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Original Article

Correlation between Serum Anti-Müllerian Hormone (AMH) Levels and Clinical Severity of Polycystic Ovarian Syndrome (PCOS)

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ABSTRACT

Background: Polycystic ovary syndrome is an endocrine disorder affecting women of reproductive age, characterized by menstrual irregularities, hyperandrogenism and polycystic ovarian morphology. Anti-Müllerian Hormone reflects ovarian follicular activity and may be associated with PCOS clinical severity. Understanding the relationship between AMH levels and disease manifestations may improve diagnostic strategies. **Objective:** This study aimed to evaluate the correlation between serum Anti-Müllerian Hormone levels and clinical severity indicators of polycystic ovary syndrome. **Methods & Materials:** This cross-sectional study was conducted at Update Diagnostic Center, Rangpur, Bangladesh, from June 2024 to July 2025. A total of 120 women were enrolled, including 60 with PCOS and 60 healthy controls. Socio-demographic data, clinical features, anthropometric measurements, hormonal profiles and ultrasonographic parameters were collected. Serum AMH, LH, FSH and testosterone levels were measured using standardized immunoassay methods. Statistical analysis used SPSS version 26.0. **Results:** PCOS women had higher BMI, waist circumference, menstrual cycle duration and prevalence of clinical manifestations versus controls. Mean serum AMH levels were higher in PCOS patients (7.62 ± 3.21 ng/mL) than in controls (2.71 ± 1.48 ng/mL) ($p < 0.001$). AMH levels showed positive correlations with BMI ($r = 0.28$), LH/FSH ratio ($r = 0.34$), ovarian volume ($r = 0.46$), antral follicle count ($r = 0.52$) and Ferriman–Gallwey score ($r = 0.31$). **Conclusion:** Serum AMH levels are elevated in women with PCOS and correlate with clinical and hormonal indicators of disease severity.

Keywords: *Polycystic ovary syndrome; Anti-Müllerian hormone; ovarian reserve; hyperandrogenism.*

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INTRODUCTION

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders affecting women of reproductive age and is characterized by a heterogeneous clinical presentation involving reproductive, metabolic and hormonal abnormalities. The condition typically manifests with menstrual irregularities, hyperandrogenism and polycystic ovarian morphology and it is associated with infertility, metabolic disturbances and long-term health risks [1]. The global prevalence of PCOS is estimated to range between 6% and 20% depending on the diagnostic criteria used and the studied population [2]. Because of its complex pathophysiology and diverse clinical manifestations, PCOS remains a major challenge in reproductive endocrinology.

The pathogenesis of PCOS involves a complex interaction between genetic predisposition, hormonal imbalance, metabolic dysfunction and environmental factors. Hyperandrogenism and chronic anovulation are considered central features of the disorder, while insulin resistance and obesity frequently contribute to its severity [3]. Women with PCOS often demonstrate increased ovarian follicle number and altered folliculogenesis, which lead to the characteristic polycystic ovarian morphology observed on ultrasonography. These abnormalities contribute to impaired ovulation and reproductive dysfunction [4].

Anti-Müllerian Hormone (AMH) is a glycoprotein hormone secreted by granulosa cells of pre-antral and small antral follicles in the ovary. It has emerged as a reliable marker of ovarian reserve and follicular activity in women of reproductive age [5]. Unlike other reproductive hormones, AMH levels remain relatively stable throughout the menstrual cycle, making it a useful biomarker for assessing ovarian function [6]. Elevated AMH levels are frequently observed in women with PCOS due to the increased number of small follicles present in the ovaries. This characteristic has prompted considerable interest in the potential role of AMH as a diagnostic and prognostic marker for PCOS [7].

Several studies have reported significantly higher serum AMH levels in women with PCOS compared with healthy controls. Butt et al. demonstrated that AMH can serve as an important biochemical marker for identifying women with PCOS and may assist in improving diagnostic accuracy [8]. Similarly, research suggests that AMH levels correlate with key clinical and hormonal features of the disorder, including hyperandrogenism, ovarian volume and antral follicle count [9]. These associations indicate that AMH may reflect the severity of ovarian dysfunction in PCOS.

In addition to its diagnostic potential, AMH has been investigated for its relationship with metabolic and anthropometric parameters in women with PCOS. Obesity and increased body mass index have been linked to alterations in hormonal profiles and reproductive function in affected individuals [10]. Some studies have reported significant correlations between AMH levels and metabolic indicators, suggesting that the hormone may also reflect underlying metabolic risk in women with PCOS [11]. However, findings regarding these associations remain inconsistent across different populations.

