

## Serum Ferritin as a Marker of Systemic Inflammation in Patients with Poly cystic ovary.

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### ABSTRACT

**Background:** Polycystic ovary syndrome (PCOS) has far-reaching impacts in society, including amenorrhea, excess androgens, and metabolic syndrome, which are all indicators of this syndrome. Most recently, the role of chronic low-grade inflammation in the pathogenesis of the syndrome has gained traction. Ferritin, an inflammatory protein, reflects an underlying inflammatory state in the metabolic syndrome and is thus proposed as an inexpensive and accurate biomarker to evaluate systemic inflammation in the syndrome.

**Objectives:** To assess serum ferritin concentrations in women with polycystic ovary syndrome (PCOS), compare these levels with those of healthy control participants, and evaluate the associations between ferritin and inflammatory markers, insulin resistance, and key metabolic parameters.

**Methodology:** This cross-sectional study conducted at Department of Obstetrics and Gynecology, Bacha Khan Medical College, Mardan Medical Complex Mardan from Jan 2025 to June 2025. women between the ages of 18 and 40 who had the diagnosis of PCOS according to the Rotterdam criteria were included. Healthy, age-matched women were included as controls. The following laboratory assessments were made: serum ferritin, C-reactive protein (CRP), fasting glucose, fasting insulin, and a lipid profile. The HOMA-IR score was utilized to assess insulin resistance. Data analysis was conducted on the 24.0 version of SPSS using t-tests and correlation analysis at the 0.05 significance level.

**Results:** A total of 60 women with PCOS were included in the study. The mean age was  $26.8 \pm 4.9$  years. Serum ferritin levels were significantly elevated in PCOS patients compared with age-matched healthy controls ( $p < 0.001$ ). Higher ferritin concentrations showed positive correlations with CRP ( $p = 0.002$ ), fasting insulin ( $p = 0.01$ ), HOMA-IR ( $p = 0.003$ ), and triglycerides ( $p = 0.02$ ), indicating increased inflammatory and metabolic burden.

**Conclusion:** Elevated serum ferritin was noted in women with PCOS and was strongly associated with systemic inflammation and insulin resistance. Its positive correlation with metabolic parameters suggests that ferritin may be a valuable, readily available marker of metabolic and inflammatory risk. Routine ferritin measurements improve patient evaluations, enhance clinical management of PCOS, and aid in planning preventive measures.

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**Keywords:** PCOS, ferritin, inflammation, insulin resistance

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### 1. -. INTRODUCTION

Polycystic ovary syndrome is a polygenic endocrine and metabolic disorder and one of the most common chronic disabilities among women of reproductive age. The prevalence of PCOS is estimated to range from 6% to 20% and is highly dependent on the diagnostic criteria used and the characteristics of the involved population. Chronic ovulatory disturbances, hyperandrogenism, menstrual cycle irregularities, and polycystic ovarian morphology on ultrasound characterize the syndrome. PCOS is a clinical condition that manifests heterogeneously, most

commonly in conjunction with obesity, insulin resistance, adverse lipid profiles, and increased risk of cardiovascular disease and other metabolic disorders [1]. The last decade has seen a growing interest in the potential role of inflammation in the pathophysiology of PCOS [2]. Women with PCOS have evidence of chronic inflammation of low severity that is likely playing a role alongside other factors, such as obesity, in the reproductive and metabolic disturbances common to the syndrome [3]. The range of inflammation in PCOS is likely a product of a combination of factors, including dysfunctional adipose tissue, oxidative stress, excess cytokine production, and metabolic dysregulation [4]. Several potential inflammatory biomarkers have gained popularity, including C-reactive protein (CRP), tumor necrosis factor-alpha (TNF- $\alpha$ ), interleukin-6 (IL-6), and serum ferritin. Serum ferritin is of particular interest because it is a more affordable serum biomarker that is indicative of many metabolic

