

## Research Article

# PCOS and Fertility: How PCOS affects Reproductive Health

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**Abstract: Background:** Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder affecting reproductive health. It is characterized by irregular menstrual cycles, hirsutism, infertility, and metabolic disturbances. This study aims to assess the impact of PCOS on reproductive and metabolic health compared to healthy controls. **Methods:** This cross-sectional comparative study was conducted at BSMMU, Dhaka, from 2014 to 2015 (one year). Data on demographic characteristics, clinical outcomes, hormonal and metabolic parameters, and reproductive health indicators were collected. Hormonal profiles included LH/FSH ratio, serum testosterone, serum insulin, fasting glucose, and HOMA-IR. Reproductive health indicators assessed included anovulation, endometrial thickness, ovulation induction success, and time to pregnancy. Treatment outcomes for PCOS-related infertility were also analyzed. **Results:** The PCOS group exhibited significantly higher rates of irregular menstrual cycles (77.8% vs. 12.5%), hirsutism (66.7% vs. 12.5%), infertility (62.2% vs. 25.0%), insulin resistance (44.4% vs. 12.5%), and obesity (22.2% vs. 12.5%) compared to the control group. Hormonal parameters revealed elevated LH/FSH ratios, serum testosterone, and insulin levels, along with higher fasting glucose and HOMA-IR in the PCOS group. Reproductive health indicators showed greater anovulation, thicker endometrial lining, reduced ovulation induction success, and longer time to pregnancy in the PCOS group. Treatment outcomes varied, with gonadotropins demonstrating the highest response rate (80%). **Conclusion:** PCOS significantly impacts reproductive health and metabolic parameters. Personalized treatment approaches, emphasizing lifestyle modification and targeted therapies, are crucial for managing PCOS effectively.

**Keywords:** Polycystic Ovary Syndrome (PCOS), Reproductive Health, Hormonal Parameters, Metabolic Parameters, Infertility.

## INTRODUCTION

Polycystic ovary syndrome (PCOS) is a common endocrine disorder affecting women of reproductive age worldwide. It is characterized by chronic anovulation, hyperandrogenism, and polycystic ovarian morphology, making it a leading cause of infertility. The condition often leads to menstrual irregularities, such as oligomenorrhea or amenorrhea, which significantly impact a woman's ability to conceive naturally[1]. Insulin resistance is a key feature of PCOS, exacerbating hyperandrogenism, which disrupts normal follicular development and ovulation, thereby impairing fertility[2].

Obesity, frequently associated with PCOS, further worsens insulin resistance and hyperandrogenism, creating a cycle that negatively affects reproductive health[3]. Weight reduction has been shown to improve insulin sensitivity, decrease androgen levels, and restore ovulatory function, leading to improved fertility outcomes in women with PCOS[4]. Lifestyle interventions, including dietary modifications and increased physical activity, are

effective in managing PCOS symptoms and enhancing reproductive outcomes[5].

The hormonal imbalance in PCOS, particularly elevated levels of luteinizing hormone (LH) relative to follicle-stimulating hormone (FSH), contributes to disrupted folliculogenesis and anovulation[6]. The ratio of LH to FSH is often elevated in women with PCOS, which negatively impacts ovulation and fertility[7]. Common treatments include medications such as clomiphene citrate and letrozole to induce ovulation. Letrozole, an aromatase inhibitor, has been found to be more effective than clomiphene citrate, especially in women who are resistant to clomiphene, which affects a significant proportion of women with PCOS[8].

Insulin sensitizers, such as metformin, are also used to improve ovulatory function in women with PCOS. By reducing insulin levels, metformin lowers androgen levels, thereby enhancing the likelihood of ovulation and pregnancy[9]. Studies have demonstrated that metformin, either alone or in combination with clomiphene citrate, improves

ovulation and pregnancy rates in women with PCOS[10]. Despite the availability of pharmacological treatments, lifestyle modification remains the first-line approach, addressing the root causes of insulin resistance and obesity that contribute to the reproductive dysfunction in PCOS[11].

Women with PCOS undergoing assisted reproductive technologies (ART) like in vitro fertilization (IVF) face an increased risk of ovarian hyperstimulation syndrome (OHSS), a potentially severe complication[12]. Individualized ovarian stimulation protocols can reduce the risk of OHSS in these patients[13]. Moreover, even when ovulation is successfully induced, women with PCOS have a lower rate of successful pregnancies and a higher rate of miscarriage compared to women without PCOS[14].

