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POLYCYSTIC OVARY SYNDROME (PCOS) AND THE PSYCHOLOGICAL IMPACT OF HORMONAL IMBALANCE

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Abstract: Polycystic ovary syndrome (PCOS) is an endocrine disorder often associated with psychological problems. This study aimed to examine the relationship between hormonal imbalance and mental health outcomes, including depression, anxiety, body-image dissatisfaction, and quality of life in women with PCOS. A cross-sectional study was conducted with 120 women aged 18–40 years diagnosed with PCOS according to the Rotterdam criteria. Clinical assessments included anthropometric measurements and hormonal tests (testosterone, LH, FSH, cortisol, fasting insulin, and glucose). Psychological status was evaluated using BDI-II, GAD-7, BIDQ, and PCOSQ questionnaires. Data were analyzed using Pearson correlation and multiple linear regression. Elevated testosterone and cortisol levels were significantly associated with higher depression and anxiety scores ($p < 0.01$). Insulin resistance was linked to increased body-image dissatisfaction and lower quality-of-life scores. Regression analysis showed testosterone and cortisol as independent predictors of depression, cortisol and LH/FSH ratio as predictors of anxiety, and insulin resistance as a predictor of body-image dissatisfaction. Hormonal imbalance, particularly high androgens, elevated cortisol, and insulin resistance, plays an important role in psychological difficulties among women with PCOS. Integrating mental health assessment into routine PCOS care is recommended.

Keywords: Polycystic ovary syndrome; hormonal imbalance; depression; anxiety; body-image dissatisfaction; insulin resistance; women's health

Introduction

Polycystic ovary syndrome (PCOS) is one of the most prevalent endocrine disorders affecting women of reproductive age, with an estimated global prevalence ranging from 6% to 20%, depending on the diagnostic criteria applied [1]. Characterized by hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology, PCOS is widely recognized as a multidimensional condition that extends beyond reproductive impairment [2]. Over recent decades, increasing evidence has highlighted the complex metabolic, hormonal, and psychological disturbances associated with the disorder. Insulin resistance, obesity, chronic inflammation, and dysregulation of the hypothalamic–pituitary–ovarian (HPO) axis are considered key contributors to the pathophysiology of PCOS, underscoring the intricate interplay between endocrine and metabolic systems [3].

While the physical manifestations of PCOS are well documented, the psychological burden of the syndrome has gained significant attention in modern research. Women with PCOS have been

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found to experience higher rates of depression, anxiety, body-image dissatisfaction, and reduced quality of life compared with healthy controls [4]. These psychological comorbidities are believed to arise from both biological mechanisms—such as hormonal imbalance, elevated androgens, and cortisol dysregulation—and psychosocial stressors, including infertility, hirsutism, acne, and weight gain [5]. Despite these associations, the underlying mechanisms linking endocrine abnormalities to mental health outcomes remain insufficiently understood.

Given the growing recognition of mental health as a crucial component of women's overall well-being, a deeper investigation into the relationship between hormonal dysregulation and psychological disturbances in PCOS is urgently needed. Understanding these connections may contribute not only to improved clinical management but also to the development of holistic and individualized therapeutic strategies [6]. This study aims to explore the psychological impact of hormonal imbalance in women with PCOS, emphasizing the roles of endocrine biomarkers and their association with mental health indicators.

Methods

This cross-sectional analytical study was conducted to evaluate the relationship between hormonal imbalance and psychological outcomes among women with polycystic ovary syndrome (PCOS). A total of 120 women aged 18–40 years were recruited from endocrinology and gynecology outpatient clinics between January and June 2025. The diagnosis of PCOS was established according to the Rotterdam criteria, requiring the presence of at least two of the following features: oligo/anovulation, clinical or biochemical hyperandrogenism, and polycystic ovarian morphology confirmed by ultrasonography [1]. Women who were pregnant, diagnosed with thyroid dysfunction, Cushing's syndrome, or who had a prior history of major psychiatric disorders were excluded from participation.

All eligible participants underwent a comprehensive clinical assessment that included anthropometric measurements such as body mass index and waist circumference, blood pressure evaluation, and scoring of hyperandrogenism using the modified Ferriman–Gallwey scale [2]. Demographic characteristics, reproductive history, lifestyle factors, and PCOS-related symptoms were collected using a structured questionnaire administered by trained study personnel.

