

COMPARISON OF HORMONAL PROFILES AND CLINICAL MANIFESTATIONS BETWEEN OBESE AND NON-OBESE WOMEN WITH POLYCYSTIC OVARY SYNDROME: A COMPARATIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: To find the association of hormonal and clinical abnormalities among obese and non-obese women and to compare hormonal and clinical abnormalities between obese and non-obese women attending a tertiary care hospital.

Materials and Methods: After ethical approval, we conducted a descriptive cross-sectional study at the Tertiary Care Hospital in District Peshawar, Pakistan, from April 2024 to March 2025. A total of 200 samples were selected using convenience non-probability sampling. Data were collected using a validated structured questionnaire and analyzed using SPSS version 24. The chi-square test was used to assess statistical association.

Results: In our study, 58.50% were under 30 years old; 38.50% were obese; 23.50% had high socioeconomic status; 39.50% were illiterate; 68% were urban residents; and 37.5% were physically inactive. Among obese PCOS women, 41.56% had prolonged periods (> 7 days); 59.74% had oligomenorrhea (< 3 days); and 77.92% had amenorrhea. Furthermore, among obese PCOS women, 71.43% had acne; 84.42% had hair loss; 50.65% had diabetes mellitus; 72.73% had infertility; 71.43% had disturbed sleep; and 58.44% had anxiety. Among non-obese women, 32.52%, 44.72%, 56.91%, 47.97%, and 38.21% had diabetes mellitus, infertility, disturbed sleep, fatigue, and anxiety, respectively (P value < 0.05).

Conclusion: Menstrual irregularities, including prolonged and partial absence of periods, were significantly associated. Moreover, acne, hair loss, diabetes mellitus, fertility disorders, disturbed sleep, and mood disorders/anxiety also showed significant associations among obese and non-obese PCOS women; thus, early detection and awareness of PCOS were needed.

Keywords: Obese, Diabetes Mellitus, Menstrual Irregularities, Acne, Hair Loss, Hirsutism, Infertility

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INTRODUCTION

Globally, the prevalence of polycystic ovary syndrome is one of the most common endocrine disorders, characterized by oligomenorrhea and androgen excess, among women of reproductive age groups and has a 10-18% prevalence.¹⁻⁴ PCOS women have abnormally long and/or irregular cycles.⁵ PCOS develops due to an intricate interaction of dietary transition, genetic, and environmental determinants.^{6,7} Additionally, anovulation is the prime feature of these women and ultimately results in infertility.⁸ Furthermore, 70% of women with PCOS ultimately

become infertile. Furthermore, women with PCOS are nearly 50% obese and are strongly associated with diabetes due to hyperinsulinemia, as well as with pregnancy complications such as miscarriages, pre-eclampsia, and low birth weight babies.⁹

Currently, approximately 3% of women are affected by PCOS globally; however, its comprehensive epidemiology remains unclear, and it causes many morbid conditions. PCOS affects nearly every important system and primarily involves the endocrine and metabolic systems in females, resulting in a wide range of manifestations and complications that can persist for up to two years after menarche, including ovulatory dysfunction, hirsutism, irregular menstrual cycles, acne, hair loss, mental health impacts, reduced health-related quality of life, and sexual dysfunction. Furthermore, these impacts vary across women in pattern and intensity. Acne severity and prevalence are strongly related to age, and adolescent women have higher severity. The cardinal feature of PCOS is that imaging shows many follicles in the ovaries; it also in-

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involves metabolic derangements such as hyperinsulinemia and dyslipidemia.

According to WHO statistics, worldwide PCOS affects 110 million women during their reproductive years and has a 3% to 25% prevalence in different geographical settings.^{10, 11} Moreover, increased levels of androgens cause excess body hair growth, resulting in hirsutism, and can lead to alopecia and acne problems in PCOS.¹³ Many international studies revealed that PCOS significantly affects women's hirsutism, hair loss, mental status, sleep disorders, infertility, and menstrual problems.^{14, 15} Moreover, physical activity has an enormous role in improving metabolic health and affects the mood/ mental status of women with PCOS. Furthermore, Acne affects a large proportion of women with PCOS, and hirsutism, along with psychological distress and emotional distress, co-exists with 70% of women with PCOS.^{16, 17}

Pakistan, a developing country, has high rates of demographic, nutritional, and epidemiological transitions and thus a high burden of communicable and non-communicable diseases. Additionally, obesity is common among women of reproductive age, and thus women are prone to a high incidence of PCOS. Therefore, this cross-sectional study was conducted to estimate the association and compare hormonal abnormalities and clinical manifestations among obese and non-obese women with PCOS visiting Khyber Teaching Hospital, Peshawar, with the aim of estimating PCOS determinants, clinical manifestations, and complications among the reproductive age groups.