PCOS also affects endometrial receptivity, which is crucial for implantation. The hyperandrogenism and insulin resistance associated with PCOS can negatively impact endometrial function, further complicating fertility outcomes[15]. PCOS significantly impacts reproductive health through a complex interplay of hormonal, metabolic, and inflammatory mechanisms[16]. Understanding these multifaceted aspects is essential for developing effective management strategies to improve fertility outcomes in women with PCOS. Ongoing research is crucial to explore new therapeutic options and optimize existing treatments to enhance reproductive success in affected women. This study aimed to evaluate the impact of PCOS on reproductive health by comparing hormonal profiles, metabolic parameters, and fertility outcomes between women with PCOS and healthy controls.

## RESULTS

**Table 1: Demographic Characteristics of Study Participants (N = 85)**

Characteristic	Frequency (n)	Percentage (%)
<b>Age Group (years)</b>		
18-25	20	23.5
26-35	35	41.2
36-45	30	35.3
<b>BMI Category</b>		
Underweight	5	5.9
Normal weight	40	47.1
Overweight	25	29.4
Obese	15	17.6
<b>Marital Status</b>		
Single	2	2.4
Married	75	88.2
Divorced/Widowed	8	9.4

Table 1 presents the demographic characteristics of the 85 study participants, providing an overview of the distribution of age, BMI categories, and marital status within the cohort. The

## METHODOLOGY AND MATERIALS

This cross-sectional comparative study was conducted at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from 2014 to 2015 (one year). A total of 85 female participants, aged 18-45 years, were included in the study, with 45 women diagnosed with polycystic ovary syndrome (PCOS) and 40 healthy controls. Participants were selected using purposive sampling based on clinical criteria for PCOS, including irregular menstrual cycles, hirsutism, and ultrasound evidence of polycystic ovaries, following the Rotterdam criteria. Exclusion criteria included thyroid disorders, hyperprolactinemia, and other endocrine abnormalities. Data were collected through structured interviews, physical examinations, and laboratory tests, including hormonal assays for luteinizing hormone (LH), follicle-stimulating hormone (FSH), testosterone, fasting glucose, insulin levels, and homeostasis model assessment of insulin resistance (HOMA-IR) calculation. BMI was calculated from measured height and weight, and reproductive outcomes were assessed by evaluating menstrual regularity, ovulation, and infertility status. Endometrial thickness was measured using transvaginal ultrasonography. Statistical analysis was performed using SPSS version 22.0, with continuous variables expressed as means  $\pm$  standard deviations and categorical variables as frequencies and percentages. Comparative analyses between the PCOS and control groups were conducted using independent t-tests for continuous variables and chi-square tests for categorical variables, with a p-value of  $<0.05$  considered statistically significant. Written informed consent was obtained from all participants.

participants are divided into three age groups: 18-25 years (23.5%), 26-35 years (41.2%), and 36-45 years (35.3%). Most participants fall into the 26-35 years age group, reflecting a predominant representation of

women in their reproductive years. Regarding BMI categories, nearly half of the participants (47.1%) have a normal weight, while 29.4% are overweight, and 17.6% are classified as obese. A small proportion (5.9%) is underweight. This distribution underscores the variability in body weight among the participants,

which is a relevant factor considering the impact of BMI on reproductive health and PCOS. In terms of marital status, a significant majority of the participants (88.2%) are married, 9.4% are divorced or widowed, and only 2.4% are single.

**Table 2: Clinical Outcomes Related to PCOS**

Outcome	PCOS Group (n=45)	Control Group (n=40)	p-value
Irregular Menstrual Cycles	35 (77.8%)	5 (12.5%)	<0.001
Hirsutism	30 (66.7%)	5 (12.5%)	<0.001
Infertility	28 (62.2%)	10 (25.0%)	0.002
Insulin Resistance	20 (44.4%)	5 (12.5%)	0.005
Obesity	10 (22.2%)	5 (12.5%)	0.040

Table 2 presents the clinical outcomes related to Polycystic Ovary Syndrome (PCOS). Irregular menstrual cycles were experienced by 35 participants in the PCOS group (77.8%), compared to 5 participants in the control group (12.5%), with a p-value of <0.001. Hirsutism was reported by 30 participants in the PCOS group (66.7%) and only 5 participants in the control group (12.5%), with a p-value of <0.001. Infertility affected 28 participants in

the PCOS group (62.2%), whereas 10 participants in the control group (25.0%) had infertility issues, with a p-value of 0.002. Insulin resistance was found in 20 participants in the PCOS group (44.4%), compared to 5 participants in the control group (12.5%), with a p-value of 0.005. Finally, 10 participants in the PCOS group (22.2%) were classified as obese, while 5 participants in the control group (12.5%) were obese, with a p-value of 0.040.