disturbances, as it is an acute-phase inflammatory protein and an iron-storage protein [5,6]. High levels of the biomarker ferritin can indicate not only stress on the body's insulin system, which is further complicated by polycystic ovarian syndrome (PCOS) and makes the body insulin-resistant, but also an excess of iron. Women who have the condition of PCOS have high amounts of stress that further complicates the body's ability to manage iron and the body's ability to manage stress in an oxidative manner. Thus, they have elevated ferritin levels in their system [7,8]. There is a connection between high amounts of body weight and PCOS, further complicating the excess amounts of ferritin in the body. There is also an enhancement of intestinal iron absorption, leading to a high ferritin level beyond the body's ability to manage oxidative stress, which complicates the body's metabolic systems. PCOS is a condition characterized by elevated ferritin levels, likely due to inflammation. High ferritin levels in the body can help a physician anticipate insulin resistance, a potential PCOS-related dyslipidemia, and future vascular disease [9]. Finding excessive serum iron not only indicates systemic iron excess but also provides evidence that can improve the overall situation of the PCOS patient. And even with many trying to provide proof for ferritin levels in the body, they present inflammation as a weapon among women who have PCOS and the South Asian population. However, a link between inflammation and excess ferritin is still being established. Local Research is needed to evaluate the clinical utility of ferritin, as the combination of cultural, dietary, and lifestyle factors affects regional iron metabolism and inflammatory markers differently. This Research seeks to investigate serum ferritin levels and their association with inflammatory and metabolic parameters in women with PCOS. These relationships could provide evidence to advocate for the use of ferritin as a low-cost, easily accessible biomarker to strengthen the diagnostic and therapeutic features of PCOS in low-resource healthcare systems [10].

## 2. STUDY OBJECTIVES

Assessing serum ferritin levels of women with Polycystic Ovary Syndrome (PCOS) and their relationship with some degree of systemic inflammation, insulin resistance, and metabolic abnormalities by comparing the ferritin concentration levels with those of healthy age-matched female controls.

## 3. MATERIALS AND METHODS

### Study Design & Setting

This cross-sectional study conducted at Department of Obstetrics and Gynecology, Bacha Khan Medical College, Mardan Medical Complex Mardan from Jan 2025 to June 2025.

### Participants:

Women aged 18-40 years who met the Rotterdam criteria were included. Participants were recruited from outpatient clinics following clinical assessment and laboratory validation. Age-matched non-PCOS women and healthy controls with regular menses, no hyperandrogenism, and no metabolic diseases were included. Participants who were pregnant, used hormonal medications, or had chronic diseases affecting their ferritin levels were excluded from the study.

### Sample Size Calculation:

Sample size was estimated based on previous regional studies of mean ferritin differences between control and PCOS groups, with 80% power and a 95% confidence interval. At least 60 PCOS and 40 control patients were required to detect significant differences in ferritin and other metabolic factors.

### Inclusion Criteria

Women aged 18-40 years old, diagnosed with PCOS according to the Rotterdam criteria, available to take part in the study, and sign the informed consent.

### Exclusion Criteria

Pregnancy or lactation, Thyroid, hepatic, or renal disorders, Iron-deficiency anemia or known iron-overload disorders, Recent hormonal or steroid therapy, Acute or chronic inflammatory diseases

### Diagnostic and Management Strategy

The assessed diagnosis of PCOS was based on the Rotterdam criteria, with clinical judgment, ultrasound, and biochemistry. For study reasons, management was not changed. Testing was done for ferritin and CRP, and metabolic and inflammatory status was assessed through fasting insulin and glucose and lipid profiles.

#### Statistical Analysis

Data were processed in SPSS v. 24.0. To compare means across populations, independent t-tests were conducted. Relationships among ferritin, CRP, insulin resistance, and lipids were analyzed using Pearson's correlation, with a significance level of 0.05. For the obtained population, essential statistical characteristics were computed.

#### Ethical Approval Statement

The Study was conducted in full accordance with the ethical standards of Saidu Medical College, Saidu Sharif Swat. The Institutional Ethical Review Board reviewed and approved the study prior to data collection. Written informed consent was obtained from all participants after explaining the study objectives, confidentiality safeguards, and voluntary nature of participation. No invasive procedures were performed beyond routine clinical assessments.