MATERIALS AND METHODS

After obtaining ethical approval from the Institutional Research and Ethical Review Board (IREB) of Khyber Medical College, Peshawar; No: 86/DME/KMC; Dated: 13-02-2024, a cross-sectional descriptive study was conducted from April 2024 to March 2025 among women visiting the Gynecology and Obstetrics OPD of Khyber Teaching Hospital, Peshawar, Pakistan. All married women $n=200$, aged 18 or older, diagnosed with PCOS, and who agreed to participate were included, and those with major psychiatric illness, pregnant women, lactating mothers, and non-permanent residents of Peshawar were excluded. We selected all PCOS patients using a convenience sampling technique. Our study used the Rotterdam diagnostic criteria for participant enrollment.¹² Using the WHO sample size calculator, we calculated a sample size of 200 based on a 95% confidence level, a 5% margin of error, and a 15% prevalence of PCOS among women of reproductive age.¹³

A modified, validated polycystic ovarian syndrome questionnaire was used to compare obese and non-obese women with PCOS. The questionnaire was validated in a pilot study of 5 obese and 5 non-obese women and was modified to address shortcomings. BMI was calculated as

weight in kg divided by height in meters squared. Women with a BMI greater than 30 kg/m² were considered obese.

Data were analyzed using SPSS version 26.0. Continuous variables were presented as means and standard deviations, whereas categorical variables were presented as frequencies and percentages. Chi-square tests and p-values were calculated to assess associations between determinants and dependent variables among obese and non-obese women with PCOS. A p-value of < 0.05 was considered significant.

RESULTS

In our study, 58.50% were under 30 years; 37% were 30-40 years; and 4.5% were over 40 years. 38.50% were obese; 34% had low socioeconomic status; 42.50% had middle status; and 23.50% had high status. Moreover, 39.50% were illiterate, and the remaining 60.50% were literate. Furthermore, 68% lived in urban areas, and 37.5% had no physical activity, as shown in Table No. 1.

Table No 1: Distribution of Sociodemographic Characteristics of Polycystic Ovarian Syndrome Patients (n=200) Visiting Tertiary Care Hospital Peshawar Pakistan

Demographics	Response	Frequency	Percentage
Age in Years	< 30 years	117	58.50
	30-40 Years	74	37.00
	> 40 years	9	4.50
Body Mass Index	Obese	77	38.50
	Non-Obese	123	61.50
	Overweight	55	27.50
	Normal	51	25.50
	Underweight	17	8.50
Socio-Economic Status/ Monthly Income (PKR)	Low (< 50K)	68	34.00
	Mid- dle(50-100K)	85	42.50
	High (> 100)	47	23.50
Literacy Status	Literate	121	60.50
	Illiterate	79	39.50
No Of Children	Nil	53	26.50
	Yes	147	73.50
	1 to 2	84	42.00
	3 to 4	44	22.00
	> 4	19	9.50
Locality	Rural	64	32.00
	Urban	136	68.00
Physical Activity	No	75	37.50
	Yes	125	62.50
	Low	84	42.00
	Moderate	28	14.00
	High	13	6.50

Table No 2: Association and Comparison of Menstrual Irregularities Among Obese and Non-Obese Polycystic Ovarian Syndrome Patients (n=200) Visiting Tertiary Care Hospital Peshawar, Pakistan

Menstrual Parameter	Category	Total (n=200)		Obese (n=77)		Non-Obese (n=123)		X2 test (p value)
		Frequency	%age	Frequency	%age	Frequency	%age	
Prolonged Periods (> 7 Days)	No	98	49.00	45	58.44	53	43.09	4.46 (0.017)
	Yes	105	52.50	32	41.56	70	56.91	
	Rarely	21	10.50	1	1.30	20	16.26	
	Sometimes	11	5.50	7	9.09	4	3.25	
	Often	63	31.50	27	35.06	36	29.27	
Scanty periods (< 3 Days)	No	91	45.50	31	40.26	60	48.78	1.38 (0.119)
	Yes	109	54.50	46	59.74	63	51.22	
	Rarely	26	13.00	3	3.90	23	18.70	
	Sometimes	56	28.00	23	29.87	33	26.83	
	Often	27	13.50	20	25.97	7	5.69	
Partial Absence of Periods (Not After 28-35 Days)	No	56	28.00	17	22.08	39	31.71	4.33 (0.0187)
	Yes	144	72.00	60	77.92	84	68.29	
	Rarely	23	11.50	16	20.78	7	5.69	
	Sometimes	51	25.50	24	31.17	27	21.95	
	Often	70	35.00	20	25.97	50	40.65	

