Proceedings of the Pakistan Academy of Sciences: B Life and Environmental Sciences 62(1): 41-49 (2025)

ISSN (Print): 2518-4261; ISSN (Online): 2518-427X
http://doi.org/10.53560/PPASB(62-1)1078

Pakistan Academy of Sciences

Research Article

Clinical Features and Diagnostic Strategies for Polycystic Ovary Syndrome (PCOS) in Bahawalpur, Pakistan

Munazzah Marryum[1], Khawar Ali Shahzad[1,2*], Muhammad Faizan Munawer[1], Mavra Saleem[1], Shabana Ramzan[1], and Muhammad Rashid[3]

[1]Department of Zoology, The Islamia University of Bahawalpur, Bahawalpur, 63100, Pakistan
[2]Shanghai Fourth People's Hospital, and School of Medicine, Tongji University, Shanghai, 200120, China
[3]Department of Biosciences, COMSATS University, Islamabad, 45550, Pakistan

Abstract: The aim is to outline the research methodology employed for diagnosing and classifying Polycystic Ovary Syndrome (PCOS) patients while offering guidance on the management and potential cure of PCOS, ultimately facilitating the ability of affected women to conceive. The methodology in this research included multiple steps: firstly, a physical examination based on clinical features; secondly, verification of the disease using biochemical tests and ultrasound. The study included 54 female patients seeking fertility assistance, utilizing physical examination, biochemical tests, and ultrasound to diagnose PCOS. The data were collected at Bahawal Victoria Hospital, Bahawalpur, Pakistan; fifty-four patients were analyzed based on clinical features, biochemical parameters, and ultrasonography. The study revealed strong correlations between PCOS and hirsutism, oligomenorrhea, family PCOS history, and acne. Unmarried women faced a higher PCOS risk. The most common features were oligomenorrhea (90.7%) and hirsutism (83.3%), followed by amenorrhea (57.4%), family history (55.6%), and acne (53.8%). All these factors showed significant associations with PCOS ($p < 0.001$ for hirsutism, oligomenorrhea, and family history, while $p = 0.002$ for acne). A positive correlation was found among patients with PCOS who had BMI, hirsutism, a family history, and acne. The research at Bahawal Victoria Hospital, Pakistan, employed diverse diagnostic tools to observe and categorize 54 patients, demonstrating early PCOS diagnosis effectiveness and manageability through medication and lifestyle changes for infertility. This study highlights the importance of integrating clinical, biochemical, and ultrasonographic features for the accurate diagnosis of PCOS. Early diagnosis and targeted management can significantly improve outcomes for affected women.

Keywords: Polycystic Ovary Syndrome, Obesity, Oligomenorrhea, LH/FSH Ratio, Family History.

1. INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is a hormonal disorder that impacts women of childbearing age, giving rise to a range of symptoms such as irregular or missing menstrual cycles, excess hair growth (hirsutism), acne, infertility, and weight gain [1]. PCOS is a multifaceted condition influenced by both genetic and environmental factors. Although the precise origin remains elusive, it is theorized that a blend of elements, encompassing genetics, hormones, and lifestyle choices, contributes to its onset [2]. The diagnosis of PCOS in women involves evaluating their symptoms, physical examination findings, ultrasound scans, and blood test results. Even though PCOS has no known cure, various treatment approaches are available to assist in symptom management and enhance a woman's overall health [3]. Oligomenorrhea is characterized by women having fewer than nine menstrual periods within a year. Frequently, it is the result of PCOS, a hormonal disorder that impacts as many as 85% of women experiencing oligomenorrhea [4]. Irregular menstrual periods are a primary symptom of PCOS. Pharmaceutical interventions can be effective in reinstating regular menstrual

Received: July 2024; Revised: February 2025; Accepted: March 2025
* Corresponding Author: Khawar Ali Shahzad <khawar7bar@yahoo.com>

cycles in women with PCOS, even if their intention is not to conceive [5]. Teenagers with irregular periods are frequently prescribed birth control pills. Nevertheless, in cases where they cannot use birth control pills or encounter side effects, alternative medications may become necessary [6].