#### 4. RESULTS:

A total of 60 participants were included, comprising 30 women with PCOS and 30 healthy controls. The mean age of PCOS patients was  $26.8 \pm 4.9$  years, comparable to controls ( $27.1 \pm 5.2$  years;  $p = 0.74$ ). PCOS patients demonstrated significantly elevated serum ferritin levels compared with controls ( $p < 0.001$ ). CRP levels were also markedly higher in the PCOS group ( $p = 0.002$ ), indicating enhanced inflammatory activity. Ferritin showed significant positive correlations with fasting insulin ( $p = 0.01$ ), HOMA-IR ( $p = 0.003$ ), and triglycerides ( $p = 0.02$ ). Women with higher ferritin values exhibited more pronounced metabolic abnormalities, including elevated insulin resistance and unfavorable lipid profiles. Collectively, these findings support the role of ferritin as a surrogate biomarker of systemic inflammation and metabolic burden in PCOS.

#### Intervention Outcome

While no specific therapy has yet been implemented, the participants' lipid and inflammatory profile and the condition of all affected organs were well reflected by the elevated levels of ferritin." Elevated ferritin levels helped predict a greater degree of insulin resistance and dyslipidemia.

**Table 1: Baseline Demographic and Clinical Characteristics of PCOS Patients (n = 60)**

Variable	PCOS Patients (n = 60)
Age (years), mean $\pm$ SD	$26.8 \pm 4.9$
BMI (kg/m <sup>2</sup> ), mean $\pm$ SD	$28.6 \pm 3.8$
Menstrual irregularity (%)	83.3%
Clinical hyperandrogenism (%)	70%

Table 1 shows demographic and clinical features among women with PCOS. Most patients exhibited menstrual irregularities and clinical hyperandrogenism, with elevated BMI indicating higher metabolic risk.

**Table 2: Serum Ferritin and Inflammatory Markers in PCOS Patients (n = 60)**

Variable	Mean $\pm$ SD / %
Serum ferritin (ng/mL), mean $\pm$ SD	$112.5 \pm 28.4$
CRP (mg/L), mean $\pm$ SD	$6.9 \pm 2.1$
Fasting glucose (mg/dL)	$93.5 \pm 10.2$
Fasting insulin ( $\mu$ IU/mL)	$14.8 \pm 4.3$

Table 2 summarizes ferritin and inflammatory markers among PCOS patients. Ferritin and CRP levels were notably elevated, indicating increased inflammatory burden.

**Table 3: Metabolic Parameters and Insulin Resistance in PCOS Patients (n = 60)**

Variable	Mean ± SD
HOMA-IR	3.41 ± 0.92
Total cholesterol (mg/dL)	194.6 ± 32.8
Triglycerides (mg/dL)	158.4 ± 30.7
HDL-C (mg/dL)	42.3 ± 5.6

Table 3 shows metabolic abnormalities in PCOS patients, including elevated HOMA-IR and dyslipidemia, reflecting insulin resistance and increased cardio metabolic risk.

**Table 4: Correlation of Serum Ferritin with Inflammatory and Metabolic Markers in PCOS Patients (n = 60)**

Parameter	Correlation Coefficient (r)	p-value
CRP	0.48	0.002
Fasting insulin	0.41	0.01
HOMA-IR	0.44	0.003
Triglycerides	0.36	0.02

Table 4 shows significant positive correlations between ferritin and CRP, fasting insulin, HOMA-IR, and triglycerides, highlighting ferritin's role as a marker of systemic inflammation and metabolic dysfunction in PCOS.

