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## Evaluating the hormonal and biochemical markers in womens with polycystic ovarian syndrome PCOS in Missan Province

Nidhal, R. Juhi

M.Sc. Cellular Biology /Biology Department / Education College / Missan University, Iraq

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### Abstract

Polycystic ovarian syndrome (PCOS) is a complex endocrine disorder characterized by enlarged ovaries with multiple cysts, hormonal imbalances, and metabolic complications. This condition significantly affects women's reproductive health. **Objective:** To evaluate the prevalence, clinical manifestations, and biochemical parameters of PCOS among married women in Missan Province, Iraq, and assess the associated risk factors, hormonal profiles, and metabolic complications. **Methods:** A case-control study was conducted from November 2023 to May 2024 at the Child and Maternity Hospital in Missan Province. The study included 150 married women aged 25-45 years (mean age 35 years), divided into two groups (75 women diagnosed with PCOS based on Rotterdam criteria and 75 healthy controls). Data collection included demographic information, menstrual history, reproductive outcomes, family history, and clinical symptoms. Biochemical analyses encompassed hormonal profiles (FSH, LH, testosterone, prolactin, TSH, progesterone, estradiol), lipid profiles, liver function tests, and complete blood counts. **Results:** Significant differences were observed between the PCOS and control groups. Women with PCOS demonstrated higher body weight ( $78.4 \pm 15.8$  kg in  $p < 0.001$ ) and BMI ( $29.7 \pm 5.9$ ), with 52% being overweight and 29.3% obese. Menstrual irregularities were prevalent in PCOS patients, with 72% experiencing irregular cycles and 57.3% having oligomenorrhea. Clinical manifestations included hirsutism (81.3%), acne (56%), and alopecia (64%). Hormonal analysis revealed significantly elevated testosterone ( $2.23 \pm 1.19$ ), LH ( $10.82 \pm 5.43$ ), and insulin levels ( $18.4 \pm 9.2$ ). Metabolic complications included dyslipidemia with elevated total cholesterol ( $207.64 \pm 73.42$  mg/dL) and triglycerides ( $199.33 \pm 82.57$  mg/dL). Liver dysfunction was indicated by elevated ALT and AST levels ( $p < 0.001$ ).

**Keywords:** Polycystic ovary syndrome, lifestyle changes, hormonal imbalance, obesity, dyslipidemia, menstrual irregularities.

### Introduction

Polycystic ovarian syndrome (PCOS) is a complex condition characterized by enlarged ovaries containing numerous cysts or follicles that rarely mature or produce eggs capable of fertilization. PCOS is relatively common, particularly among infertile women (1). The condition arises from an endocrine imbalance, leading to elevated levels of estrogen, testosterone, and luteinizing hormone

(LH), while follicle-stimulating hormone (FSH) levels are decreased. This imbalance disrupts the hypothalamic-pituitary-ovarian axis and can be associated with androgen-producing tumors (2).

The most prevalent manifestation of PCOS is menstrual irregularity, affecting nearly 80% of patients. Common menstrual issues include oligomenorrhea, secondary amenorrhea, primary

amenorrhea, and menorrhagia. Despite these irregularities, around 20% of women may experience apparently regular cycles without ovulation. Additionally, symptoms such as hirsutism are present in 50-60% of patients, acne in 15-20%, and androgenic alopecia in 5%. Obesity is observed in approximately 30-75% of patients, often with an android distribution of fat and features of insulin resistance like acanthosis nigricans and skin tags (3).

PCOS can lead to several serious complications. Elevated estrogen levels increase the risk of endometrial hyperplasia and endometrial cancer. Elevated androgen levels contribute to the risk of metabolic syndrome and hirsutism. Hyperinsulinemia due to insulin resistance can enhance ovarian androgen production, and chronic androgen excess raises the risk of cardiovascular disorders, including hypertension (4).

Women with PCOS are also more prone to mental health issues such as depression, anxiety, poor self-esteem, impaired coping abilities, strained relationships, reduced quality of life, disordered eating, and psychosexual dysfunction (5). The exact etiology of PCOS remains unknown, but there is strong evidence suggesting a genetic component. Familial clustering and inheritance patterns of hyperandrogenemia and hyperinsulinemia indicate a hereditary influence, with environmental factors such as obesity potentially playing a role as well (6).