Obesity is a health condition characterized by an excessive accumulation of body fat, typically assessed through the calculation of body mass index (BMI), which takes into account a person's weight and height. An individual with a BMI of 30 or greater is classified as obese [7]. There is a strong association between obesity and irregular or absent menstrual periods in women diagnosed with PCOS. In fact, obesity stands out as one of the most prevalent symptoms of PCOS [8]. Researchers are continuing their efforts to precisely understand the mechanisms through which obesity contributes to irregular periods in women with PCOS. However, their current hypothesis suggests that obesity might elevate insulin levels, potentially disrupting the process of ovulation [9, 10]. The diagnosis of PCOS is made based on a combination of clinical features, ultrasound findings, and blood test results [11]. There is no single universally accepted set of criteria for diagnosing PCOS. However, diagnosis typically requires the presence of at least two of the following three features: clinical features, ultrasonography, and blood tests. The most common clinical features of PCOS are Irregular menstrual cycles, Excess hair growth (hirsutism), Acne, Weight gain and Infertility [12].The ultrasound criteria for PCOS vary from study to study. However, the most commonly used criteria are the presence of 12 or more follicles in each ovary, increased ovarian volume (>10 mL) and increased ovarian area (>5.5 cm2) [13].Blood tests can be used to measure hormone levels and rule out other conditions that can mimic PCOS. The most commonly tested hormones are Luteinizing hormone (LH), Follicle-stimulating hormone (FSH), Testosterone and Sex hormone-binding globulin (SHBG) [14].

PCOS is a prevalent endocrine disorder, affecting an estimated 10-15% of women worldwide. In South Asia, including Pakistan, the prevalence is notably high, with estimates ranging from 20-30%. PCOS presents with a spectrum of symptoms, including irregular menstrual cycles, excessive hair growth (hirsutism), acne, infertility, and metabolic disturbances such as insulin resistance and obesity. The exact etiology remains unclear, but genetic, hormonal, and lifestyle factors play crucial roles.

The diagnosis of PCOS lacks a universally accepted criterion, although the Rotterdam Criteria (requiring at least two of the three criteria: hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology) is widely used. This study aims to examine the clinical, biochemical, and ultrasonographic features of PCOS and provide insights into effective diagnostic and management strategies. Additionally, the frequency of PCOS in the Bahawalpur region has been incorporated based on available data. The ovarian morphology of patients was observed after the initial physical examination of the patients through pelvic or transvaginal ultrasound.

2. MATERIALS AND METHODS

The study was conducted in Gynecology outdoor patient department (OPD) of Bahawal Victoria Hospital (BVH) in Bahawalpur (BWP) which is located in Punjab province of Pakistan. Clinical, hormonal and U/S features that were consecutively recorded from patients referred to outdoor patient department. These examinations were performed in the early follicular phase, between Day 2 and 5 of the menstrual cycle. The parameters such as family history, pre-menstrual detail, and physical examine were recorded according to the survey report. Diagnosis of PCOS is shown in Figure 1.

2.1. Clinical Evaluation

First, a questionnaire-based interview about premenstrual details, obstetric histories, the severity of PCOS clinical symptoms, drug use history, family history of diabetes, oligomenorrhea, amenorrhea, length of the marriage and other associated diseases were conducted as part of the clinical evaluation. Second, a physical examination was performed to check the BMI, waist-to-hip ratio (WHR), blood pressure (BP), hirsutism and acne distribution. According to recommendations, trained medical professionals examined unmarried women via trans-abdominal ultrasound and married women via transvaginal ultrasound.