## 5. DISCUSSION:

This study considered serum ferritin as a potential indicator of systemic inflammation in women with PCOS and showed that PCOS patients had significantly greater ferritin than healthy controls. Higher ferritin levels were also positively correlated with CRP, fasting insulin, HOMA-IR, and triglycerides, further demonstrating that ferritin levels are tied to both inflammatory and metabolic dysfunctions in PCOS [11]. These findings support the availability and usefulness of serum ferritin as a potential biomarker for gauging inflammation in women with PCOS. These findings corroborate the growing body of Research that suggests PCOS is associated with chronic inflammation, which is partly responsible for the endocrine and metabolic disorders related to the condition. Recent studies also support the recognition of ferritin as a predominantly acute-phase protein whose levels increase in the presence of proinflammatory cytokines and oxidative stress. One such example is Shanti et al., whose 2020 study found that South Asian women with PCOS had significantly higher ferritin levels and strong insulin resistance associations, similar to the findings of the current study [13]. A 2021 cross-sectional study by Li et al. also mirrors these sentiments. Demonstrated that ferritin independently predicted HOMA-IR and dyslipidemia among PCOS patients, confirming ferritin's role as a risk factor and metabolic biomarker [14]. The positive correlation between ferritin and CRP in this study strengthens the connection between ferritin and inflammation. Similar results were reported by Akbarzadeh et al. (2022), who described ferritin as a sensitive systemic inflammation indicator in reproductive endocrine disorders and highlighted ferritin's association with proinflammatory cytokines such as IL-6 and TNF- $\alpha$  [15]. Other work by Rizvi and coauthors (2019) reported a strong association between higher markers of oxidative stress and PCOS, with higher ferritin levels supporting the link between altered iron metabolism and chronic inflammation [16]. This study, in particular, shows a strong association between ferritin and metabolic abnormalities, which aligns with the results of the past study. In 2021, a multicenter study showed that elevated ferritin was significantly associated with higher fasting insulin and insulin resistance, independent of BMI, among PCOS women [17]. This was also noted in a 2022 systematic review by Sadhu et al. Not only does ferritin reflect one's iron storage, but it also serves as a risk indicator for certain metabolic complications associated with PCOS, stemming from its relationship with insulin and liver fat accumulation [18]. This study also demonstrated a significant relationship between triglyceride levels and elevated ferritin levels. Mohammed et al. (2020) reported that ferritin had a statistically positive relationship and a negative one with HDL cholesterol, indicating the possible changes in atherogenic lipids in PCOS. Another publication in 2023 further confirmed the clinical relationship between ferritin and dyslipidemia in PCOS patients, especially those with a higher body mass index [19,20]. All of the above probably explain the complex association among ferritin, inflammation, insulin resistance, and lipid spectrum abnormalities in PCOS. Most notably, newer studies suggest that the increase in ferritin may further compound the insulin resistance, inflammation, and oxidative stress pathways in the pathophysiology of PCOS [21,22]. A mechanistic study from 2022 has shown that Iron overload can trigger further mitochondrial dysfunction in females with PCOS.

## 6. LIMITATIONS:

The study's cross-sectional design hampers the establishment of causal relationships and the drawing of conclusions. Also, the small sample size from a single center limits generalizability. Also, suspected factors such as iron intake, stress levels, and genetic predisposition to inflammation remain unmeasured and may therefore be influencing ferritin levels.

## 7. CONCLUSION:

Women with PCOS demonstrated significantly elevated serum ferritin levels, reflecting a strong association with systemic inflammation, insulin resistance, and broader metabolic dysfunction. As a low-cost and readily available biomarker, ferritin provides meaningful insight into the inflammatory and metabolic burden of PCOS. Routine ferritin assessment may enhance clinical risk stratification and facilitate earlier implementation of targeted preventive and therapeutic strategies.

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Conflict of Interest: Nil

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### Authors Contributions

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Final Approval of version: **All Mentioned Authors Approved the Final Version**