Management of PCOS should emphasize support, education, and lifestyle modifications, alongside targeted medical therapy when needed. Initial treatment focuses on lifestyle changes, including nutritional counseling and exercise, to address diabetes risk through weight loss and improved glucose metabolism, which can help stabilize some distressing symptoms. If lifestyle interventions are

insufficient, medications are chosen based on specific metabolic disorders, including insulin resistance and menstrual irregularities related to high androgen levels (7,8). The rising rates of obesity among Iraqi women are largely attributed to unhealthy dietary habits, including the consumption of junk and fast food, combined with increasingly sedentary lifestyles. Recent research highlights that lifestyle changes—such as diet, exercise, and weight loss—should be the first line of treatment for PCOS, preceding pharmacological interventions. This study aims to evaluate the effect of lifestyle changes on the symptoms of polycystic ovarian syndrome (PCOS), the prevalence and risk factors associated with ovarian cysts among married women, determine laboratory evaluations and biochemical parameter changes in women with PCOS and evaluate abnormal changes in hormones such as estrogen, progesterone, prolactin, TSH, testosterone, FSH, and LH in women with PCOS.

## Materials and Methods

### Study Design

This case-control study was conducted from November 2023 to May 2024. The study included 150 married women aged between 25 and 45 years, with a mean age of 35 years, divided into two distinct groups. **PCOS Group (75)** Women diagnosed with Polycystic Ovarian Syndrome (PCOS) who were new patients visiting the infertility department. Diagnosis of PCOS was based on the Rotterdam criteria, which include the presence of polycystic ovarian morphology or anovulation and clinical or biochemical signs of hirsutism. **Non-PCOS Group (75)** includes healthy women without PCOS, recruited from the general gynecology clinic for routine check-ups. These women served as controls and had no history of PCOS or related endocrine disorders. Both groups' recruitment took place at the Child and Maternity Hospital in Missan Province.

## Study Tools

Data collection was facilitated through a structured questionnaire encompassing Demographic data (Age, Weight, Height, BMI calculation), Blood pressure, Nature of menstrual cycle (frequency, regularity), History of abortion, Family history of PCOS, Presence of pain during menstrual cycles, Height and weight for Body Mass Index (BMI) calculation and Clinical symptoms including acne, alopecia, and hirsutism.

## Blood Sampling and Processing

**Sample Collection:** Five milliliters (5 ml) of venous fasting blood were collected from each participant in both groups in the morning. Blood samples were immediately centrifuged at 3000 rpm for 10 minutes. The resulting serum was stored at -20°C until further analysis.

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**Biochemical Analysis:** Biochemical parameters such as lipid profile, liver function tests, kidney function tests, and blood glucose levels were analyzed at the Baby and Maternity Hospital – Amarha City for both groups. Standard laboratory methods and analysis kits from Spinach Company (Spain) were used.

**Complete Blood Count (CBC):** Performed using an automated hematology analyzer (System X kx-21n; JAPAN CARE CO., LTD) for both groups, providing measurements of hemoglobin (Hb), white blood cells (WBCs), red blood cells (RBCs), platelets, and hematocrit (packed cell volume, PCV).

**Hormonal Measurements:** Hormone levels were measured at Al-Sadder Hospital for both groups. Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) levels were determined using commercial kits from Izotop (Budapest, Hungary),

distributed by Shin Jin Medics Inc. Levels of prolactin, testosterone, thyroid-stimulating hormone (TSH), and progesterone were assessed using diagnostic kits from Diagnostic Biochem Canada Co. (London, ON, Canada).

## Ethical considerations:

This study adhered to strict ethical principles and foundations, where the initial consent of the women was obtained to participate, as well as the approval of the Maysan Health Department and the Maternity and Child Hospital in Maysan Governorate to conduct the study. In addition, the privacy of the participants and the confidentiality of their answers were ensured. We made efforts to minimize any potential harm or psychological distress to the participants, and we were keen to inform all participants of their right to withdraw from the study at any time without consequences.

## Statistical Analysis:

Statistical analyses were conducted using SPSS version 17. Differences between groups were assessed using one-way analysis of variance (ANOVA). The significance level was set at  $P < 0.05$ .