2.2. Biochemical Evaluation

The biochemical evaluation involved two blood

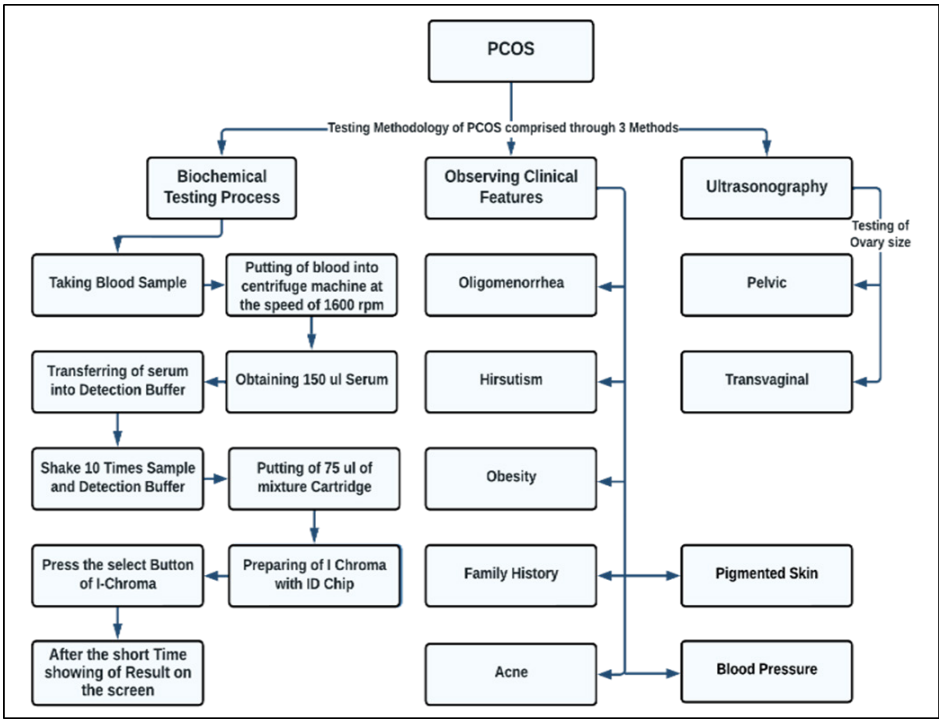

Fig. 1. Diagnosis of PCOS by Clinical Features, Biochemical Tests and Ultrasonography.

tests which were LH and FSH blood tests [15]. LH and FSH are two hormones that play a role in the menstrual cycle. LH levels are typically elevated in women with PCOS, while FSH levels are typically low.

2.3. Ultrasonography

Transvaginal Ultrasonography of ovaries was performed on five patients using a 5-9 MHz transvaginal transducer. At least one ovary with 12 follicles measuring 2 to 9 mm in size or greater than 10 mL in volume was shown on the image of the computer screen thus PCOS diagnosis was confirmed. The simplified formula for a prolate ellipsoid was used to calculate ovarian volume (OVol). OVol, follicle number (OFN) and mean follicle diameter for both ovaries were calculated and summarized. The greatest and smallest follicles' maximum sizes were measured and recorded in millimeters. Two unmarried women had her ovaries examined via transabdominal ultrasound (in this case, only OVol was assessed, without OFN).

2.4. Statistical Analysis

Descriptive statistics were utilized to depict the characteristics of PCOS in the female subjects. Frequencies, means, standard deviations were applied to investigate the relationships between BMI, LH, FSH, and LH/FSH with oligomenorrhea, acne, hirsutism, and polycystic ovaries. Data were analyzed using SPSS 25.0. Descriptive statistics were presented as means and standard deviations. Multiple logistic regression was applied to determine significant associations, adjusting for confounders such as age, BMI, and hormonal levels. Justification for using multiple logistic regression has been added. A p-value < 0.05 was considered statistically significant. Multiple logistic regression was employed to scrutinize the associations between the variables under study, with odds ratios (ORs) and their respective 95% confidence intervals (CIs) being presented. All independent variables meeting the stipulated criteria were integrated into the multiple logistic regressions. Adjustments were made for age, BMI, LH, FSH, and LH/FSH as independent variables. Statistical significance was established at a P value below 0.05.

3. RESULTS

3.1. Descriptive Analysis of Clinical and Biochemical Features in Women with PCOS

In present study, data of 54 patients fulfilled the criteria for PCOS diagnosis. All patients had physical examined and referred to their

Ultrasonography and biochemical tests. Descriptive statistics were presented for 54 polycystic ovary syndrome (PCOS) patients. Mean and standard deviation (SD) were provided for various variables. For instance, patients' marital status had a mean of 0.33, indicating around 33% were married. The average age was 27.30 ± 8.28 years, with a range of 19.02 to 35.58 years. Mean BMI was 29.04 ± 5.16, suggesting most patients were overweight or obese. Other variables like oligomenorrhea had a mean of 0.91 (91% prevalence), and hirsutism had a mean of 0.83 (83% prevalence), see Table 1.

