

# Prevalence of Depression and Anxiety among Women with Polycystic Ovary Syndrome and their Association with Hormonal and Metabolic Parameters

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## ABSTRACT

**Background:** Polycystic ovary syndrome (PCOS) remains one of the most common endocrine disorders in women of reproductive age. PCOS encompasses a variety of symptoms across multiple domains, including frank reproductive, metabolic, and psychological disturbances. Numerous studies suggest a greater occurrence of depression and anxiety in women with PCOS, which may be a result of the endocrine perturbations, insulin resistance, dysregulated body fat, and metabolic syndrome. These comorbidities affect the women's quality of life and likely hinder their overall health and well-being. Moreover, psychological comorbidities in women with PCOS affect treatment compliance and health outcomes over an extended period.

**Objectives:** To ascertain the levels of incidence of depression and anxiety in women suffering from PCOS and the relationship of these conditions with certain hormonal and metabolic variables.

**Methodology:** This cross-sectional study examined women aged 18–45 years diagnosed with PCOS and seen in a tertiary gynecology clinic. Using standard tools, depression and anxiety were measured. Participants had their anthropometric measures taken, and a blood draw was done to test for hormonal levels (total testosterone, luteinizing hormone, follicle-stimulating hormone) and for metabolic variables (fasting glucose, fasting insulin, HOMA-IR, lipid profile). The information was analyzed in SPSS, with statistical significance accepted if  $p$  was  $< 0.05$ .

**Results:** A total of 130 women with PCOS were included, with a mean age of  $26.8 \pm 5.4$  years. Depression was observed in 38.5% of participants, while anxiety was present in 42.3%. Women with depression demonstrated significantly higher body mass index and HOMA-IR values compared to those without depression ( $p=0.01$ ). Anxiety showed a significant association with elevated total testosterone levels and dyslipidemia ( $p=0.02$ ). Increasing insulin resistance and hyperandrogenism were significantly correlated with higher depression and anxiety scores.

**Conclusion:** Evidence suggests that women who have PCOS are at higher risk of having depression and anxiety. This is often linked to factors such as depression, adverse metabolic factors, and insulin resistance. Screening for mental health and psychological comorbidities as part of the metabolic and endocrine workup in women with PCOS is vital to provide complete care.

**Keywords:** PCOS; Depression; Anxiety; Insulin resistance.

## INTRODUCTION

Polycystic ovary syndrome (PCOS) continues to be a highly prevalent disorder within the female population, with a global prevalence between 6% to 20% based on the population and criteria employed. Within those who are of reproductive age, as a heterogeneous condition, it exhibits various ovulatory dysfunctions, hyperandrogenism, and polycystic ovarian morphology<sup>1</sup>. Various reproductive conditions have begun to be recognized, including menstrual disorders and infertility, as well as, more recently, acne and hirsutism. Multisystem PCOS is a disorder of various systems with a metabolic and psychological role<sup>2</sup>. PCOS has various metabolic perturbations, as they are central to its pathophysiology. A major portion of those women who have PCOS and are insulin resistant exhibit hyperinsulinemia regardless of the BMI, which is also explained by these metabolic disorders. Androgen excess is caused by ovarian stimulation and the suppression of sex hormone-binding globulin and the concomitant release of free androgens<sup>3,4</sup>. Dyslipidemia, obesity, and type 2 diabetes are concerns and are long-term cardiovascular diseases, alongside the morbidities of PCOS. Obesity and cardiovascular diseases also influence psychological well-being<sup>5</sup>. Surveys of women with PCOS have shown that they experience depression and anxiety more frequently and at higher levels than the general female population<sup>6</sup>. There has been a contribution of more than PCOS to the psychological burden of women. Surveys of women with PCOS have shown that they experience depression and anxiety more frequently and at higher levels than the general female population. In recent years, diabetes has proven to be a more recognized disorder, with a higher burden on the psychological spectrum<sup>7</sup>. The