Despite increasing global research on AMH and PCOS, limited studies have evaluated the relationship between serum AMH levels and clinical severity indicators in South Asian populations, particularly in Bangladesh. Differences in genetic

background, lifestyle and environmental factors may influence hormonal patterns and disease expression among women with PCOS. Therefore, region-specific data are important to better understand the clinical utility of AMH in this population.

The present study aimed to evaluate the correlation between serum Anti-Müllerian Hormone levels and clinical severity indicators of polycystic ovary syndrome among women attending a diagnostic center in Rangpur, Bangladesh. By comparing hormonal, clinical and ultrasonographic parameters between women with PCOS and healthy controls, this study seeks to provide further insight into the potential role of AMH as a marker of disease severity.

OBJECTIVES

The objective of this study was to evaluate the correlation between serum Anti-Müllerian Hormone levels and clinical severity indicators of polycystic ovary syndrome.

METHODS & MATERIALS

This cross-sectional comparative study was conducted at the Update Diagnostic Center, Rangpur, Bangladesh. The study period extended from June 2024 to July 2025. The study population consisted of women of reproductive age attending the diagnostic center for gynecological evaluation or infertility assessment. A total of 120 participants were enrolled, including 60 women diagnosed with polycystic ovary syndrome and 60 apparently healthy women serving as controls.

Inclusion criteria

1. Women aged 18–35 years.
2. Women diagnosed with PCOS based on clinical and ultrasonographic findings.
3. Women with regular menstrual cycles and normal ovarian morphology for the control group.
4. Participants willing to provide informed consent.

Exclusion criteria

1. Women with known endocrine disorders such as thyroid dysfunction or hyperprolactinemia.
2. Women receiving hormonal therapy within the previous three months.
3. Women with ovarian tumors or other gynecological pathologies.
4. Pregnant women.
5. Women with systemic diseases affecting reproductive hormones.

Data Collection Procedure

Data collection was performed through a structured clinical and laboratory assessment process. Participants attending the diagnostic center during the study period were screened according to the predefined inclusion and exclusion criteria. Eligible participants were informed about the purpose of the study and written informed consent was obtained before enrollment.

Sociodemographic information and relevant clinical history were collected using a structured questionnaire. Information regarding age, marital status, menstrual history and infertility status was recorded. Anthropometric measurements including body mass index and waist circumference were obtained using standardized techniques. Body weight was measured using a calibrated digital weighing scale, while height was recorded using a stadiometer. Body mass index was calculated by dividing weight in kilograms by the square of height in meters. Waist circumference was measured at the midpoint between the lower rib margin and the iliac crest using a non-stretchable measuring tape.

Clinical examination was conducted to identify features of hyperandrogenism such as hirsutism and acne. Hirsutism severity was assessed using the modified Ferriman–Gallwey scoring system. Transvaginal or transabdominal ultrasonography was performed to evaluate ovarian morphology, including ovarian volume and antral follicle count.

Venous blood samples were collected from each participant during the early follicular phase of the menstrual cycle or at a random time in women with irregular cycles. Serum samples were analyzed for hormonal parameters including Anti-Müllerian Hormone, luteinizing hormone, follicle-stimulating hormone and total testosterone using standardized immunoassay techniques available at the diagnostic laboratory. All laboratory analyses were conducted according to manufacturer guidelines to ensure accuracy and reproducibility.

All collected data were recorded using unique identification numbers to maintain participant confidentiality. Personal identifiers were removed during data entry and analysis to ensure privacy and data security.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Independent sample t-tests were used to compare mean values between groups. Chi-square tests were applied for categorical variables. Pearson correlation analysis was performed to determine relationships between serum AMH levels and clinical severity indicators.

RESULT

Table I presents the socio-demographic and anthropometric characteristics of the study participants. The mean age of participants was comparable between the PCOS group (25.8 ± 4.2 years) and controls (26.1 ± 4.5 years), showing no statistically significant difference ($p = 0.712$). Body mass index was significantly higher among women with PCOS (26.7 ± 3.8 kg/m²) compared with controls (23.9 ± 3.2 kg/m²) ($p = 0.001$). Similarly, waist circumference was greater in the PCOS group (87.5 ± 7.9 cm) than in controls (79.8 ± 6.6 cm), indicating a statistically significant difference ($p < 0.001$). The duration of menstrual cycles was also markedly prolonged in PCOS participants (40.2 ± 9.1 days) compared with controls (29.4 ± 3.6 days), which was statistically significant ($p < 0.001$).