3.2. Frequencies and Percentage of Respondents Physical Examination

The study provided distribution details for various characteristics within a group of 54 individuals. Among the individuals surveyed, 66.7% were unmarried, accounting for 36 individuals, while 33.3% were married, representing 18 individuals. Oligomenorrhea was observed in 90.7% of participants (49 individuals), whereas 9.3% (5 individuals) did not experience this condition. Hirsutism was present in 83.3% of individuals (45 cases), while 16.7% (9 individuals) did not exhibit this condition. Amenorrhea affected 40.7% of participants (22 individuals), whereas 59.3% (32 individuals) did not have this condition. Additionally, a family history of the specified condition was reported in 61.1% of cases (33 individuals), while 38.9% (21 individuals) had no family history. Acne was present in 74.1% of cases (40 individuals), whereas 25.9% (14 individuals) did not have acne. Pigmentation issues were observed in 66.7% of cases (36 individuals), while 33.3% (18 individuals) had no pigmentation issues. PCOS was reported in 51.9% of cases (28 individuals), whereas 48.1% (26 individuals) did not have PCOS.

Regarding other health issues, 57.4% of individuals (31 cases) reported no additional health concerns. Various health issues were reported, including high blood pressure, abdominal pain, infections, and other conditions. These percentages represented the breakdown of characteristics within the surveyed group of 54 individuals are given in Table 2.

Table 1. Descriptive analysis of observed women.

Clinical and biochemical features	M ± SD
Marital Status	0.33 ± 0.476
Age	27.30 ± 8.28
BMI	29.04 ± 5.16
Oligomenorrhea	0.91 ± 0.29
Hirsutism	0.83 ± 0.38
LH mlU/ml	8.11 ± 15.07
FSH mlU/ml	5.10 ± 11.22
Other issues	1.78 ± 3.14
Amenorrhea	0.41 ± 0.50
Family History	0.61 ± 0.49
Acne	0.74 ± 0.44
Headache	0.78 ± 0.42
Pigmentation	0.67 ± 0.48
PCOS	0.52 ± 0.50

3.3. Correlation of PCOS with Biochemical and Clinical Features

A t-test was conducted on 54 patients with PCOS to compare their biochemical and clinical features. The t-test results, including t-statistic, degrees of freedom, mean difference, and 95% confidence intervals, were examined. Statistically significant mean differences were observed in the following features:

Age: Patients with PCOS had a significantly higher mean age compared to those without PCOS. The mean difference was 27.286 years (95% CI: 25.03 to 29.55). BMI: Patients with PCOS had a significantly higher mean BMI than those without PCOS. The mean difference was 29.0295 (95% CI: 27.6210 to 30.4381). Oligomenorrhea: Patients with PCOS had a significantly lower mean number of menstrual cycles per year compared to those without PCOS. The mean difference was 0.897 (95% CI: 0.82 to 0.98). Normal ranges for LH and FSH in women of reproductive age are 2-10 mIU/mL and 3-20 mIU/mL, respectively. In PCOS patients, LH levels are typically elevated (> 10 mIU/mL), while FSH levels remain within the normal range.

Table 2. Frequencies and percentages of clinical features.

Clinical features	Frequency	Percent
Marital status		
Unmarried	36	66.7
Married	18	33.3
Total	54	100.0
Oligomenorrhea		
No	5	9.3
Yes	49	90.7
Total	54	100.0
Hirsutism		
No	9	16.7
Yes	45	83.3
Total	54	100.0
Amenorrhea		
No	32	59.3
Yes	22	40.7
Total	54	100.0
Family history		
No	21	38.9
Yes	33	61.1
Total	54	100.0
Acne		
No	14	25.9
Yes	40	74.1
Total	54	100.0
Pigmentation		
No	18	33.3
Yes	36	66.7
Total	54	100.0
PCOS		
No	26	48.1
Yes	28	51.9
Total	54	100.0
Other health issues		
No	31	57.4
BP High	8	14.8
Lower abdomen pain	4	7.4
Secondary Amenorrhea	1	1.9
Uterus size enlarged	1	1.9
Vaginal discharge	2	3.7
Heavy Bleeding (Hb=7)	1	1.9
UTI	1	1.9
Intestinal infection	1	1.9
Renal infection	1	1.9
Diabetes	1	1.9
Hypotheroidism	1	1.9
Vaginal infection	1	1.9
Total	54	100.0

