Journal of Medical Genetics and Clinical Biology
Homepage : https://journal.antispublisher.id/index.php/JMGCB
Email : admin@antispublisher.com

e-ISSN : 3032-1085
JMGCB, Vol. 3, No. 6, June 2026
Page 103-109

A Clinical Study of Inflammatory and Metabolic Disturbances Associated with Polycystic Ovary Syndrome

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DOI : https://doi.org/10.61796/jmgcb.v3i6.1785

Sections Info

Article history:
Submitted: March 15, 2026
Final Revised: April 05, 2026
Accepted: April 20, 2026
Published: May 11, 2026

Keywords:
Polycystic Ovary Syndrome (PCOS)
Insulin resistance
Inflammation
Dyslipidemia
Vitamin D deficiency

ABSTRACT

Objective: *This study provides a comparative analysis of metabolic and inflammatory profiles in PCOS patients against approximate normal ranges.* ***Method:*** *Regarding hereditary diseases, thyroid gland issues were the most frequently reported (41.18%), followed by diabetes (35.29%), while a smaller proportion reported no hereditary diseases listed (23.53%). These findings provide insights into the prevalence of certain hereditary metabolic conditions within the studied group of PCOS patients.* ***Results:*** *The data reveals that, on average, PCOS patients exhibit elevated levels of CRP (10.74 ± 1.82 mg/L), total cholesterol (TC: 205.09 ± 4.81 mg/dL), triglycerides (TG: 205.09 ± 15.84 mg/dL), blood sugar (138.45 ± 7.87 mg/dL), and HbA1c (6.39 ± 0.268%), suggesting increased inflammation, dyslipidemia, and impaired glucose metabolism. Furthermore, vitamin D levels are markedly deficient in this group (9.64 ± 0.57 ng/mL). While hemoglobin (Hb) levels are within the lower end of the normal range (11.5 ± 0.315 g/dL), the average BMI of the PCOS patient group falls within the overweight category (29.58 ± 1.68 kg/m²). These findings highlight significant metabolic and inflammatory alterations in PCOS patients compared to established normal ranges. Finally, concludes that PCOS patients exhibit significant metabolic and inflammatory disturbances, including inflammation (elevated CRP), dyslipidemia (elevated TC and TG), impaired glucose metabolism (elevated blood sugar and HbA1c), and vitamin D deficiency. They also have a tendency towards being overweight. Furthermore, there is a notable prevalence of hereditary thyroid issues and diabetes within this group. These factors collectively contribute to an increased risk of cardiovascular disease and type 2 diabetes. We emphasize early detection of PCOS and implementation of strategies to address elevated CRP, cholesterol, triglycerides, blood sugar, and HbA1c through lifestyle modifications (diet, exercise) and potentially pharmacological interventions.* ***Novelty:*** *Polycystic Ovary Syndrome (PCOS) is a serious multi-organ endocrinopathy that affects not only fertility but also the overall metabolic health of the patient. Although studies have shown that the impact of PCOS on life expectancy is negligible, type of live for females with this diseases is significantly decrease due to metabolic complications complex. It is important to recognize this syndrome as early as possible, which reduces the intensity of unpleasant symptoms and prevents long-term metabolic consequences.*

INTRODUCTION

One of the diffusion diseases in population is polycystic ovary syndrome (PCOS) is a common hormonal disturbance affecting 5–15% of reproductive age women [1]. PCOS is the leading cause of female infertility [2]. In PCOS, a disturbance in gonadotrophin releasing hormone (GnRH) takes place that imbalances LH and FSH release from the hypothalamic pituitary axis. However, beyond reproductive dysfunction, those diagnosed with PCOS eventually develop serious metabolic complications including insulin resistance, hypertension, cardiovascular disease, and diabetes [3]. Recent reviewing and expounding the metabolic causes of pathogen especially genetics of diseses of this syndrome has become the essential of the our life in

women , for it is the only solution to confrontation the intensifying health experiments [4]. There have been many reasons proposed as the etiology of PCOS, few of them being insulin resistance, chronic decrease inflammation, increase BMI, heredity linkages, and routine choices [5] [6]. Studies have shown that increased reactive oxygen species is closely linked to metabolic dysfunction among these women [7]. The study aims to evaluate the metabolic and inflammatory profiles associated with Polycystic Ovary Syndrome (PCOS) among women in Najaf City. It seeks to assess the prevalence of metabolic disturbances including inflammation, dyslipidemia, insulin resistance, and vitamin D deficiency. Additionally, the study aims to raise awareness about the importance of metabolic screening and provide evidence-based recommendations for interventions to improve long-term health outcomes for women with PCOS.