Table I

Socio-demographic and anthropometric characteristics of the study participants ($n = 120$).

Variable	PCOS (n=60) Mean ± SD	Control (n=60) Mean ± SD	p-value
Age (years)	25.8 ± 4.2	26.1 ± 4.5	0.712
BMI (kg/m²)	26.7 ± 3.8	23.9 ± 3.2	0.001
Waist circumference (cm)	87.5 ± 7.9	79.8 ± 6.6	<0.001
Duration of menstrual cycle (days)	40.2 ± 9.1	29.4 ± 3.6	<0.001

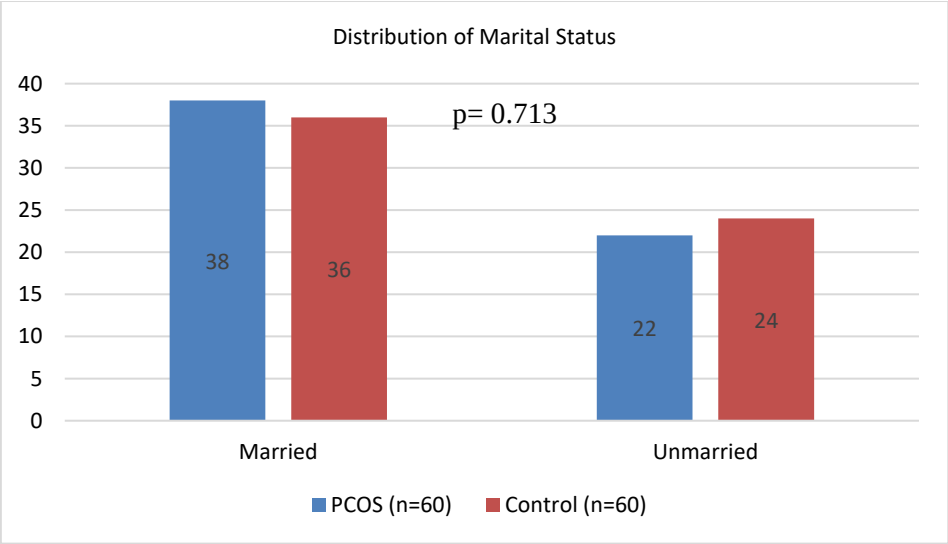

Figure 1 Distribution of Marital Status.

Figure 1 shows the distribution of marital status, the proportion of married women was 63.3% in the PCOS group and 60.0% in controls, while unmarried participants constituted 36.7% and 40.0% respectively. No significant difference was observed between groups in marital status (p = 0.713).

Table II shows the distribution of clinical manifestations among study participants. Menstrual irregularity was present in 76.7% of women with PCOS compared with 13.3% of controls, demonstrating a highly significant difference (p < 0.001). Clinical hyperandrogenism, including hirsutism or acne, was reported in 56.7% of PCOS patients but only 10.0% of controls (p < 0.001). Polycystic ovarian morphology detected by ultrasonography was found in 85.0% of the PCOS group compared with 8.3% in the control group (p < 0.001). A history of infertility was observed in 46.7% of women with PCOS and 15.0% of controls (p < 0.001). Central obesity was present in 51.7% of the PCOS group and 23.3% of the control group, indicating a statistically significant difference (p = 0.002).

Table II
Clinical manifestations among study participants.

Clinical Feature	PCOS (n=60) n (%)	Control (n=60) n (%)	p-value
Menstrual irregularity	46 (76.7)	8 (13.3)	<0.001
Clinical hyperandrogenism (hirsutism/acne)	34 (56.7)	6 (10.0)	<0.001
Polycystic ovarian morphology (USG)	51 (85.0)	5 (8.3)	<0.001
Infertility history	28 (46.7)	9 (15.0)	<0.001
Central obesity	31 (51.7)	14 (23.3)	0.002