## Results

### Demographic Characteristics

This table(1) shows the baseline characteristics of women with and without polycystic ovary syndrome (PCOS). The study included 150 women and measured two groups of 75 women each—one with PCOS and the other a control group without PCOS. Age was similar, with no significant differences ( $p=0.742$ ). This indicates good agreement between the two groups. Weight was significantly higher in the PCOS group than in the control group (78.4 kg vs. 62.3 kg (16 kg difference)). Blood pressure showed significant differences, with systolic and diastolic blood pressures significantly higher in the PCOS group, although the means for both groups fell within the

normal to slightly elevated range. Height did not show a significant difference between the two groups, indicating that height is not typically affected by PCOS.

### Body Mass Index (BMI)

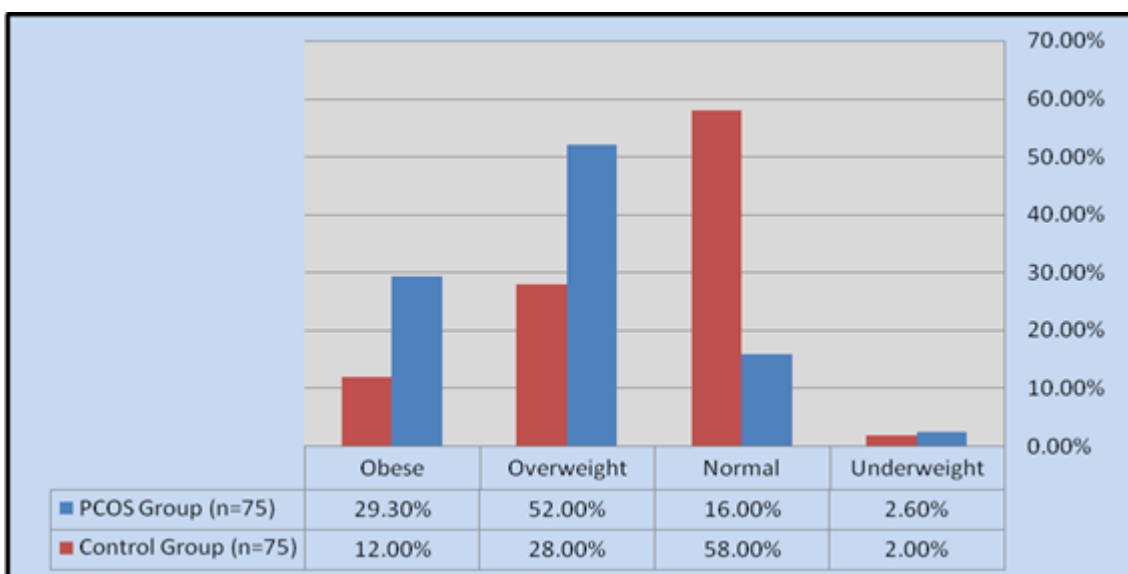
Figure (1) shows significant differences were observed in BMI distribution between groups ( $P <$

0.001), where the PCOS group (52%) was found in overweight, (29.3%) were found obese, (16%) had normal weight, and (2.6%) were found underweight. In contrast, the control group showed (28%) overweight, (12%) obese, (58%) found in normal weight, and (2%) were found underweight

**Table 1: Baseline Demographic Characteristics comparison between PCOS and Non-PCOS Groups**

Characteristic	PCOS Group (n = 75)	Non-PCOS Group (n = 75)	P-value
Age (years)	34.8 ± 6.2	35.1 ± 5.9	<b>0.742</b>
Weight (kg)	78.4 ± 15.8	62.3 ± 9.7	<b>&lt;0.001</b>
Height (cm)	162.5 ± 6.1	163.2 ± 5.8	<b>0.478</b>
BMI (kg/m <sup>2</sup> )	29.7 ± 5.9	23.4 ± 3.2	<b>&lt;0.001</b>
Systolic BP (mmHg)	128.3 ± 14.6	118.7 ± 11.2	<b>&lt;0.001</b>
Diastolic BP (mmHg)	82.1 ± 9.8	76.4 ± 7.3	<b>&lt;0.001</b>

- Values expressed as means ± SD; BMI: Body Mass Index; BP: Blood Pressure.
- Statistically significant differences ( $p < 0.05$ ) are highlighted in red, while non-significant differences ( $p \geq 0.05$ ) are shown in green.