increased vulnerability in individuals is connected to chronic symptoms and associated stress of infertility, dissatisfaction with body image, and social stigma related to features of hyperandrogenism. Biological insulin resistance, low-grade inflammation, hypothalamic-pituitary-adrenal axis dysregulation, and increased secretion of androgens<sup>8</sup>. Depression and anxiety are relevant associated comorbidities in PCOS, as they could affect activities of daily living, adherence to treatment, ability to perform lifestyle changes, and overall quality of life. Psychological distress could worsen the already existing metabolic dysregulation due to unhealthy food consumption, lack of exercise, increased level of stress, and hormonal changes, thus creating a negative cycle of intertwined comorbid mental dysfunction and metabolic dysregulation. Still, in many low-resource healthcare settings, mental health screening is often not included in the standard PCOS paradigm<sup>9</sup>. The severity of depressive and anxiety symptoms appears to correlate with some hormonal and metabolic imbalances, including increased androgens, higher body mass index, insulin resistance, and dyslipidemia. However, the contrary in some studies is often found. South Asia studies are even more limited. In Pakistan, cultural, socioeconomic, and health care access factors could also affect the recognition of psychological disorders in women. Unfortunately, PCOS is a significant public health problem in Pakistan and has been largely overlooked<sup>10</sup>. Psychological factors associated with PCOS are frequently overlooked, even though much clinical focus is placed on menstruation and reproduction. It is vital to understand the relationships between depression and anxiety and the clinical, hormonal, and metabolic abnormality phenomena to formulate comprehensive and tailored management techniques. Hence, the objective of the study was to examine the prevalence of depression and anxiety in PCOS patients and determine their

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associations with some selected hormonal and metabolic variables.

**Study Objectives:** To determine and assess the constellation of hormonal and metabolic parameters associated with depression and anxiety among women with PCOS.

## MATERIALS AND METHODS

**Study Design & Setting:** This cross-sectional analytical study was carried out Department of Psychiatry and Gynecology Bacha Khan Medical College / Mardan Medical Complex Mardan from January 2023 to June 2023

**Participants:** Using consecutive sampling, we recruited women aged 18–45 years with a diagnosis of PCOS. All participants provided informed consent before the commencement of the study and/or underwent clinical assessment, psychological evaluation, and laboratory testing.

**Sample Size Calculation:** This sample size calculation was based on a single proportion formula that calculated a 95% level of confidence, a 5% Margin of Error, and a 40% response rate of anxiety and/or depression symptomology in a population of persons with PCOS. Given anticipated nonresponse, a final sample size of 130 participants was included in the study.

**Inclusion Criteria:** Females between the ages of 18 and 45 years  
Have a confirmed diagnosis of polycystic ovarian syndrome as per the guidelines

Have the ability to take part in the study and have agreed to give their informed consent

**Exclusion Criteria:** Pregnancy or breastfeeding  
Historical psychiatric disorder before developing PCOS  
Prescriptions for antidepressants or antipsychotic medication  
A long-term medical condition that impacts the hormonal or metabolic system.

**Diagnostic and Management Strategy:** Diagnosis of PCOS stems from clinical, biochemical, and sonographic criteria. The presence of depression and anxiety was quantified and assessed through the use of psychometrically validated instruments. Participants with moderate and severe symptoms were provided counseling and referrals to the appropriate level of psychiatric care.

**Statistical Analysis:** Data analysis was performed using SPSS 24.0. For continuous variables, means and standard deviations were reported. For categorical variables, frequency and percentages were reported. For group differences, independent t-tests and chi-square tests were performed, and a p-value of <0.05 was considered statistically significant.

## RESULTS

A total of 130 women diagnosed with PCOS were included in the study. The mean age of participants was  $26.8 \pm 5.4$  years. Depression was identified in 38.5% of patients, while anxiety was present in 42.3%. Women with depression had significantly higher mean body mass index and HOMA-IR values compared to those without depressive symptoms ( $p=0.01$ ). Similarly, anxiety was significantly associated with elevated total testosterone levels and adverse lipid profiles, including higher triglycerides and lower HDL cholesterol ( $p=0.02$ ). Increasing insulin resistance and hyperandrogenism demonstrated a statistically significant correlation with higher depression and anxiety scores, indicating a strong link between metabolic dysfunction, hormonal imbalance, and psychological morbidity in women with PCOS.