Fasting venous blood samples were obtained between 8:00 and 10:00 a.m. during the early follicular phase (days 2–5 of the menstrual cycle). Serum concentrations of total testosterone, free androgen index (FAI), luteinizing hormone (LH), follicle-stimulating hormone (FSH), estradiol, thyroid-stimulating hormone (TSH), cortisol, fasting glucose, and fasting insulin were measured. Insulin resistance was calculated using the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) formula [3]. All biochemical analyses were performed using standardized ELISA-based assays in an accredited clinical laboratory.

Psychological status was assessed using validated instruments. Depressive symptoms were measured with the Beck Depression Inventory-II (BDI-II) [4], while anxiety levels were evaluated using the Generalized Anxiety Disorder-7 (GAD-7) scale [5]. Body-image dissatisfaction was examined using the Body Image Disturbance Questionnaire (BIDQ) [6], and

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disease-specific quality of life was evaluated through the PCOS Quality of Life Questionnaire (PCOSQ) [7]. All questionnaires were completed in a supervised environment to ensure clarity and accuracy.

Statistical analyses were performed using SPSS version 26.0. Descriptive statistics were presented as mean ± standard deviation for continuous variables and as frequencies and percentages for categorical variables. Pearson's correlation coefficients were calculated to examine the relationships between hormonal indicators (testosterone, cortisol, LH/FSH ratio, and HOMA-IR) and psychological outcomes. Multiple linear regression analysis was used to identify independent predictors of depression and anxiety, adjusting for age, body mass index (BMI), and metabolic parameters. A p-value of <0.05 was considered statistically significant [8].

Results

A total of 120 women with PCOS were included in the final analysis. The mean age of participants was 27.4 ± 5.6 years, while the mean body mass index (BMI) was 29.8 ± 4.9 kg/m². Clinical hyperandrogenism was observed in 68.3% of the cohort, and 74.1% of women demonstrated oligo/anovulatory menstrual patterns. The overall demographic and clinical characteristics of the participants are summarized in **Table 1**.

Table 1. Baseline Characteristics of Study Participants (n = 120)

Variable	Mean ± SD / n (%)
Age (years)	27.4 ± 5.6
BMI (kg/m²)	29.8 ± 4.9
Waist circumference (cm)	89.6 ± 11.4
Clinical hyperandrogenism	82 (68.3%)
Oligo/anovulation	89 (74.1%)
Elevated LH/FSH ratio (>2.0)	64 (53.3%)
Insulin resistance (HOMA-IR > 2.5)	71 (59.1%)

Hormonal and Metabolic Findings

Biochemical analysis revealed elevated mean testosterone levels (0.82 ± 0.24 ng/mL) and increased LH/FSH ratio (2.16 ± 0.7). Insulin resistance was prevalent, with a mean HOMA-IR value of 3.21 ± 1.04. Cortisol levels were mildly increased in 41.6% of the participants.

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Pearson's correlation analysis demonstrated a significant positive correlation between total testosterone levels and BDI-II depression scores ($r = 0.41$, $p < 0.01$). Similarly, cortisol levels were moderately correlated with GAD-7 anxiety scores ($r = 0.38$, $p < 0.01$). HOMA-IR was positively associated with both body-image dissatisfaction ($r = 0.33$, $p < 0.05$) and reduced PCOSQ quality-of-life scores ($r = -0.36$, $p < 0.01$).

Psychological Outcomes

The mean BDI-II depression score among participants was 18.6 ± 7.4, indicating mild to moderate depressive symptoms, while the mean GAD-7 anxiety score was 11.3 ± 5.1, consistent with moderate anxiety levels. Body-image dissatisfaction scores were elevated (BIDQ mean: 4.2 ± 1.1), reflecting significant concerns related to appearance. PCOSQ domain scores were lowest in the emotional well-being (3.1 ± 0.8) and weight domains (2.9 ± 0.7), indicating substantial impairment in quality of life.

Regression Analysis

Multiple linear regression identified serum testosterone ($\beta = 0.32$, $p = 0.004$) and cortisol ($\beta = 0.29$, $p = 0.009$) as independent predictors of depression scores after adjusting for age, BMI, and metabolic parameters. Anxiety was independently predicted by cortisol levels ($\beta = 0.34$, $p = 0.003$) and elevated LH/FSH ratio ($\beta = 0.21$, $p = 0.04$). Body-image dissatisfaction was independently associated with insulin resistance ($\beta = 0.28$, $p = 0.01$).