**Figure (1): Shows the BMI distribution comparison between PCOS and Non-PCOS Groups.**

### Nature of the Menstrual Cycle

This table (2) shows that there are significant differences in menstrual cycle characteristics between women with and without polycystic ovary syndrome (PCOS) through the difference in high statistical significance and the results as following: Women with PCOS had significant difficulty regulating their menstrual cycle length, with only 28% having normal cycles (21-35 days), compared to 92% of women without PCOS, over half (57.3%) of PCOS women experience oligomenorrhea, nearly 15% of PCOS women have amenorrhea as compared to the control group. the results also found that (72%) of PCOS women have irregular cycles, whereas only (8%) of non-PCOS women have irregular menstrual cycles. The results showed that women with PCOS had significantly more severe menstrual flow and bleeding (46.7%) and light bleeding (29.3%) compared to women without PCOS with normal flow patterns (77.3%). The study also showed that women with PCOS had more pronounced menstrual pain, with 38.7% reporting severe pain and 34.7% reporting moderate pain, compared to 77.3% of women without PCOS who did not experience any pain during their menstrual period.

### Reproductive History

The table (3) shows that significant differences were observed in reproductive outcomes between the women with PCOS and those without PCOS. The results showed that women with PCOS were 60% less likely not to get pregnant compared to 37.3% in the unaffected group. Women without PCOS gave birth more than once (29.3%) compared to women with PCOS (16%), indicating that women with PCOS face greater difficulty in multiple pregnancies. The results showed that women with PCOS had experienced infertility for a

period of time, with only 10.7% of women with PCOS conceiving within one year, compared to 69.3% of women without the condition. Furthermore, 42.7% of women with PCOS experienced infertility for two to five years, and 13.3% of women with PCOS experienced infertility lasting more than five years. No women in the control group experienced such prolonged infertility. The study also showed lower live birth rates for women with PCOS (40% vs. 62.7%) and higher rates of spontaneous abortion (37.3% vs. 12%), suggesting that PCOS not only affects pregnancy, but also its continuation and outcomes. The study also showed that women with PCOS required more medical intervention to achieve pregnancy than women without PCOS, with 37.3% of women with PCOS requiring ovulation induction, compared to 10.7% of women in the control group.

### Family History and Genetic Predisposition

This table (4) compares the family medical history between the women with PCOS and the women without PCOS, where the results observed that 58.7% of women with PCOS had a history of diabetes compared to 20% of women in the control group. Most of them also had type 2 diabetes (54.7%) compared to 18.7% in the control group. The results showed that women with PCOS were 46.7% obese, compared to 16.0% of women without PCOS. High blood pressure was also observed in women with PCOS, at 33.3% compared to 18.7% of the control group. Cardiovascular disease was present in 24.0% of women with PCOS, compared to 10.7% of women without PCOS. Only 8% of PCOS patients had no family history, while 61.3% of controls had no family history; that means 92% of PCOS patients had some genetic predisposition.

**Table 2: Menstrual Cycle Characteristics Comparison between PCOS and Non-PCOS Groups**

CHARACTERISTIC	PCOS GROUP (N=75)	NON-PCOS GROUP (N=75)	P-VALUE
<b>Cycle Length</b>			<0.001
Normal (21-35 days)	21 (28.0%)	69 (92.0%)	
Oligomenorrhea (>35 days)	43 (57.3%)	6 (8.0%)	
Amenorrhea (no cycles)	11 (14.7%)	0 (0%)	
<b>Cycle Regularity</b>			<0.001
Regular	21 (28.0%)	69 (92.0%)	
Irregular	54 (72.0%)	6 (8.0%)	
<b>Menstrual Flow</b>			<0.001
Normal	18 (24.0%)	58 (77.3%)	
Heavy	35 (46.7%)	12 (16.0%)	
Light	22 (29.3%)	5 (6.7%)	
<b>Dysmenorrhea</b>			<0.001
None	12 (16.0%)	58 (77.3%)	
Mild	8 (10.7%)	15 (20.0%)	
Moderate	26 (34.7%)	2 (2.7%)	
Severe	29 (38.7%)	0 (0%)	