LH mlU/ml: Patients with PCOS had a significantly higher mean LH level than those without PCOS. The mean difference was 8.096 (95% CI: 3.983 to 12.210). FSH mlU/ml: Patients with PCOS had a significantly higher mean FSH level than those without PCOS. The mean difference was 5.090 (95% CI: 2.026 to 8.153). Hirsutism: Patients with PCOS had a significantly higher mean hirsutism score than those without PCOS. The mean difference was 0.823 (95% CI: 0.72 to 0.93), see Table 3.

The study focused on women aged 18-40 years diagnosed with Polycystic Ovary Syndrome (PCOS) based on the Rotterdam Criteria, with exclusion criteria applied to patients with other endocrine disorders, chronic illnesses, or recent hormonal therapy. Clinical assessments included detailed history-taking and physical examinations, covering BMI, blood pressure, hirsutism assessment using the Ferriman-Gallwey Score, acne severity, and menstrual history. Biochemical evaluations were conducted on fasting blood samples, analyzing Luteinizing Hormone (LH), Follicle-Stimulating Hormone (FSH) levels to assess insulin resistance. Ultrasonographic assessments were performed using transvaginal ultrasound for married women and transabdominal ultrasound for unmarried women to evaluate ovarian morphology. Polycystic ovaries were identified by an ovarian volume greater than 10 mL, the presence of 12 or more follicles measuring 2-9 mm in each ovary, and a detailed ultrasound protocol was followed to ensure accuracy.

3.4. Pearson Correlation Coefficient between Biochemical and Clinical Features

A Pearson correlation coefficient was used to analyze the relationships between various biochemical and clinical features in 54 patients with polycystic ovary syndrome (PCOS). Notable correlations included: A positive correlation between age and BMI suggested that older patients tended to have higher BMIs, possibly due to increased likelihood of being overweight or obese. A negative correlation between marital status and amenorrhea, indicating unmarried patients were more prone to irregular menstrual cycles. A positive correlation between hirsutism and amenorrhea, suggesting patients with more hirsutism also experienced amenorrhea due to shared androgen excess symptoms. A positive

Table 3. T-Test of biochemical and clinical features.

Biochemical and clinical features	t	df	Mean difference	Confidence interval	
				Lower	Upper
Age	24.204	53	27.286	25.03	29.55
BMI	41.337	53	29.0295	27.6210	30.4381
Oligomenorrhea	22.539	53	0.897	0.82	0.98
LH mlU/ml	3.947	53	8.096	3.983	12.210
FSH mlU/ml	3.332	53	5.090	2.026	8.153
Hirsutism	16.083	53	0.823	0.72	0.93
Marital Status	4.993	53	0.323	0.19	0.45
Amenorrhea	5.888	53	0.397	0.26	0.53
Family history	8.977	53	0.601	0.47	0.74
Acne	12.140	53	0.731	0.61	0.85
Headache	13.445	53	0.768	0.65	0.88
Pigmentation	10.141	53	0.657	0.53	0.79
PCOS	7.409	53	0.509	0.37	0.65

* 95% Confidence interval of the difference.

correlation between family history and PCOS suggested a genetic link between PCOS and family history. Positive correlation between acne and PCOS, as acne and androgen excess symptoms were related, and both can indicate PCOS (Table 4).

3.5. Presentation of ultrasonography

PCOS was diagnosed through pelvic and trans-vaginal ultrasound. Seven patients had greater ovarian volume (> 10ml) in the right ovary, left ovary, or both ovaries mentioned as yes or No. Many follicles were counted during the ultrasonography in both ovaries, or one had 10-12 or > 12 number of follicles. 4 patients had greater than 12 follicles and remaining had less than 12 (Table 5). Out of 7 patients, 5 had right ovary volume > 10ml, 3 had left ovary volume > 10ml and 1 patient had normal ovary size.