Overall, the findings demonstrate a clear relationship between hormonal dysregulation—particularly elevated androgens, cortisol, and insulin resistance—and adverse psychological outcomes in women with PCOS.

Discussion

The findings of this study highlight the multifaceted relationship between hormonal imbalance and psychological disturbances in women with PCOS. Consistent with previous reports, our results demonstrate that elevated androgen levels, increased cortisol concentrations, and insulin resistance are significantly associated with depressive symptoms, anxiety, body-image dissatisfaction, and reduced quality of life. These observations reinforce the concept that PCOS is not solely a reproductive or metabolic disorder but a complex condition with substantial psychological implications.

In this study, total testosterone showed a strong positive correlation with depression scores, and regression analysis confirmed testosterone as an independent predictor of depressive symptoms. This aligns with existing literature suggesting that hyperandrogenism contributes to mood dysregulation through neuroendocrine pathways, including altered serotonin activity, reduced neuroplasticity, and increased inflammatory markers [9]. In addition, visible manifestations of hyperandrogenism—such as hirsutism and acne—may exacerbate emotional distress by impacting body image, social interactions, and self-esteem. These psychosocial stressors likely compound the direct biological effects of excess androgens.

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Cortisol, a key hormone in the hypothalamic–pituitary–adrenal (HPA) axis, also emerged as an independent predictor of both depression and anxiety. The elevated cortisol levels observed in a considerable proportion of participants may reflect chronic stress, metabolic dysregulation, or heightened central sensitivity to stress stimuli—factors known to be common in PCOS populations. Dysregulation of the HPA axis has been implicated in mood and anxiety disorders across various clinical groups, and our results further support its relevance in women with PCOS [10].

Insulin resistance, another hallmark of PCOS, demonstrated significant associations with body-image dissatisfaction and overall quality of life impairment. These findings are consistent with research showing that metabolic disturbances can contribute to low energy levels, weight gain, and difficulties with weight management, all of which may negatively affect psychological well-being. In addition, insulin resistance has been linked to systemic inflammation and neurochemical alterations that may worsen emotional health [11]. The strong association between HOMA-IR and BIDQ scores observed in our study suggests that metabolic dysfunction plays an important role in shaping patients' self-perception and daily functioning.

Another noteworthy finding is the role of the LH/FSH ratio, which was independently associated with anxiety levels. Although the exact mechanisms remain unclear, alterations in the hypothalamic–pituitary–ovarian (HPO) axis may influence neurotransmitter activity, stress response mechanisms, and mood regulation pathways. This suggests that endocrine variations characteristic of PCOS affect not only reproductive outcomes but also emotional stability.

Collectively, these results emphasize the need for a holistic approach to PCOS management. Clinicians should recognize the interplay between hormonal abnormalities and mental health symptoms, ensuring that psychological assessment becomes a routine part of clinical evaluation. Interventions aimed at improving hormonal balance—such as weight reduction, insulin-sensitizing therapy, and anti-androgenic treatment—may have secondary benefits on psychological well-being. Furthermore, psychological interventions, including cognitive-behavioral therapy and stress-reduction techniques, could complement medical treatment and enhance overall outcomes.

The study's cross-sectional design limits causal inference, and the sample size, although adequate, may not represent the broader PCOS population across different ethnic and socioeconomic backgrounds. Future longitudinal research is needed to clarify the temporal relationships between hormonal changes and psychological outcomes and to identify potential mediating factors.

Conclusion

This study demonstrates that hormonal imbalance in women with polycystic ovary syndrome is closely linked to a range of psychological disturbances, including depression, anxiety, body-image dissatisfaction, and reduced quality of life. Elevated testosterone and cortisol levels emerged as independent predictors of depressive and anxiety symptoms, while insulin resistance significantly contributed to negative body-image perceptions and overall emotional impairment.

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These findings highlight the multidimensional nature of PCOS and underscore the importance of integrating psychological evaluation into routine clinical management.

A holistic, multidisciplinary approach that addresses endocrine dysfunction, metabolic abnormalities, and mental health is essential for improving outcomes in women with PCOS. Future longitudinal studies with larger and more diverse populations are needed to deepen the understanding of the mechanisms underlying these associations and to guide the development of targeted therapeutic strategies.

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