**Table 3: Reproductive History Comparison between PCOS and Non-PCOS Groups**

PARAMETER	PCOS GROUP (N=75)	NON-PCOS GROUP (N=75)	P-VALUE
<b>Parity</b>			0.001
Nulliparous	45 (60.0%)	28 (37.3%)	
Primiparous	18 (24.0%)	25 (33.3%)	
Multiparous	12 (16.0%)	22 (29.3%)	
<b>Infertility Duration</b>			<0.001
<1 year	8 (10.7%)	52 (69.3%)	
1-2 years	25 (33.3%)	18 (24.0%)	
2-5 years	32 (42.7%)	5 (6.7%)	
>5 years	10 (13.3%)	0 (0%)	
<b>Pregnancy Outcomes</b>			<0.001
Live births	30 (40.0%)	47 (62.7%)	
Spontaneous abortions	28 (37.3%)	9 (12.0%)	
Induced abortions	17 (22.7%)	6 (8.0%)	
<b>Conception Method</b>			<0.001
Natural conception	35 (46.7%)	67 (89.3%)	
Ovulation induction	28 (37.3%)	8 (10.7%)	
Assisted reproduction	12 (16.0%)	0 (0%)	



**Table 4: Family History Comparison between PCOS and Non-PCOS Groups**

CONDITION	PCOS GROUP (N=75)	CONTROL GROUP (N=75)	P-VALUE
<b>Diabetes Mellitus</b>			
Present	44 (58.7%)	15 (20.0%)	<0.001
Type 1	3 (4.0%)	1 (1.3%)	0.621
Type 2	41 (54.7%)	14 (18.7%)	<0.001
<b>Hypertension</b>	25 (33.3%)	14 (18.7%)	0.048
<b>Cardiovascular Disease</b>	18 (24.0%)	8 (10.7%)	0.025
<b>PCOS (in relatives)</b>	22 (29.3%)	2 (2.7%)	<0.001
<b>Obesity</b>	35 (46.7%)	12 (16.0%)	<0.001
<b>Metabolic Syndrome</b>	28 (37.3%)	7 (9.3%)	<0.001
<b>Thyroid Disorders</b>	19 (25.3%)	9 (12.0%)	0.044
<b>No Family History</b>	6 (8.0%)	46 (61.3%)	<0.001

### ***Clinical Manifestations and Symptoms***

The table (5) observed clinical findings for the women with PCOS as compared to a control group without PCOS, where the most difference was in hirsutism (81.3%) of PCOS patients had excessive hair growth compared to (2.7%) of control group, and more than half (56%) of PCOS patients had acne versus (12%) of controls, the moderate and severe acne were much more common in PCOS patients. Hair Loss or Alopecia was found in 64% of PCOS patients as compared to 5.3% of the control group. PCOS patients also showed insulin resistance-related skin changes like acanthosis nigricans (dark and skin patches) in 42.7%, as compared to 4% of the control group, and 77.3% of PCOS patients reported difficulty losing weight compared to 16% reported in the control group. These findings confirm that PCOS causes a distinct constellation of symptoms related to elevated androgen levels and insulin resistance.

### **Hormonal Parameters**

Table 6 reveals that hormonal disturbances are associated with PCOS compared to women without PCOS. It showed an increase in LH and FSH levels, as well as a higher LH/FSH ratio, in women with PCOS compared to the control group. This increase in levels is indicative of PCOS. The

disruption of normal ovulation results in an increase in androgen levels. The study also showed an increase in testosterone levels in women with PCOS, three times higher than in women without PCOS. This was accompanied by clinical symptoms including hirsutism, acne, and male pattern hair loss, which is the primary factor behind the apparent symptoms of PCOS. The results also showed an increase in estradiol levels (231.24 pg/ml) in women with PCOS compared to women without PCOS (178.42 pg/ml). This increase in estradiol levels may cause multiple follicles to develop without ovulation, increasing the risk of endometrial hyperplasia. Progesterone levels were relatively low in women with PCOS (1.28 ng/ml). This relative decrease indicates menopause in many PCOS patients.

The results showed that there was an increase in the level of prolactin hormone by (17.17) ng/ml in women with polycystic ovary syndrome compared to women without the syndrome, which appeared at a rate of (10.83) ng/ml. The high level of prolactin may inhibit ovulation and contribute to menstrual disorders. The study also showed a dysfunction in the thyroid gland, which appeared through an increase in the level of the TSH hormone by (2.86) milli-international units/liter, compared to the total control (2.15) milli-international units/liter. The

results of this study showed an increase in insulin levels by 18.4 mIU/ml in women with polycystic ovary syndrome (PCOS) compared to the control group (8.7 mIU/ml). This increase in insulin levels is due to severe insulin resistance, which leads to increased stimulation of androgen production, worsens ovulation dysfunction, and increases the risk of diabetes and cardiovascular disease.