3.6. Patient Characteristics

Among the 54 PCOS patients, 33.3% were married, and 66.7% were unmarried. The mean BMI was 29.04 ± 5.16, indicating a high prevalence of overweight and obesity. Oligomenorrhea (90.7%) and hirsutism (83.3%) were the most common clinical features, followed by acne (74.1%) and amenorrhea (40.7%). A strong familial predisposition was noted, with 61.1% reporting a positive family history of PCOS.

3.6.1. Biochemical and ultrasonographic findings

The LH/FSH ratio was elevated in 70.6% of cases (mean LH = 8.11 IU/mL, mean FSH = 5.10 IU/mL). Hyperandrogenism was confirmed in 68.5% of patients via elevated testosterone levels. In ultrasound findings, 75% of patients had polycystic ovarian morphology, with an average ovarian volume exceeding 10mL. Grouping of patients and control details have been clarified.

3.6.2. Correlations and risk factors

Higher BMI was found to be correlated with increased fasting insulin and glucose levels ($p < 0.01$), supporting the link between obesity and

Table 4. Correlation between clinical and biochemical features.

		BMI	LH mlU/ml	FSH mlU/ml
Age	Pearson Correlation	0.213	0.067	0.367**
	Sig. (2-tailed)	0.122	0.632	0.006
Marital status	Pearson Correlation	-0.213	-0.154	-0.281*
	Sig. (2-tailed)	0.123	0.266	0.040
Oligomenorrhea	Pearson Correlation	-0.073	-0.085	0.043
	Sig. (2-tailed)	0.599	0.539	0.757
Hirsutism	Pearson Correlation	-0.027	0.004	0.010
	Sig. (2-tailed)	0.846	0.978	0.943
Amenorrhea	Pearson Correlation	-0.147	-0.450**	-0.380**
	Sig. (2-tailed)	0.287	0.001	0.005
Family history	Pearson Correlation	0.039	0.329*	.297*
	Sig. (2-tailed)	0.780	0.015	0.029
Acne	Pearson Correlation	-0.086	-0.087	-0.133
	Sig. (2-tailed)	0.535	0.532	0.336
Pigmentation	Pearson Correlation	0.153	0.004	-0.250
	Sig. (2-tailed)	0.270	0.974	0.069
PCOS	Pearson Correlation	0.156	0.345*	0.296*
	Sig. (2-tailed)	0.259	0.011	0.030
Headache	Pearson Correlation	0.041	-0.140	-0.181
	Sig. (2-tailed)	0.767	0.313	0.189
Other issues	Pearson Correlation	0.029	-0.023	-0.009
	Sig. (2-tailed)	0.835	0.866	0.946

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 5. Polycystic ovaries on ultrasonography.

No. of patients (n = 7)	Right ovary > 10ml	Left ovary > 10ml	Normal ovary	No. of follicles
1	yes	No	No	>14
2	yes	Yes	No	Multiple
3	No	No	Yes	8-10
4	yes	No	No	14-15
5	yes	No	No	Multiple
6	No	Yes	No	>12
7	yes	Yes	No	14-16

metabolic disturbances in PCOS. Unmarried women exhibited higher PCOS prevalence, potentially due to delayed diagnosis and cultural factors.

4. DISCUSSION

Irregular menstrual cycles and a range of symptoms, along with significant changes in the LH/FSH ratio, are attributed to polycystic ovary syndrome (PCOS) [16]. Managing PCOS involves targeting endocrine and biochemical factors, which encompasses addressing concerns such as hyperinsulinemia, insulin resistance, and the LH/FSH ratio, as supported by the findings in this study. In our findings, 68.51% of patients were obese, which contrasts with the 50.4% [17] in the study. Notably,

the women in our study had a comparatively younger mean age. Disparities in the levels of LH and FSH production, with a higher LH/FSH ratio emerging as the predominant clinical feature among women diagnosed with PCOS [18]. A heightened LH/FSH ratio was observed in 70.58% of women diagnosed with PCOS. Consequently, the authors propose that the LH/FSH ratio represents one of the distinctive features of women with PCOS [19]. However, no correlation was detected between LH and FSH levels in conjunction with the LH/FSH ratio in our initial observations [20]. However, our study documented a substantial link between hormone levels and the LH/FSH ratio. This connection may be attributed to the LH levels, potentially explaining the positive association with LH and the negative association with FSH.