**Intervention Outcome:** Depression or anxiety respondents with symptoms in the moderate to severe range were provided counseling and referrals to mental health services. Integration of endocrine, mental health, and PCOS-related health is crucial. Psychology and lifestyle changes were employed early in the process, with an emphasis on the specialization of integrating multiple aspects in the system's health.

Table 1. Baseline Demographic and Clinical Characteristics of Women with PCOS (n = 130)

Variable	Mean $\pm$ SD / n (%)
Age (years)	26.8 $\pm$ 5.4
Body Mass Index (kg/m <sup>2</sup> )	28.6 $\pm$ 4.9
Waist Circumference (cm)	89.3 $\pm$ 8.7
Married	72 (55.4%)
Unmarried	58 (44.6%)
Oligo/Amenorrhea	96 (73.8%)
Clinical Hyperandrogenism	82 (63.1%)

Table 1 summarizes baseline demographic and clinical characteristics of women diagnosed with polycystic ovary syndrome. Continuous variables are presented as mean  $\pm$  standard deviation, while categorical variables are expressed as frequencies and percentages.

Table 2. Prevalence of Depression and Anxiety Among Women with PCOS

Psychological Condition	n (%)
Depression Present	50 (38.5%)
No Depression	80 (61.5%)
Anxiety Present	55 (42.3%)
No Anxiety	75 (57.7%)

Table 2 shows the prevalence of depression and anxiety among women with PCOS, assessed using validated psychological screening instruments. Depression and anxiety were categorized based on established cut-off scores.

Table 3. Comparison of Hormonal and Metabolic Parameters by Depression Status

Parameter	Depression (n=50) Mean $\pm$ SD	No Depression (n=80) Mean $\pm$ SD	p-value
BMI (kg/m <sup>2</sup> )	30.1 $\pm$ 4.6	27.5 $\pm$ 4.8	0.01
Fasting Insulin ( $\mu$ U/mL)	19.4 $\pm$ 5.2	15.8 $\pm$ 4.7	0.01
HOMA-IR	4.3 $\pm$ 1.2	3.2 $\pm$ 1.0	0.01
Total Testosterone (ng/dL)	68.7 $\pm$ 18.9	60.2 $\pm$ 16.4	0.04

Table 3 compares key hormonal and metabolic parameters between women with and without depression. Independent t-tests were used for comparisons. A p-value <0.05 was considered statistically significant.

Table 4. Association of Anxiety with Hormonal and Metabolic Parameters

Parameter	Anxiety (n=55) Mean $\pm$ SD	No Anxiety (n=75) Mean $\pm$ SD	p-value
Total Testosterone (ng/dL)	71.5 $\pm$ 19.3	58.6 $\pm$ 15.7	0.02
Triglycerides (mg/dL)	168.2 $\pm$ 34.6	142.7 $\pm$ 30.1	0.02
HDL Cholesterol (mg/dL)	38.1 $\pm$ 6.4	44.3 $\pm$ 7.1	0.01
HOMA-IR	4.1 $\pm$ 1.1	3.3 $\pm$ 1.0	0.03

Table 4 illustrates the association between anxiety and selected hormonal and metabolic parameters among women with PCOS. Elevated androgen levels, insulin resistance, and dyslipidemia were significantly associated with anxiety symptoms.