Table No 3: Association and Comparison of Hormonal Disturbances and Clinical Manifestations among Obese and Non-Obese Polycystic Ovarian Syndrome Patients (n=200) attending a Tertiary Care Hospital in Peshawar, Pakistan

Hormonal Disturbances	Response	Total (n=200)		Obese (n=77)		Non-Obese (n=123)		X2 test (p value)
		Frequency	%age	Frequency	%age	Frequency	%age	
Acne Problems	No	78	39.00	22	28.57	56	45.53	5.72 (0.0084)
	Yes	111	55.50	55	71.43	67	54.47	
	Rare	23	11.50	8	10.39	8	6.50	
	Sometimes	37	18.50	16	20.78	27	21.95	
	Often	51	25.50	20	25.97	32	26.02	
Hair Loss	No	51	25.50	12	15.58	39	31.71	6.48 (0.0055)
	Yes	155	77.50	65	84.42	84	68.29	
	Mild	46	23.00	15	19.48	31	25.20	
	Moderate	27	13.50	8	10.39	19	15.45	
	Severe	82	41.00	48	62.34	34	27.64	
Hirsutism	No	56	28.00	19	24.68	37	30.08	0.686 (0.203)
	Yes	144	72.00	58	75.32	86	69.92	
	Mild	30	15.00	7	9.09	23	18.70	
	Moderate	76	38.00	30	38.96	46	37.40	
	Severe	38	19.00	21	27.27	17	13.82	
Diabetes Mellitus	Yes	59	29.50	39	50.65	40	32.52	6.513 (0.0054)
	No	141	70.50	38	49.35	83	67.48	
Fertility Problems	Yes	111	55.50	56	72.73	55	44.72	15.04 (0.0001)
	No	89	44.50	21	27.27	68	55.28	
Disturbed Sleep	Yes	125	62.50	55	71.43	70	56.91	4.25 (0.0195)
	No	75	37.50	22	28.57	53	43.09	
Fatigue/ Limited Activities	Yes	104	52.00	45	58.44	59	47.97	2.081 (0.0746)
	No	96	48.00	32	41.56	64	52.03	
Mood Disorders/ Anxiety	Yes	92	46.00	45	58.44	47	38.21	7.80 (0.0026)
	No	108	54.00	32	41.56	76	61.79	

In our study, among obese PCOS women, 41.56% had prolonged periods (> 7 days); 59.74% had scanty periods (< 3 days); and 77.92% had partial absence of periods. Among non-obese PCOS women, 56.91% had prolonged periods (> 7 days); 51.22% had scanty periods (< 3 days); and 68.29% had partial absence of periods, as shown in Table No. 2. Additionally, prolonged periods (4.46, 0.017) and partial absence of periods (4.33, 0.018) showed significant chi-square values and p-values. Thus, a significant association was found between menstrual irregularities, i.e., prolonged periods and partial absence of periods, and obese and non-obese PCOS women.

In our study, among obese and non-obese PCOS women, 71.43% and 54.47% had acne, respectively; 84.42% and 68.29% had hair loss, respectively; and 75.32% and 69.92% had hirsutism, respectively. Among obese women, 50.65%, 72.73%, 71.43%, 58.44%, and 58.44% had diabetes mellitus, fertility problems, disturbed sleep, fatigue, and mood disorders/anxiety, respectively. Among non-obese women, 32.52%, 44.72%, 56.91%, 47.97%, and 38.21% had diabetes mellitus, fertility problems, disturbed sleep, fatigue, and mood disorders/anxiety, respectively, as shown in Table No. 3. Furthermore, acne, hair loss, diabetes mellitus, infertility, disturbed sleep, and anxiety showed a significant association with obese and non-obese PCOS women. However, hirsutism ($p=0.203$) and fatigue ($p=0.0746$) were not significant.

DISCUSSIONS

This study was conducted to assess the association between obesity and clinical manifestations among women with PCOS, among obese and non-obese women with PCOS visiting a tertiary Care Hospital in Peshawar.