A substantial portion of participants as having polycystic ovary syndrome (PCOS). Among these individuals, 31.4% displayed acne, and 78.9% exhibited hirsutism [20]. These prevalence rates exceeded those documented in earlier research. Furthermore, individuals with PCOS who were undergoing treatment exhibited a higher incidence of irregular menstrual cycles, acne, and hirsutism. The authors posit that a study involving a larger sample size and extended longitudinal monitoring would yield more conclusive findings. Within our study, individuals diagnosed with PCOS underwent treatment involving metformin, resulting in reduced glucose levels and enhanced insulin sensitivity. Additionally, letrozole and clomiphene were employed to induce ovulation in infertile women. While health enhancements were observed throughout the treatment, a disparity in the prevalence of acne and hirsutism was discernible between those who received treatment and those who did not. Treatment of patients with metformin and inositol leads to decreased glucose levels and increased insulin sensitivity [21].

There were 93% of daughters whose mothers had PCOS also experienced PCOS themselves a study from [22]. Additionally, PCOS and about 50% of the sisters of women affected by PCOS exhibited hyperandrogenemia [23]. Through the application of linear regression, it was determined that among patients receiving PCOS treatment, the consistency of menstrual cycles was notably influenced by the LH/FSH ratio. Women with regular menstrual cycles had a lower LH/FSH ratio compared to those with irregular cycles. In our current investigation, it was identified a prevalence rate of 61% among females with PCOS who had both mothers and sisters with the condition.

5. CONCLUSIONS

PCOS is a multifaceted condition requiring early diagnosis and tailored treatment. This study highlights the importance of incorporating clinical, biochemical, and ultrasonographic markers for an accurate diagnosis. Managing obesity and insulin resistance should be prioritized to improve patient outcomes. Further research with larger sample sizes is needed to validate these findings.

6. ETHICAL STATEMENT

This study was approved by the Ethical Review Committee of The Islamia University of Bahawalpur, Pakistan. Written informed consent was obtained from all participants before their inclusion in the study.

7. ACKNOWLEDGEMENTS

The authors express their gratitude to the Gynecology Outdoor Patient Department (OPD) at Bahawal Victoria Hospital and the Khan Hospital laboratory in Bahawalpur, Pakistan, for granting them access to sample collection and processing facilities.

8. CONFLICT OF INTEREST

The authors declare no conflict of interest.

9. REFERENCES

1. M. Zehravi, M. Maqbool, and I. Ara. Polycystic ovary syndrome and infertility: an update. *International Journal of Adolescent Medicine And Health* 34(2): 1-9 (2021).
2. N. Gleicher, S. Darmon, P. Patrizio, and D.H. Barad. Reconsidering the Polycystic Ovary Syndrome (PCOS). *Biomedicines* 10(7): 1505 (2022).
3. F. Orio and S. Palomba. New guidelines for the diagnosis and treatment of PCOS. *Nature Reviews Endocrinology* 10(3): 130-132 (2014).
4. R.S. Legro. American College of Obstetricians and Gynecologists' (ACOG) Practice Bulletin No. 194: Polycystic Ovary Syndrome. *Obstetrics and Gynecology* 131(6): e157-e171 (2018).
5. M. Shannon and Y. Wang. Polycystic ovary

syndrome: a common but often unrecognized condition. *Journal of Midwifery & Women's Health* 57(3): 221-230 (2012).