## DISCUSSION

This study corroborates what previous studies have documented - namely, the overwhelming majority of women suffering from polycystic ovary syndrome also suffer from depression and/or anxiety, 38.5% and 42.3% respectively, highlighting the exceptional psychological cost of this endocrine condition<sup>11</sup>. These results support the understanding of polycystic ovary syndrome as something beyond a reproductive and/or metabolic condition to a syndrome that is a biopsychosocial syndrome that needs to be managed as such. Depression and anxiety are mental health disorders. Vulnerability is elevated because there is an increased

incidence of polycystic ovary syndrome<sup>12</sup>. Recent studies have also reported similar findings. Recent studies have also reported similar findings. In a recent meta-analysis, the combined prevalence of PCOS-related depression was close to 40% and anxiety was 40 - 45%, similar to what this study has documented<sup>13</sup>. Studies conducted in the Middle East and Asia have also reported a 30 - 50% prevalence of depression within these populations, suggesting that there may be geography and culture-related differences in the perception of alleviating the symptoms related to depression<sup>14</sup>. These findings are consistent with the considerable comorbidity of psychological and psychiatric disorders of ovarian polycystic syndrome (PCOS). These are the major findings of the study and what is relevant to the study hypothesis. Another major finding was the considerable relationship between depression and increased HOMA-IR with an increased BMI within that collective group of participants<sup>15</sup>. The impact of metabolic dysfunction plays an important role in the development of mood disorders in individuals with PCOS, as shown in this study. A recent study has shown that insulin resistance and hyperinsulinemia may affect certain neurotransmitter functions that control the central nervous system and may cause depressive symptoms<sup>16,17</sup>. In addition, the high prevalence of obesity, which is an independent risk factor for depression, may further amplify the psychological impact of PCOS. In this cohort, anxiety was significantly correlated with high total testosterone and dyslipidemia<sup>18</sup>. These results align with some of the most recent studies that have postulated that hyperandrogenism may be associated with anxiety-related disorders<sup>19</sup>. Androgens could contribute to the regulation of certain mood disorders in the central nervous system and may worsen the hyperandrogenism physical symptoms like hirsutism and acne, which lower self-esteem and social functioning. Increased anxiety and depression that resulted in the most recent study on cardio metabolic disorders have been associated with dyslipidemia, specifically with high triglycerides and low HDL cholesterol, possibly due to inflammatory and vascular issues<sup>20</sup>. There is a bidirectional relationship between psychological distress and PCOS. Depression and anxiety may worsen metabolic parameters by lowering the motivation for lifestyle changes, increasing emotional eating, poor sleep, and exacerbating insulin resistance and weight gain<sup>21</sup>. On the other hand, the metabolic and hormonal changes involved in PCOS might trigger and/or worsen psychological issues. Recent studies show that psychological distress in people with PCOS that is not addressed tends to correlate with worse long-term metabolic regulation and lower quality of life<sup>22</sup>. Mental distress associations in PCOS continue to be overlooked, and screening remains absent from overall PCOS management, especially in low- and middle-income countries. The investigation emphasizes the need to apply established screening criteria in gynecology and endocrinology. The prompt recognition of depression and/or anxiety might enable timely psychological assistance, and the positive effects of such assistance on lifestyle and pharmacological therapy compliance in PCOS have been documented<sup>23</sup>. This study contributes to the specific evaluation of the co-occurring metabolic and hormonal correlates of depression and anxiety while also providing detailed evidence of depression and anxiety. This leads to supporting the multidisciplinary model of PCOS management and the psychological, metabolic, and endocrine synthesis.

**Limitations:** This study has its own set of limitations. First, the cross-sectional design does not enable the establishment of causal relationships between the psychological disorders and the metabolic and/or hormonal abnormalities. Also, the use of self-report screening tools could result in reporting biases, and the single-center nature of the study could result in issues with generalizability to other populations.

## CONCLUSION

Study shows that Mental conditions such as depression and anxiety are common amongst PCOS women and affect patients disproportionately due to the presence of comorbidities such as

obstructed insulin response mechanisms, high levels of androgens, and negative health observations. Including psychological evaluations as part of ongoing, multifactorial assessments that include hormones and metabolism is a step that needs to be taken to manage the condition effectively and avoid increased levels of distress.

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