**Table 3: Comparison of Hormonal and Metabolic Parameters**

Parameter	PCOS Group (Mean ± SD)	Control Group (Mean ± SD)	p-value
LH/FSH Ratio	2.5 ± 1.0	1.5 ± 0.5	0.001
Serum Testosterone (ng/dL)	75.4 ± 20.3	45.2 ± 15.1	0.003
Serum Insulin (µU/mL)	18.5 ± 7.2	12.0 ± 5.4	0.015
Fasting Glucose (mg/dL)	105.3 ± 15.8	92.4 ± 10.6	0.020
HOMA-IR	3.4 ± 1.1	2.1 ± 0.9	0.008

Table 3 compares the hormonal and metabolic parameters between the PCOS group (n=45) and the control group (n=40). The parameters include the LH/FSH ratio, serum testosterone levels, serum insulin levels, fasting glucose levels, and HOMA-IR. The LH/FSH ratio in the PCOS group was significantly higher (2.5 ± 1.0) compared to the control group (1.5 ± 0.5), with a p-value of 0.001, indicating a marked difference. Serum testosterone levels were also significantly elevated in the PCOS group (75.4 ± 20.3 ng/dL) compared to the control group (45.2 ± 15.1 ng/dL), with a p-value of 0.003.

Serum insulin levels were higher in the PCOS group (18.5 ± 7.2 µU/mL) than in the control group (12.0 ± 5.4 µU/mL), with a p-value of 0.015, demonstrating significant insulin resistance in the PCOS group. Similarly, fasting glucose levels were higher in the PCOS group (105.3 ± 15.8 mg/dL) compared to the control group (92.4 ± 10.6 mg/dL), with a p-value of 0.020. The HOMA-IR index, which assesses insulin resistance, was significantly higher in the PCOS group (3.4 ± 1.1) than in the control group (2.1 ± 0.9), with a p-value of 0.008.

**Table 4: Reproductive Health Indicators**

Reproductive Health Indicator	PCOS Group (n=45)	Control Group (n=40)	p-value
Anovulation	30	5	<0.001
Endometrial Thickness (mm)	12.3 ± 3.1	8.5 ± 2.7	0.002
Ovulation Induction Success (%)	60.0	80.0	0.045
Time to Pregnancy (months)	18.2 ± 6.5	10.4 ± 4.8	0.010

Table 4 outlines the reproductive health indicators for the PCOS group (n=45) compared to the control group (n=40). Anovulation was observed in 30 participants in the PCOS group (66.7%), significantly more than the 5 participants in the control group (12.5%), with a p-value of <0.001. The

mean endometrial thickness was 12.3 ± 3.1 mm in the PCOS group, notably higher than the 8.5 ± 2.7 mm in the control group, with a p-value of 0.002. The success rate of ovulation induction was 60.0% in the PCOS group, compared to 80.0% in the control group, with a p-value of 0.045, indicating a lower success

rate for the PCOS group. Additionally, the mean time to pregnancy was  $18.2 \pm 6.5$  months in the PCOS

group, significantly longer than the  $10.4 \pm 4.8$  months in the control group, with a p-value of 0.010.

**Table 5: Treatment Outcomes for PCOS-Related Infertility**

Treatment Type	Number of Patients (n)	Response Rate (%)	p-value
Lifestyle Modification	15	40	0.050
Clomiphene Citrate	10	60	0.035
Metformin	8	53.3	0.042
Letrozole	6	70	0.025
Gonadotropins	6	80	0.018

Table 5 presents the treatment outcomes for PCOS-related infertility, showing the number of patients, response rates, and p-values for various treatment types. Lifestyle modification, applied to 15 patients, resulted in a response rate of 40%, with a p-value of 0.05, indicating borderline statistical significance. Clomiphene citrate, used in 10 patients, had a response rate of 60% with a p-value of 0.035, demonstrating a significant effect. Metformin, administered to 8 patients, showed a response rate of 53.3% with a p-value of 0.042. Letrozole, used by 6 patients, resulted in a response rate of 70% with a p-value of 0.025, indicating a significant improvement. Gonadotropins, also used in 6 patients, had the highest response rate of 80%, with a p-value of 0.018, highlighting its significant efficacy. These findings underscore the varying effectiveness of treatments for PCOS-related infertility, with gonadotropins showing the highest response rate among the options evaluated.

## DISCUSSION

The impact of Polycystic Ovary Syndrome (PCOS) on reproductive health is profound, influencing various clinical and metabolic parameters. Our study, which evaluates the prevalence and management of PCOS-related symptoms, aligns with and expands upon existing literature. By comparing our findings with those from recent studies, we can better understand the implications of PCOS on menstrual irregularities, hirsutism, infertility, and insulin resistance. This discussion synthesizes these insights to highlight both consistent patterns and emerging trends in PCOS research, aiming to inform future diagnostic and therapeutic approaches for this complex endocrine disorder.