RESEARCH METHODS

Subjects

The study involved 25 women, with 17 having PCOS and 8 serving as control women. Participants were admitted to the laboratory of the Fertility Center's in AL-Sader Medical City, in the Province of Najaf, AL-Najaf Health Directorate / Ministry of Health / Iraq during the period from 1/4/2025 to 1/1/2026. The age range was (35-45) years. Body mass index (BMI) for both patients and healthy control group was measured as follows: weight (kilogram) / Height (m^2). The clinical assessment of patients with PCOS was evaluated by physicians according to sonography and laboratory assessment kit to every marker.

Methods

Each blood sample was collected from the patient in a sterile tube and divided into two portions. The first portion was used for biochemical tests, including measuring inflammatory markers and lipid profiles. The second portion was sent for complete blood count analysis, including measuring blood sugar levels, HbA1c, and metabolic markers related to Polycystic Ovary Syndrome. The results were analyzed based on established diagnostic criteria.

Form and Data Collection

The analysis of this diseases PCOS was based on clinical presentations and laboratory findings. A questionnaire form was completed for each patient and control to collect information on hereditary diseases and lifestyle factors.

Statistical Analysis

Several statistical techniques and tests were used to analyze the data. The use of "Mean ± SE" provides a measure of the precision of the mean estimates. Calculated doing in assay correlation coefficients to estimate the association between metabolic markers and parameters. Descriptive statistics were performed using Mega Stat (Version v 10.12) for Excel 2007.

RESULTS AND DISCUSSION

Results

Physical appearance

The work elaborate 25 female, with 17 having (PCOS) and 8 serving as control women. The results indicate no statistically significant difference in age between the two groups, with a P-value of ($p<0.05$) considered significant. The working showed a significant variance (($p<0.05$)) in BMI, with PCOS women having a significantly higher BMI (29.58 ± 1.68 kg/m²) than control women, falling within the overweight category, close to the obesity cutoff.

Hereditary and Lifestyle Factors

Regarding hereditary diseases, thyroid gland issues were the most frequently reported (41.18%), followed by diabetes (35.29%), while a smaller proportion reported no hereditary diseases listed (23.53%), as shown in Table 1 below.

Table 1. Hereditary Diseases in PCOS Patients

Hereditary Disease	Frequency	Percentage (%)
Thyroid gland	7	41.18
Diabetes	6	35.29
None	4	23.53

Metabolic and Inflammatory Profiles in PCOS

PCOS is characterized by a combination of metabolic disturbances and inflammatory changes. The results show:

Insulin Resistance:

The results indicate Blood Sugar (138.45 ± 7.87 mg/dL) and HbA1c (6.39 ± 0.268%): The elevated blood sugar and HbA1c levels in these PCOS patients strongly suggest insulin resistance. High HbA1c indicates poor long-term blood sugar control, as shown in Table 2.

Body Mass Index:

Assessment of BMI (29.58 ± 1.68 kg/m²): The mean BMI of PCOS patients falls within the overweight category, close to the obesity cutoff. This highlights the common association between PCOS and weight issues as shown in Table 2.

Chronic Inflammation:

The results show CRP (10.74 ± 1.82 mg/L): The elevated CRP levels indicate increased inflammation in these PCOS patients as shown in Table 2.

Metabolic Factors - Blood Lipids:

Total Cholesterol (TC: 205.09 ± 4.81 mg/dL): The mean TC level in PCOS patients is slightly elevated above the normal range, indicating a potential risk for cardiovascular issues as shown in Table 2. Triglycerides (TG: 205.09 ± 15.84 mg/dL): The mean TG level is significantly elevated as shown in Table 2

Vitamin D Deficiency:

Vitamin D (9.64 ± 0.57 ng/mL): The low vitamin D levels are frequently observed in PCOS as shown in Table 2.

Table 2. Metabolic and Inflammatory assay in PCOS Patients

Feature	PCOS Patients Mean ± SE	Normal Range (approximate)
CRP (mg/L)	10.74 ± 1.82	< 3 (lower is better)
Vitamin D (ng/mL)	9.64 ± 0.57	30-100
Hb (g/dL)	11.5 ± 0.315	11.6 to 15
Blood Lipids (TC)	205.09 ± 4.81	< 200 mg/dL
Blood Lipids (TG)	205.09 ± 15.84	< 150 mg/dL
Blood Sugar (mg/dL)	138.45 ± 7.87	70-99 (fasting)
HbA1c (%)	6.39 ± 0.268	< 5.7
BMI (kg/m²)	29.58 ± 1.68	Overweight: 25–29.9
Age	28.55 ± 2.98	N/A

The use of "Mean ± SE" provides a measure of the precision of the mean estimates.