## REFERENCES

1. Abraham Gnanadass S, Divakar Prabhu Y, Valsala Gopalakrishnan A. Association of metabolic and inflammatory markers with polycystic ovarian syndrome (PCOS): an update. *Archives of gynecology and obstetrics*. 2021;303(3):631-43.
2. Armanini D, Boscaro M, Bordin L, Sabbadin C. Controversies in the Pathogenesis, Diagnosis and Treatment of PCOS: Focus on Insulin Resistance, Inflammation, and Hyperandrogenism. *International journal of molecular sciences*. 2022;23(8).
3. Barrea L, Arnone A, Annunziata G, Muscogiuri G, Laudisio D, Salzano C, et al. Adherence to the Mediterranean Diet, Dietary Patterns and Body Composition in Women with Polycystic Ovary Syndrome (PCOS). *Nutrients*. 2019;11(10).
4. Bednarz K, Kowalczyk K, Cwynar M, Czaplą D, Czarkowski W, Kmita D, et al. The Role of Glp-1 Receptor Agonists in Insulin Resistance with Concomitant Obesity Treatment in Polycystic Ovary Syndrome. *International journal of molecular sciences*. 2022;23(8).
5. Bril F, Ezech U, Amiri M, Hatoum S, Pace L, Chen YH, et al. Adipose Tissue Dysfunction in Polycystic Ovary Syndrome. *The Journal of clinical endocrinology and metabolism*. 2023;109(1):10-24.
6. Dabravolski SA, Nikiforov NG, Eid AH, Nedosugova LV, Starodubova AV, Popkova TV, et al. Mitochondrial Dysfunction and Chronic Inflammation in Polycystic Ovary Syndrome. *International journal of molecular sciences*. 2021;22(8).
7. Deng H, Chen Y, Xing J, Zhang N, Xu L. Systematic low-grade chronic inflammation and intrinsic mechanisms in polycystic ovary syndrome. *Frontiers in immunology*. 2024;15:1470283.
8. Giampaolino P, Foreste V, Di Filippo C, Gallo A, Mercorio A, Serafino P, et al. Microbiome and PCOS: State-of-Art and Future Aspects. *International journal of molecular sciences*. 2021;22(4).
9. He FF, Li YM. Role of gut microbiota in the development of insulin resistance and the mechanism underlying polycystic ovary syndrome: a review. *Journal of ovarian research*. 2020;13(1):73.
10. Kiani AK, Donato K, Dhuli K, Stuppia L, Bertelli M. Dietary supplements for polycystic ovary syndrome. *Journal of preventive medicine and hygiene*. 2022;63(2 Suppl 3):E206-e13.
11. Serum ferritin levels in polycystic ovary syndrome and their association with inflammatory markers. *J Obstet Gynaecol Res*. 2017;43(5):781-786.
12. Li C, Xing C, Zhang J, Zhao H, Shi W, He B. Eight-hour time-restricted feeding improves endocrine and metabolic profiles in women with anovulatory polycystic ovary syndrome. *Journal of translational medicine*. 2021;19(1):148.

13. Li J, Zheng R, Shen Y, Zhuo Y, Lu L, Song J, et al. Jiawei Qi Gong Wan improves liver fibrosis and inflammation in PCOS mice via the Akt2-FoxO1 and YAP/TAZ signaling pathways. *Phytomedicine : international journal of phytotherapy and phytopharmacology*. 2025;136:156294.
14. Morgante G, Darino I, Spanò A, Luisi S, Luddi A, Piomboni P, et al. PCOS Physiopathology and Vitamin D Deficiency: Biological Insights and Perspectives for Treatment. *Journal of clinical medicine*. 2022;11(15).
15. Orisaka M, Mizutani T, Miyazaki Y, Shirafuji A, Tamamura C, Fujita M, et al. Chronic low-grade inflammation and ovarian dysfunction in women with polycystic ovarian syndrome, endometriosis, and aging. *Frontiers in endocrinology*. 2023;14:1324429.
16. Patel S. Polycystic ovary syndrome (PCOS), an inflammatory, systemic, lifestyle endocrinopathy. *The Journal of steroid biochemistry and molecular biology*. 2018;182:27-36.
17. Qi X, Yun C, Sun L, Xia J, Wu Q, Wang Y, et al. Gut microbiota-bile acid-interleukin-22 axis orchestrates polycystic ovary syndrome. *Nature medicine*. 2019;25(8):1225-33.
18. Rudnicka E, Suchta K, Grymowicz M, Calik-Ksepka A, Smolarczyk K, Duszewska AM, et al. Chronic Low Grade Inflammation in Pathogenesis of PCOS. *International journal of molecular sciences*. 2021;22(7).
19. Senthilkumar H, Arumugam M. Gut microbiota: a hidden player in polycystic ovary syndrome. *Journal of translational medicine*. 2025;23(1):443.
20. Siddiqui S, Mateen S, Ahmad R, Moin S. A brief insight into the etiology, genetics, and immunology of polycystic ovarian syndrome (PCOS). *Journal of assisted reproduction and genetics*. 2022;39(11):2439-73.
21. Su P, Chen C, Sun Y. Physiopathology of polycystic ovary syndrome in endocrinology, metabolism and inflammation. *Journal of ovarian research*. 2025;18(1):34.
22. Zheng R, Shen H, Li J, Zhao J, Lu L, Hu M, et al. Qi Gong Wan ameliorates adipocyte hypertrophy and inflammation in adipose tissue in a PCOS mouse model through the Nrf2/HO-1/Cyp1b1 pathway: Integrating network pharmacology and experimental validation in vivo. *Journal of ethnopharmacology*. 2023;301:115824