Table 7 shows the prevalence of various hormonal abnormalities in women with PCOS compared to healthy women. All comparisons showed ( $p < 0.001$ ), indicating that these differences are highly statistically significant. This strongly supports the hormonal variation associated with PCOS and underscores the importance of these markers as diagnostic and monitoring tools.

**Table 5: Clinical Symptoms and Physical Manifestations Comparison between PCOS and Non-PCOS Groups**

SYMPTOM/SIGN	PCOS GROUP (N=75)	CONTROL GROUP (N=75)	OR (95% CI)	P- VALUE
<b>Hirsutism</b>				
Present	61 (81.3%)	2 (2.7%)	175.75 (39.32-785.42)	<0.001
≥8 (significant)	61 (81.3%)	2 (2.7%)	175.75 (39.32-785.42)	<0.001
<b>Acne</b>				
Present	42 (56.0%)	9 (12.0%)	9.33 (4.14-21.00)	<0.001
Mild	15 (20.0%)	7 (9.3%)	2.43 (0.94-6.29)	0.068
Moderate	18 (24.0%)	2 (2.7%)	11.57 (2.58-51.76)	0.001
Severe	9 (12.0%)	0 (0%)	-	0.003
<b>Alopecia</b>				
Present	48 (64.0%)	4 (5.3%)	32.00 (10.74-95.29)	<0.001
Male pattern	35 (46.7%)	1 (1.3%)	60.44 (7.96-459.04)	<0.001
Diffuse thinning	13 (17.3%)	3 (4.0%)	4.98 (1.38-18.02)	0.011
<b>Skin Changes</b>				
Acanthosis nigricans	32 (42.7%)	3 (4.0%)	17.07 (4.94-58.99)	<0.001
Skin tags	28 (37.3%)	5 (6.7%)	8.40 (3.06-23.07)	<0.001
<b>Weight-related Issues</b>				
Difficulty losing weight	58 (77.3%)	12 (16.0%)	17.42 (8.06-37.65)	<0.001
Central obesity	52 (69.3%)	8 (10.7%)	18.85 (8.10-43.87)	<0.001



**Table 6: Hormonal Profile Comparison between PCOS and Non-PCOS Groups**

PARAMETER	PCOS GROUP (N=75)	CONTROL GROUP (N=75)	P-VALUE
<b>Reproductive Hormones</b>			
LH (U/L)	10.82 ± 5.43	4.89 ± 1.02	<0.001
FSH (U/L)	9.18 ± 2.33	6.95 ± 1.12	<0.001
LH/FSH ratio	1.18 ± 0.47	0.70 ± 0.12	<0.001
Testosterone (nmol/L)	2.23 ± 1.19	0.72 ± 0.21	<0.001
Androstenedione (nmol/L)	12.8 ± 5.1	6.4 ± 2.3	<0.001
<b>Ovarian Hormones</b>			
Estradiol (pg/mL)	231.24 ± 50.36	178.42 ± 18.65	<0.001
Progesterone (ng/mL)	1.28 ± 0.78	0.85 ± 0.22	<0.001
<b>Pituitary Hormones</b>			
Prolactin (ng/mL)	17.17 ± 7.64	10.83 ± 2.15	<0.001
<b>Thyroid Function</b>			
TSH (mIU/L)	2.86 ± 1.12	2.15 ± 0.45	<0.001
T3 (ng/dL)	142.3 ± 28.6	135.7 ± 22.1	0.117
T4 (µg/dL)	8.9 ± 2.1	8.2 ± 1.6	0.028
<b>Metabolic Hormones</b>			
Insulin (µIU/mL)	18.4 ± 9.2	8.7 ± 3.1	<0.001
Glucose (mg/dL)	96.8 ± 12.4	86.3 ± 8.9	<0.001

\*Values expressed as means ± SD.

