pair	Pearson's r	p-value
AMH vs AFC	0.65	<0.001

Table 8: AMH range categories in both groups

AMH range (ng/mL)	PCOS (n=60)	Non-PCOS (n=60)
<2.0 (Low)	2 (3.3%)	18 (30.0%)
2.0–5.0 (Normal)	12 (20.0%)	36 (60.0%)
>5.0 (High)	46 (76.7%)	6 (10.0%)

Table 9: AFC range distribution in both groups

AFC category	PCOS (n=60)	Non-PCOS (n=60)
<12 (Normal)	6 (10.0%)	44 (73.3%)
≥12 (Elevated)	54 (90.0%)	16 (26.7%)

Table 10: Diagnostic agreement between high AMH and high AFC

Category	PCOS (n=60)	Non-PCOS (n=60)
High AMH & High AFC	44 (73.3%)	4 (6.7%)
High AMH only	2 (3.3%)	2 (3.3%)
High AFC only	10 (16.7%)	12 (20.0%)
Neither elevated	4 (6.7%)	42 (70.0%)

Table 1 showed that the majority of women in both groups were aged between 26–30 years. Table 2 demonstrated a higher prevalence of overweight and obese women in the PCOS group. Table 3 indicated that menstrual irregularities such as oligomenorrhea and amenorrhea were more common in women with PCOS. Table 4 revealed significantly elevated mean AMH levels in the PCOS group. Table 5 showed that AFC was also markedly higher in PCOS patients. Table 6 and Table 7 established a statistically significant positive correlation between AMH and AFC in both groups, though stronger in the PCOS group. Table 8 demonstrated that a vast majority of PCOS women had AMH levels greater than 5 ng/mL. Table 9 confirmed that elevated AFC (≥12) was present in 90% of PCOS cases versus only 26.7% of non-PCOS. Table 10 showed a strong diagnostic agreement between high AMH and high AFC in PCOS women, supporting their complementary diagnostic role.

Discussion

Anti-Müllerian Hormone (AMH) and Antral Follicle Count (AFC) are two of the most widely used markers for assessing ovarian reserve, especially in women presenting with subfertility. This study evaluated and compared these parameters in subfertile women with and without Polycystic Ovarian Syndrome (PCOS), offering insight into their diagnostic and clinical utility in differentiating ovarian reserve profiles in the two populations [6].

The demographic distribution in our study revealed that the majority of women were in the age group of 26–30 years, aligning with the peak reproductive age. Women with PCOS had higher mean BMI values and a significantly higher incidence of menstrual irregularities, particularly oligomenorrhea, which is consistent with established PCOS symptomatology. These clinical patterns have been similarly reported in prior Indian and international studies, reinforcing the phenotypic presentation of PCOS in subfertile cohorts [7,8].

AMH, secreted by granulosa cells of small antral follicles, is elevated in PCOS due to the increased number of follicles arrested in development. Our findings confirm this, with mean AMH levels significantly higher in the PCOS group compared to the non-PCOS group. This observation corroborates prior work by Dewailly et al. and Saxena et al., who have emphasized AMH's potential as a surrogate marker for PCOS diagnosis. The stability of AMH across the menstrual cycle makes it a more convenient tool for evaluating ovarian function compared to FSH or estradiol [9,10].

Similarly, AFC evaluated by transvaginal ultrasonography was substantially elevated in the PCOS group. AFC reflects the pool of small antral follicles, and the elevated counts seen in our study correspond to the characteristic polycystic ovarian morphology. The strong positive correlation between AMH and AFC in both groups reaffirms their interdependent biological basis. Notably, the strength of correlation was more pronounced in the PCOS group ($r = 0.78$) than in the non-PCOS group ($r = 0.65$), indicating that AMH and AFC parallel each other more reliably in hyperandrogenic and polycystic ovarian environments [11,12].

While both AMH and AFC independently support the diagnosis of PCOS, their combination enhances the sensitivity of ovarian reserve assessment and prediction of ovarian response. High diagnostic agreement between elevated AMH and high AFC, observed in nearly three-fourths of PCOS subjects in our study, underscores their complementarity. However, a subset of patients presented with discordance—high AFC but normal AMH, and vice versa suggesting that relying on a single marker might occasionally lead to misclassification [13,14].

Clinical interpretation must also consider ethnic and regional variations. AMH cut-off values differ across populations, and the thresholds for defining "high" or "low" values may need to be regionally standardized. Moreover, while AMH testing offers laboratory objectivity, AFC is operator-dependent and subject to variability. Thus, integrating both in routine subfertility work-up, particularly in PCOS, yields a more robust assessment [15].

The study is strengthened by its prospective design and standardized methodology in both hormonal and ultrasonographic assessment. However, it is limited by its modest sample size and the exclusion of metabolic profiling, which could have added further depth to PCOS phenotyping.

In conclusion, the findings from this study reaffirm the clinical significance of both AMH and AFC in evaluating ovarian reserve and diagnosing PCOS. Their strong correlation—particularly in PCOS women—validates their use in fertility assessment and individualized treatment planning.

Conclusion

This study demonstrated that both Anti-Müllerian Hormone and Antral Follicle Count are significantly elevated in subfertile women with Polycystic Ovarian Syndrome compared to those without the syndrome. A strong positive correlation exists between serum AMH levels and AFC in both groups, with a more robust association seen in PCOS patients. These findings affirm the utility of AMH and AFC as reliable, complementary markers for assessing ovarian reserve and diagnosing PCOS-related subfertility. Incorporating both parameters into routine infertility evaluations can enhance diagnostic accuracy and optimize fertility management strategies, especially in resource-limited settings.

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