According to our results, the mean age of participant's was 27.7 ± 2 years; whereas in study of Tandogan et al., 2024; had 28.47; Mei et al., 2022; had 31.5; Rebeiro et al., 2025; had 34.78; and Mortimer et al., 2026; had 33 years;^{3,4,14,15} and thus study findings showed similar prevalence as was found in Tandogan et al., 2024. In our study, 38.5% were obese, whereas in studies by Elasm et al. (2022) and Mortimer et al. (2026), 42.4% and 62% were obese among PCOS, respectively.^{3,18} Moreover, in our study, 34% had low; 42.50% had middle; and 23.50% had high socio-economic status; whereas in studies by Mortimer et al., 2026; Erener et al., 2025; and Marasine et al. (2026), 30%; 70%; and 32.7% had low, middle, and high socio-economic status, respectively.^{1,3,11}

In Marasine et al. (2026), 80.7% were literate, whereas our study found 60.50%. Additionally, 68% reside in an urban setting, whereas Marasine et al. (2026) reported a similar finding of 68.2%; thus, our findings are consistent with previous studies.¹¹

In our study, regarding the hormonal imbalances that result in menstrual irregularities among obese and

non-obese PCOS women, the obese group revealed a higher prevalence of scanty periods (59.74%), partial absence of periods (77.92%), and a lower prevalence of prolonged periods (41.56%), as compared to non-obese participants. In international studies by Mei et al., 2022; Aslam et al., 2022; and Mortimer et al., the prevalence of menstrual irregularities among obese women with PCOS was 59.4%, 53.9%, and 36%, respectively. Thus, in our study, the prevalence of these manifestations is higher than in previous studies. Moreover, only prolonged periods and partial absence of periods showed a significant association, as indicated by chi-square test values and p-values of 4.46 and 4.33 and 0.017 and 0.0187, respectively, as found in studies by Aslam et al., 2022, and Mortimer et al., 2026.^{3,13} In our study, 55.50% had acne problems, whereas Garcia and Kenner-Bell (2026) and Pourahmad et al. reported 52.2% and 49%, respectively, among women with PCOS; thus, our study revealed consistent findings and supported previous international studies. Moreover, acne problems also revealed a significant χ^2 test value and p-value (5.72; 0.0084). In contrast to previous studies, our obesity prevalence was lower than in Almuhsen et al. (2021), which reported 75.3%.¹⁹

In our study, 84.42% of obese PCOS women had hair loss, whereas in studies by Tandogan et al. (2024) and Aslam et al. (2022), it was 44.2% and 29%, respectively. Thus, our results were consistent with previous international studies. Additionally, in our study, hirsutism among obese women was less prevalent than among non-obese PCOS women; thus, the χ^2 test was non-significant ($p = 0.686$; 0.203). Furthermore, 72% of participants had hirsutism, whereas in studies by Almuhsen et al. (2021) and Marasine et al. (2026), it was 59.6% and 41% among obese PCOS women, respectively.

In our study, 55.50% had fertility problems, whereas in studies by Mei et al. (2022), 64.23%; Erener et al. (2025), 89.2%; and Aljefri et al. (2021), 25.70% had fertility problems, respectively; thus, our findings revealed a significant association. Moreover, diabetes mellitus, disturbed sleep, and anxiety/mood disorders also showed higher prevalence and a significant association among obese compared to non-obese PCOS women. Furthermore, hormonal disturbances and biochemical abnormalities showed a significant association with obese and non-obese PCOS women, except for hirsutism (0.686; 0.203) and fatigue (2.081; 0.0746). Additionally, in the study by Garcia and Kenner-Bell (2026), 29.75% had anxiety/depression disorders among obese PCOS women, whereas our study had 58.44%; thus, our findings revealed a higher prevalence compared with the previous international study. Moreover, our results revealed a significant association (0.0026) with depression/anxiety among obese and non-obese PCOS women, as was found in the study of Bahadori et al., 2022 (0.004).

The main limitation was that it was a descriptive cross-sectional study; an analytical or prospective design would yield more valid results. The second limitation was that we sampled from a single tertiary health care facility in Peshawar; results would be more valid if the study were conducted in both public and private tertiary care hospitals. Lastly, studies with larger sample sizes and more diverse patient populations were needed to estimate the true association and highlight the PCOS problem among women of reproductive age.

CONCLUSIONS

Our study concluded that polycystic ovarian syndrome leads to clinical manifestations like hirsutism, acne, infertility, and anxiety. The clinical complications were higher in obese women as compared to non-obese women. Weight-reduction strategies can positively impact clinical manifestations.

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Rehman UU	✓	✓	✗	✗	✓	✗
Shah J	✓	✗	✓	✓	✓	✗
Khan MA	✓	✓	✗	✗	✗	✓
Shah MR	✓	✗	✓	✓	✓	✗
Ishtiaq	✓	✓	✗	✗	✗	✓
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Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

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