**Table 7: Prevalence of Hormonal Abnormalities in women with PCOS compared to healthy women.**

ABNORMALITY	PCOS GROUP (N=75)	CONTROL GROUP (N=75)	P-VALUE
<b>Hyperandrogenemia</b>	68 (90.7%)	3 (4.0%)	<0.001
<b>Elevated LH</b>	52 (69.3%)	2 (2.7%)	<0.001
<b>Insulin resistance</b>	58 (77.3%)	8 (10.7%)	<0.001
<b>Hypothyroidism</b>	22 (29.3%)	3 (4.0%)	<0.001
<b>Hyperprolactinemia</b>	18 (24.0%)	2 (2.7%)	<0.001

### Lipid Profile

The results in Table 8 show lipid levels (cholesterol and triglyceride levels) for the women with PCOS associated with increased cardiovascular risk as compared with the control group, where the Total Cholesterol (28%) is higher in PCOS, Triglycerides (37%) are higher in PCOS, and vLDL-Cholesterol

(47%) higher in PCOS as compared with healthy women, while HDL-Cholesterol (9% lower is in women with PCOS. These changes indicate that in PCOS patients, likely driven by insulin resistance and the elevated triglycerides and VLDL with reduced HDL, create a particularly concerning cardiovascular risk profile

**Table 8: Lipid Profile Comparison between PCOS and Non-PCOS Groups**

PARAMETER	PCOS GROUP (N=75)	CONTROL GROUP (N=75)	P- VALUE
Total Cholesterol (mg/dL)	207.64 ± 73.42	162.35 ± 28.45	<0.001
LDL-Cholesterol (mg/dL)	157.51 ± 38.67	118.22 ± 22.15	<0.001
Triglycerides (mg/dL)	199.33 ± 82.57	145.67 ± 35.24	<0.001
VLDL-Cholesterol (mg/dL)	56.69 ± 47.83	38.45 ± 18.22	0.005
HDL-Cholesterol (mg/dL)	153.50 ± 35.62	168.75 ± 25.18	0.003

\*Values expressed as means ± SD

The table (9) compares biochemical parameters between women with PCOS (Polycystic Ovary Syndrome) and healthy controls, revealing several significant differences that suggest metabolic and liver-related complications in PCOS patients, where both liver enzymes (ALT and AST) are significantly elevated in the PCOS group compared to controls. ALT levels are about 43% higher, and AST levels are about 59% higher in the PCOS group. These elevations suggest potential liver dysfunction or fatty liver disease, which is

commonly associated with PCOS due to insulin resistance and metabolic syndrome. Alkaline Phosphatase is also significantly elevated in PCOS patients as compared with healthy women; this elevation likely reflects liver involvement as part of the metabolic complications. Serum creatinine levels are significantly higher in the PCOS group, and this slight elevation might suggest early kidney function changes, possibly related to insulin resistance, hypertension, or other metabolic factors associated with PCOS

**Table 9: Biochemical Parameters Comparison between PCOS and Non-PCOS Groups**

PARAMETER	PCOS GROUP (N=75)	CONTROL GROUP (N=75)	P- VALUE
Alkaline Phosphatase (IU/L)	86.93 ± 56.92	72.15 ± 18.45	0.028
Creatinine (mg/dL)	1.02 ± 0.59	0.89 ± 0.12	0.048
ALT (IU/L)	38.25 ± 25.87	26.78 ± 8.95	0.001
AST (IU/L)	39.17 ± 35.12	24.65 ± 7.23	0.001

\*Values expressed as means ± SD

## Discussion:

This study observed that the majority of women with Polycystic Ovary Syndrome (PCOS) were between 31 and 35 years old (50.6%). This finding aligns with existing literature, which indicates that PCOS commonly presents in women during their reproductive years, particularly in their 30s (Azziz et al., 2004). Women aged 26 to 30 years represented the next largest group (30.6%), while those aged 19 to 25 years were the smallest cohort (19.2%). This distribution underscores the prevalence of PCOS in the later reproductive years and suggests that the condition might become more apparent as women age and experience cumulative hormonal and metabolic changes (9).

The BMI analysis revealed that 52% of women with PCOS were overweight, and 29.3% were classified as obese. This high prevalence of overweight and obesity among PCOS patients is consistent with studies highlighting the strong association between PCOS and obesity (Wild et al., 2014). Only 2.6% of participants were underweight, and 16% had a normal weight. The elevated BMI in PCOS patients may contribute to the exacerbation of symptoms and increase the risk of metabolic complications (10).