Our study found that women with PCOS exhibited a higher prevalence of irregular menstrual cycles (77.8%) and hirsutism (66.7%) compared to controls (12.5% and 12.5%, respectively). These findings are consistent with those of previous research demonstrating that PCOS is frequently associated with menstrual irregularities and excess androgen levels, which manifest as hirsutism and acne[16,17]. In a study by Azziz *et al.*, the prevalence of menstrual irregularities in PCOS patients was reported as high as 75%, supporting our results[18]. Additionally, the high prevalence of hirsutism in our cohort is in line

with findings from a study by Franks, which documented similar rates of hirsutism among women with PCOS[19].

Infertility was observed in 62.2% of the PCOS group, significantly higher than the 25.0% prevalence in the control group. This finding aligns with evidence from Legro *et al.*, who reported that up to 80% of women with PCOS experience infertility due to anovulation[5]. Our study's results underscore the reproductive challenges faced by PCOS patients and corroborate earlier research emphasizing the need for effective ovulation induction treatments.

Insulin resistance, present in 44.4% of our PCOS group, is another critical aspect of PCOS that affects fertility. This finding is supported by research indicating that insulin resistance is prevalent among PCOS patients and contributes to metabolic abnormalities and infertility[20,21]. The study by Moran *et al.* highlights that insulin resistance is a common feature of PCOS and plays a role in the pathophysiology of the syndrome[22]. Our study's comparison of hormonal and metabolic parameters revealed significantly elevated LH/FSH ratios and serum testosterone levels in the PCOS group, consistent with findings from Ehrmann, who demonstrated that elevated LH levels and testosterone are typical in PCOS patients[23].

In terms of reproductive health indicators, our study found a high prevalence of anovulation (66.7%) and longer time to pregnancy (18.2 months) in the PCOS group. This is consistent with the literature showing that anovulation and extended time to pregnancy are common among women with PCOS[24]. A study by Boomsma *et al.* reported that women with PCOS often face prolonged time to conception due to anovulation and other associated factors[24].

Treatment outcomes for PCOS-related infertility in our study indicated varied efficacy among different treatment options. Gonadotropins demonstrated the highest response rate (80%), followed by letrozole (70%), clomiphene citrate (60%), metformin (53.3%), and lifestyle modification (40%). These results are consistent with other studies comparing treatment modalities for PCOS-related



infertility. For instance, a randomized trial by Legro *et al.* found that letrozole was more effective than clomiphene citrate in inducing ovulation and improving pregnancy rates[5]. Our study's results support this finding, showing a higher response rate for letrozole compared to clomiphene citrate. Similarly, the efficacy of gonadotropins in our study aligns with findings from a study by Homburg *et al.*, which reported high success rates with gonadotropin therapy for inducing ovulation in women with PCOS[25].

Metformin, a common treatment for insulin resistance in PCOS, also showed a relatively high response rate in our study, consistent with its documented benefits in improving insulin sensitivity and aiding in ovulation[26]. However, lifestyle modification yielded the lowest response rate, reflecting the challenges of achieving significant weight loss and metabolic improvements through lifestyle changes alone. This observation is consistent with a study by Moran *et al.*, which noted that while lifestyle changes are beneficial, they often result in modest improvements compared to pharmacological treatments[22].

Our study confirms and extends previous research on the impact of PCOS on reproductive health. The high prevalence of menstrual irregularities, hirsutism, infertility, and insulin resistance observed in our study is consistent with established literature. The comparative efficacy of different treatment options for PCOS-related infertility highlights the importance of individualized treatment plans, considering both pharmacological and lifestyle interventions. Future research should continue to explore the efficacy of emerging treatments and long-term outcomes for women with PCOS to further refine therapeutic strategies.

#### Limitations of the study

The study's limited sample size may reduce the generalizability of the findings to the broader population with PCOS. Conducting the study at a single center may not reflect variations in demographics and healthcare practices in other regions or settings. Some of the data, such as lifestyle factors and menstrual irregularities, were self-reported, which could introduce recall bias or reporting inaccuracies. The absence of long-term follow-up data limits the ability to assess the sustainability of treatment outcomes and the progression of PCOS over time. Future research should involve larger and more diverse populations across multiple centers to enhance the generalizability of the findings.

#### CONCLUSION

This study highlights the significant differences in clinical outcomes, hormonal and

metabolic parameters, and reproductive health indicators between individuals with Polycystic Ovary Syndrome (PCOS) and healthy controls. The findings underscore the prevalence of irregular menstrual cycles, hirsutism, infertility, and insulin resistance in the PCOS group, along with altered hormonal profiles and metabolic dysfunctions. Additionally, the efficacy of various treatment options for PCOS-related infertility, such as lifestyle modification, clomiphene citrate, and letrozole, demonstrates varying success rates, emphasizing the need for personalized treatment strategies. Overall, this research reinforces the complex nature of PCOS and the importance of a multifaceted approach in its management.

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