6. E. Reiser, J. Lanbach, B. Böttcher, and B. Toth. Non-Hormonal Treatment Options for Regulation of Menstrual Cycle in Adolescents with PCOS. *Journal of Clinical Medicine* 12(1): 67 (2022).
7. L.P. Mayoral, G.M. Andrade, E.P. Mayoral, T.H. Huerta, S.P. Canseco, F.J. Rodal Canales, H.A. Cabrera-Fuentes, M.M. Cruz, A.D. Pérez Santiago, J.J. Alpuche, E. Zenteno, H.M. Ruíz, R.M. Cruz, J.H. Jeronimo, and E. Perez-Campos. Obesity subtypes, related biomarkers & heterogeneity. *Indian Journal of Medical Research* 151(1): 11-21 (2020).
8. R. Azziz, K.S. Woods, R. Reyna, T.J. Key, E.S. Knochenhauer, and B.O. Yildiz. The prevalence and features of the polycystic ovary syndrome in an unselected population. *The Journal of Clinical Endocrinology & Metabolism* 89(6): 2745-2749 (2004).
9. A. Gambineri, C. Pelusi, V. Vicennati, U. Pagotto, and R. Pasquali. Obesity and the polycystic ovary syndrome. *International Journal of Obesity and Related Metabolic Disorders* 26(7): 883-896 (2002).
10. R. Pasquali, A. Gambineri, and U. Pagotto. The impact of obesity on reproduction in women with polycystic ovary syndrome. *An International Journal of Obstetrics and Gynaecology* 113(10): 1148-1159 (2006).
11. M.T. Sheehan. Polycystic ovarian syndrome: diagnosis and management. *Clinical Medicine & Research* 2(1): 13-27 (2004).
12. B. Alsadi. Clinical Features of PCOS. In: Polycystic Ovarian Syndrome. Z. Wang (Ed.). *IntechOpen* pp. 1-14 (2019).
13. D. Dewailly, H. Gronier, E. Poncelet, G. Robin, M. Leroy, P. Pigny, A. Duhamel, and S. Catteau-Jonard. Diagnosis of polycystic ovary syndrome (PCOS): revisiting the threshold values of follicle count on ultrasound and of the serum AMH level for the definition of the polycystic ovary (PCO). *Human Reproduction* 26(11): 3123-3129 (2011).
14. L. Mu, J. Pan, L. Yang, Q. Chen, Y. Chen, Y. Teng, P. Wang, R. Tang, X. Huang, and X. Chen. Association between the prevalence of hyperuricemia and reproductive hormones in polycystic ovary syndrome. *Reproductive Biology and Endocrinology* 16(1): 104 (2018).
15. S. Bains, C. Anyaeche, A. Wyatt, O. Coker, and J. Bolodeoku. Evaluation of Point of Care Test (POCT), i-CHROMA™ Serum C-Reactive Protein (CRP) Assay and Microalbumin Urine (MAU) Methods. *Annals of Clinical Laboratory Research* 5(3): 192 (2017).
16. M. Mitrašinović-Brulić, M. Buljan, and D. Suljević. Association of LH/FSH ratio with menstrual cycle regularity and clinical features of patients with polycystic ovary syndrome. *Middle East Fertility Society Journal* 26(1): 40 (2021).
17. B. Wiweko, I. Indra, C. Susanto, M. Natadisastra, and A. Hestiantoro. The correlation between serum AMH and HOMA-IR among PCOS phenotypes. *BMC Research Notes* 11(1): 114 (2018).
18. S. Catteau-Jonard and D. Dewailly. Pathophysiology of polycystic ovary syndrome: the role of hyperandrogenism. *Polycystic Ovary Syndrome* 40: 22-27 (2013).
19. C.K. Nath, B. Barman, A. Das, P. Rajkhowa, P. Baruah, M. Baruah, and A. Baruah. Prolactin and thyroid stimulating hormone affecting the pattern of LH/FSH secretion in patients with polycystic ovary syndrome: A hospital-based study from North East India. *Journal of Family Medicine and Primary Care* 8(1): 256-260 (2019).
20. S. Esmaeilzadeh, M.G. Andarieh, R. Ghadimi, and M.A. Delavar. Body mass index and gonadotropin hormones (LH & FSH) associate with clinical symptoms among women with polycystic ovary syndrome. *Global Journal of Health Science* 7(2): 101-106 (2015).
21. F. Fruzzetti, D. Perini, M. Russo, F. Bucci, and A. Gadducci. Comparison of two insulin sensitizers, metformin and myo-inositol, in women with polycystic ovary syndrome (PCOS). *Gynecological Endocrinology* 33(1): 39-42 (2017).
22. C. Battaglia, G. Regnani, F. Mancini, L. Iughetti, C. Flamigni, and S. Venturoli. Polycystic ovaries in childhood: a common finding in daughters of PCOS patients. A pilot study. *Human Reproduction* 17(3): 771-776 (2002).
23. A. Dunaif and A. Thomas. Current concepts in the polycystic ovary syndrome. *Annual Review of Medicine* 52(1): 401-419 (2001).