Table III presents the hormonal and ultrasonographic parameters of the study participants. Mean serum AMH levels were markedly higher in the PCOS group (7.62 ± 3.21 ng/mL) compared with controls (2.71 ± 1.48 ng/mL), showing a highly significant difference (p < 0.001). Luteinizing hormone levels were significantly elevated in PCOS participants (10.1 ± 4.6 IU/L) relative to controls (5.9 ± 2.3 IU/L) (p < 0.001). Follicle-stimulating hormone levels were slightly lower in the PCOS group (5.8 ± 1.7 IU/L) than in controls (6.3 ± 1.5 IU/L), although this difference was not statistically significant (p = 0.082). The LH/FSH ratio was significantly higher in women with PCOS (1.74 ± 0.69) compared with controls (0.94 ± 0.38) (p < 0.001). Total testosterone levels were also significantly elevated in the PCOS group (62.4 ± 18.7 ng/dL) compared with controls (39.6 ± 12.5 ng/dL) (p < 0.001). Ultrasonographic findings showed greater ovarian volume in PCOS participants (12.1 ± 3.6 cm^3) than controls (7.2 ± 2.1 cm^3) (p < 0.001). The antral follicle count was significantly higher in the PCOS group (22.6 ± 6.4) compared with controls (9.3 ± 3.2) (p < 0.001).

Table III
Hormonal and ultrasonographic parameters of study participants.

Parameter	PCOS (n=60) Mean ± SD	Control (n=60) Mean ± SD	p-value
Serum AMH (ng/mL)	7.62 ± 3.21	2.71 ± 1.48	<0.001
LH (IU/L)	10.1 ± 4.6	5.9 ± 2.3	<0.001
FSH (IU/L)	5.8 ± 1.7	6.3 ± 1.5	0.082
LH/FSH ratio	1.74 ± 0.69	0.94 ± 0.38	<0.001
Total testosterone (ng/dL)	62.4 ± 18.7	39.6 ± 12.5	<0.001
Ovarian volume (cm^3)	12.1 ± 3.6	7.2 ± 2.1	<0.001
Antral follicle count	22.6 ± 6.4	9.3 ± 3.2	<0.001

Table IV describes the correlation between serum AMH levels and clinical severity indicators among women with PCOS. Serum AMH levels demonstrated a weak but statistically significant positive correlation with BMI (r = 0.28, p = 0.030). A moderate positive correlation was observed between AMH levels and the LH/FSH ratio (r = 0.34, p = 0.008). AMH levels showed a stronger positive correlation with ovarian volume (r = 0.46, p < 0.001). A significant moderate correlation was also identified between AMH levels and antral follicle count (r = 0.52, p < 0.001). Additionally, AMH levels were positively correlated with Ferriman–Gallwey score, indicating clinical hyperandrogenism (r = 0.31, p = 0.016).

Table IV
Correlation between serum AMH levels and clinical severity indicators in PCOS patients (*n* = 60).

Variable	Mean ± SD	Correlation coefficient (r) with AMH	p-value
BMI (kg/m²)	26.7 ± 3.8	0.28	0.03
LH/FSH ratio	1.74 ± 0.69	0.34	0.008
Ovarian volume (cm³)	12.1 ± 3.6	0.46	<0.001
Antral follicle count	22.6 ± 6.4	0.52	<0.001
Ferriman–Gallwey score	9.8 ± 4.1	0.31	0.016

DISCUSSION

Polycystic ovary syndrome is a complex endocrine disorder characterized by reproductive, metabolic and hormonal disturbances. The present study evaluated the relationship between serum Anti-Müllerian Hormone (AMH) levels and clinical severity indicators among women with PCOS compared with healthy controls. The findings demonstrated significantly elevated AMH levels in women with PCOS and showed positive correlations between AMH and several clinical and ultrasonographic markers of disease severity.

In this study, women with PCOS had significantly higher body mass index and waist circumference compared with controls. These findings reflect the well-established association between PCOS and obesity, particularly central adiposity. Dobbie et al. reported that increased adiposity across different stages of life is associated with a higher risk of developing PCOS and may aggravate its clinical manifestations [12]. Obesity contributes to metabolic dysfunction and hormonal imbalance in PCOS, often worsening reproductive outcomes. Similarly, Oldfield et al. observed that obesity influences hormonal profiles in women of reproductive age and may affect ovarian physiology through complex endocrine mechanisms [10].

Menstrual irregularity was one of the most prevalent clinical manifestations observed among women with PCOS in this study. More than three-quarters of affected participants reported irregular menstrual cycles, which was significantly higher than in the control group. This observation is consistent with the findings of Witchel et al., who described menstrual dysfunction and anovulation as hallmark features of PCOS resulting from dysregulation of the hypothalamic–pituitary–ovarian axis [4]. Ezeh et al. further demonstrated that the severity of menstrual dysfunction in PCOS is often associated with metabolic disturbances and endocrine abnormalities, highlighting the multifactorial nature of the disorder [13].