The majority of women in the study experienced irregular menstrual cycles (57.3%), a common symptom of PCOS, which is often characterized by menstrual irregularity due to an ovulation (11). Regular menstrual cycles were noted in 28% of participants, and 4.6% had amenorrhea. These findings are reflective of the variability in menstrual cycle patterns observed in PCOS, where irregular cycles are prevalent but not universal (12). Severe menstrual pain was reported by 84% of women with PCOS, a significantly higher proportion compared to the 16% who did not experience pain. This high incidence of dysmenorrhea among PCOS patients may be

related to the presence of endometrial hyperplasia or the elevated levels of androgens that are characteristic of the syndrome (13).

The study found that 47.5% of women with PCOS experienced medication-induced abortions using mifepristone and misoprostol. Self-induced abortions were reported in 37.3% of cases, with 12% of women having no history of miscarriages. This increased rate of miscarriage in PCOS patients is consistent with the higher risk of pregnancy loss associated with the condition, often due to hormonal imbalances and insulin resistance (14). A significant proportion of women with PCOS had a family history of diabetes mellitus (58.5%) and hypertension (33.3%). This association suggests a genetic or familial predisposition to PCOS, as well as a shared risk for metabolic disorders (15). Only 5.2% of women had no family history of these conditions, highlighting the strong genetic component in the etiology of PCOS.

The study identified several common symptoms among women with PCOS: acne (56%), alopecia (64%), hirsutism (81.3%), and depression (70.6%). The high prevalence of these symptoms corroborates findings from other studies that highlight the dermatological and psychological impact of PCOS (9). The fact that 20% of women did not exhibit these symptoms could suggest variability in symptom expression among PCOS patients.

Hormonal analyses revealed elevated TSH (77.3%) in patients, which may indicate a potential overlap with thyroid dysfunction, although PCOS itself is not directly linked to elevated TSH levels (6). Increase in Testosterone (81.3%) of women, consistent with the hyperandrogenism characteristic of PCOS (4). Decreased levels of LH and FSH were observed in 64% and 69.3% of patients, respectively, which reflects the altered pituitary

hormone balance often seen in PCOS (12). Significant decreases in Progesterone and Estrogen, these hormones were noted, aligning with the anovulatory cycles and hormonal imbalances typical in PCOS (11). Elevated Prolactin (70.6%) of patients, which may be indicative of the broader endocrine dysregulation associated with PCOS (15).

The lipid profile showed an elevation in Total Cholesterol (70.6%) in patients, reflecting an increased risk of cardiovascular disease often associated with PCOS (16,17). An increase in LDL-Cholesterol (77.3%) of patients, which is consistent with the dyslipidemia frequently observed in PCOS (10). Elevated Triglycerides 64% of women, corroborating the association between PCOS and increased triglyceride levels (Ehrmann, 2005), an increase in VLDL-Cholesterol 74.6% of patients, further emphasizing the lipid abnormalities present in PCOS (14).

Biochemical analyses indicated Elevated alkaline phosphatase in 58.6% of patients, possibly due to liver dysfunction or bone metabolism changes associated with PCOS (6). An increase in Creatinine in 90.6% of women, suggesting possible renal involvement (17). Elevated Liver Enzymes, such as AST and ALT levels, were observed in 70.6% and 73.3% of patients, respectively, indicating possible hepatic involvement (9). Elevated Blood Glucose 69.3% of patients, consistent with the insulin resistance often observed in PCOS (Palomba et al., 2015), an increase in Blood Urea 74.6% of patients, which may be related to renal function changes or increased metabolic demand (12).

### Conclusion

The study on Polycystic Ovary Syndrome (PCOS) among married women in Missan Province reveals that PCOS predominantly affects women in their late 20s and 30s, emphasizing its impact during the

reproductive years. The condition is strongly linked to overweight and obesity, which aggravates symptoms and complicates treatment. Many women experience irregular menstrual cycles and severe menstrual pain, pointing to a need for improved management of these symptoms. Additionally, women with PCOS have elevated miscarriage rates, both spontaneous and medication-induced, indicating a need for enhanced care strategies. The study also finds a significant genetic component, with many women having a family history of diabetes and hypertension. Hormonal and biochemical abnormalities, including high androgen levels and disrupted lipid profiles, are common, reflecting the metabolic and endocrine disturbances of PCOS. Furthermore, elevated levels of creatinine, liver enzymes, and dyslipidemia signal additional risks for cardiovascular and renal health.

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