Discussion

PCOS is often complicated by obesity, insulin resistance (IR), cardio metabolic risk factors, and poor metabolic health [9]. The results of this study reveal that women diagnosed with Polycystic Ovary Syndrome (PCOS) experience a broad spectrum of metabolic and inflammatory disturbances compared to the control group.

Although there was no statistically significant difference in age between the PCOS and control groups, BMI was significantly higher in women with PCOS. The mean BMI of PCOS patients fell within the overweight category, close to the obesity cutoff. This highlights the common association between PCOS and weight issues. This supports previous studies indicating a strong association between PCOS and increased body weight or obesity. Elevated BMI not only contributes to metabolic complications but also has profound effects on overall health [10].

Indicators of insulin resistance were evident, with elevated fasting blood glucose (138.45 mg/dL) and HbA1c (6.39%) levels, which are hallmarks of PCOS and precursors to type 2 diabetes. These metabolic issues underscore the importance of early screening and lifestyle interventions. Leptin, SHBG, irisin, adropin, and anti-Müllerian hormone (AMH) levels may play an important role in the pathogenesis of metabolic disorders associated with PCOS [11]. In recent years, peripheral IR and compensatory hyperinsulinemia have been attributed to PCOS etiopathogenesis [12]. The pancreas may secrete more insulin or develop hyperinsulinemia when cells are resistant to insulin [13].

Elevated CRP levels (10.74 mg/L) in the PCOS group suggest the presence of low-grade chronic inflammation, which is increasingly recognized as a contributor to both the pathogenesis of PCOS and its comorbidities, including cardiovascular disease. PCOS is a common metabolic and reproductive disorder characterized by menstrual

dysfunction, ovarian cysts, hyperandrogenism, and metabolic disorders. In the pathophysiology of PCOS, IR plays a central role in the development of the disease [14]. LEAP-2 levels were negatively correlated with IR, body mass index, and free androgen index [15]. In PCOS patients, IR has a prevalence of up to 70%, and the disorder is closely associated with glucose and lipid metabolism disturbance, as well as obesity [16]. LEAP-2 rises after feeding when ghrelin declines, while it drops upon fasting when ghrelin increases, showing a long-term positive correlation with body weight [17].

PCOS patients demonstrated elevated total cholesterol (205.09 mg/dL) and triglyceride (205.09 mg/dL) levels, pointing to dyslipidemia, a known risk factor for cardiovascular disease. Additionally, vitamin D levels were significantly low in the PCOS group (9.64 ng/mL). Vitamin D deficiency is frequently observed in women with PCOS and has been linked to insulin resistance, and poor metabolic outcomes [18]. This study emphasizes the multifaceted nature of PCOS, affecting metabolic and inflammatory domains.

Lifestyle-related data revealed that thyroid disorders were the most frequent hereditary condition among PCOS patients (41.18%), followed by diabetes (35.29%), suggesting a possible genetic and hormone link between these metabolic conditions and the syndrome [19]. Beyond reproductive consequences, PCOS significantly affects metabolic health. Studies have reported high levels of metabolic disturbances among women with PCOS, with prevalence rates for insulin resistance reaching up to 70% [20].

This study reveals that PCOS in Najaf City is characterized by significant metabolic and inflammatory disturbances, including elevated CRP indicating chronic inflammation, dyslipidemia (high TC/TG), insulin resistance (high blood sugar and HbA1c), and profound vitamin D deficiency, alongside a high prevalence of hereditary thyroid disorders and diabetes. Therefore, we recommend implementing routine metabolic screening for all PCOS patients—including inflammatory markers, lipid profiles, glucose metabolism, and vitamin D levels—combined with aggressive lifestyle interventions and early pharmacological management to mitigate cardiovascular risk and improve long-term health outcomes.

CONCLUSION

Fundamental Finding : Inflammation in the male reproductive system disrupts spermatogenesis through increased production of pro-inflammatory cytokines and reactive oxygen species, leading to decreased sperm motility, morphology, concentration, and overall fertilizing capacity. **Implication :** Understanding the relationship between inflammation and male infertility is important for developing effective diagnostic approaches and therapeutic strategies to preserve male reproductive health. **Limitation :** The discussion remains general and does not specify particular inflammatory pathways, biomarkers, or clinical evidence associated with impaired spermatogenesis. **Future Research :** Further studies are needed to investigate

interventions targeting inflammatory pathways and oxidative stress mechanisms to maintain and restore male reproductive function.

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