The present study also showed significantly higher prevalence of clinical hyperandrogenism, infertility and polycystic ovarian morphology among women with PCOS. Hyperandrogenism is considered a central pathogenic feature of the syndrome and contributes to several clinical manifestations including hirsutism and acne. Hernández-Jiménez et al. explained that excessive androgen production in PCOS results from ovarian and adrenal dysfunction and leads to characteristic clinical signs and reproductive disturbances [14]. Furthermore, infertility observed in many PCOS patients is largely attributed to chronic anovulation and disrupted follicular maturation [15].

A key finding of this study was the significantly elevated serum AMH level among women with PCOS compared with controls. This result is consistent with numerous studies indicating that AMH levels are markedly increased in PCOS due to the accumulation of small antral follicles in the ovaries. Rudnicka et al. reported that granulosa cells of pre-antral and small antral follicles produce AMH and the increased follicle number in PCOS leads to elevated circulating AMH concentrations [5]. Similarly, Sivanandy and Ha emphasized that AMH has gained increasing attention as a potential diagnostic biomarker for PCOS because of its close association with follicular excess and ovarian dysfunction [7].

In addition to increased AMH levels, the present study found significant differences in other hormonal parameters between PCOS patients and controls. Luteinizing hormone levels and the LH/FSH ratio were significantly higher in women with PCOS, while follicle-stimulating hormone levels showed no significant difference. These hormonal patterns are widely recognized in PCOS and reflect altered gonadotropin secretion. Malini and Roy George demonstrated that elevated LH and increased LH/FSH ratios are frequently observed in women with PCOS and contribute to abnormal follicular development and hyperandrogenism [16].

Ultrasonographic parameters also differed significantly between the two groups. Women with PCOS had greater ovarian volume and higher antral follicle counts compared with controls. These findings correspond with the typical morphological features of polycystic ovaries. Afrine et al. reported that ovarian volume is strongly associated with the clinical manifestations of PCOS and may reflect disease severity [17]. Similarly, Bhide et al. demonstrated that small antral follicles in polycystic ovaries produce higher amounts of AMH, explaining the strong association between follicle number and circulating AMH levels [18].

The correlation analysis conducted in this study further demonstrated significant positive relationships between serum AMH levels and several indicators of PCOS severity. AMH levels showed moderate correlations with ovarian volume and antral follicle count, suggesting that the hormone closely reflects ovarian morphological changes in PCOS. Jacob et al. also reported that serum AMH concentration correlates strongly with the severity of PCOS and may serve as an indicator of follicular excess and ovarian dysfunction [19]. Similar associations have been reported in other studies, which suggest that AMH may represent an integrated marker of ovarian follicle activity in women with PCOS.

Furthermore, AMH levels in this study showed positive correlations with LH/FSH ratio and Ferriman–Gallwey score, indicating associations with hormonal imbalance and hyperandrogenism. These findings support previous research demonstrating that AMH may be linked to endocrine abnormalities in PCOS. Lv et al. observed that AMH interacts with androgen production and follicular growth, suggesting a potential role in the pathophysiological mechanisms of the syndrome [20]. Santhiya et al. also reported that AMH levels vary among different PCOS phenotypes and are associated with clinical manifestations of

hyperandrogenism and ovarian morphology [21].

A weak but significant correlation between AMH levels and body mass index was also observed in this study. Although previous findings have been inconsistent, some evidence suggests that metabolic factors may influence AMH levels in PCOS. Zhao et al. found associations between obesity, insulin resistance and AMH concentrations in women with PCOS, indicating potential interactions between metabolic status and ovarian function [22].

Overall, the findings of the present study support the growing evidence that serum AMH is closely associated with the hormonal and morphological features of PCOS. Elevated AMH levels and their correlation with clinical severity indicators suggest that AMH may serve as a useful biomarker for evaluating ovarian dysfunction and disease severity in women with PCOS.

CONCLUSION

This study demonstrated significantly higher serum Anti-Müllerian Hormone levels in women with polycystic ovary syndrome compared with healthy controls. Serum AMH showed positive correlations with ovarian volume, antral follicle count, LH/FSH ratio, body mass index and Ferriman–Gallwey score. These findings indicate that AMH is closely associated with clinical, hormonal and ultrasonographic indicators of PCOS severity. Therefore, AMH may serve as a useful biomarker for assessing ovarian dysfunction and evaluating disease severity in women with PCOS in clinical practice.

CONFLICTS OF INTEREST

None.

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