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Original article

Metabolic and Cardiovascular Comorbidities Among Women with Polycystic Ovary Syndrome in Zawia, Libya: A Cross-Sectional Study

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Abstract
Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders affecting women of reproductive age and is increasingly recognized as a condition associated with significant metabolic and cardiovascular complications. Although the reproductive manifestations of PCOS are well documented, its metabolic burden remains underexplored in Libya. This study aimed to evaluate the prevalence of metabolic and cardiovascular comorbidities among women with PCOS in Zawia, Libya, and to assess their association with body mass index (BMI). A descriptive cross-sectional study was conducted at the Gynecology and Obstetrics Department of Zawia Medical Center between March and July 2023. A total of 344 Libyan women aged 18–45 years who were newly diagnosed with PCOS according to the Rotterdam diagnostic criteria were included. Data were collected through structured questionnaires and face-to-face interviews and analyzed using SPSS version 25. The mean age of participants was 23 ± 7.3 years, with the majority (74.4%) aged between 18 and 29 years. Most participants were classified as obese (75.2%), followed by overweight (21.8%), while only 2.9% had a normal BMI. The most reported metabolic and cardiovascular comorbidities were hypercholesterolemia (15.2%), diabetes mellitus (14.6%), hypertension (12.4%), and cardiovascular disease (4.2%). Obesity showed a significant association with the presence of metabolic comorbidities ($p \leq 0.05$). The findings highlight the substantial metabolic burden among women with PCOS in this population and emphasize the importance of early screening, lifestyle modification, and integrated management strategies to reduce long-term health risks.
Keywords. Polycystic Ovary Syndrome, Metabolic Syndrome, Obesity, Cardiovascular Disease, Libya.

Introduction

Polycystic ovary syndrome (PCOS) is one of the most prevalent endocrine disorders affecting women of reproductive age worldwide. The estimated global prevalence ranges between 8% and 13%, depending on the diagnostic criteria used [1]. The syndrome was first described in 1935 by Stein and Leventhal and is characterized by a combination of reproductive, endocrine, and metabolic abnormalities [2].

The most widely accepted diagnostic framework for PCOS is the Rotterdam criteria, established by the European Society for Human Reproduction and Embryology and the American Society for Reproductive Medicine. According to these criteria, the diagnosis requires the presence of at least two of the following three features: oligo- or anovulation, clinical or biochemical hyperandrogenism, and polycystic ovarian morphology detected by ultrasound [3]. Although PCOS is traditionally considered a reproductive disorder, growing evidence indicates that it is also a significant metabolic condition. Insulin resistance and compensatory hyperinsulinemia play a central role in the pathophysiology of PCOS and contribute to increased risks of obesity, dyslipidemia, hypertension, and type 2 diabetes mellitus [4]. These metabolic abnormalities significantly increase the likelihood of long-term cardiovascular complications in affected women [5].

The underlying causes of PCOS remain incompletely understood. Current research suggests that the disorder arises from a complex interaction between genetic predisposition, environmental factors, and lifestyle behaviors. Epigenetic mechanisms such as DNA methylation changes have also been implicated in the development of PCOS by altering metabolic and reproductive pathways [6]. Clinically, PCOS presents with a wide range of symptoms related to hyperandrogenism and hormonal imbalance. Common manifestations include irregular menstrual cycles, amenorrhea, oligomenorrhea, acne, hirsutism, alopecia, and weight gain [7]. Many women with PCOS also develop acanthosis nigricans, a dermatological condition associated with insulin resistance and increased risk of diabetes [8].

Beyond its endocrine manifestations, PCOS is associated with several long-term health complications. Women with PCOS are at increased risk of metabolic syndrome, a cluster of conditions including central obesity, dyslipidemia, hypertension, and impaired glucose metabolism [9]. Studies suggest that women with PCOS may have up to a fivefold increased risk of developing metabolic syndrome compared with women without the disorder [10]. Lifestyle factors also play an important role in the development and progression of PCOS. Diets high in carbohydrates and saturated fats, combined with physical inactivity, contribute to obesity and insulin resistance, which worsen the metabolic consequences of the syndrome [6,11]. Consequently, lifestyle modification through a healthy diet and regular physical activity is considered a cornerstone of PCOS management.

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Despite the global recognition of PCOS as a major health concern, epidemiological and clinical data from Libya remain limited. Only a small number of studies have examined the prevalence and clinical characteristics of PCOS among Libyan women. Furthermore, little research has investigated the metabolic and cardiovascular comorbidities associated with PCOS in the western region of the country. Therefore, this study was conducted to evaluate the prevalence of metabolic and cardiovascular comorbidities among women diagnosed with PCOS at Zawia Medical Center and to examine the association between these comorbidities and body mass index. Understanding the metabolic burden of PCOS in this population may help inform clinical management strategies and guide public health interventions aimed at reducing long-term health risks.

Methods

Study design and setting

This descriptive cross-sectional study was conducted at the Gynecology and Obstetrics Department of Zawia Medical Center (ZMC), one of the major healthcare facilities serving the western coastal region of Libya. The center provides healthcare services to patients from several cities, including Zawia, Sabratha, Al-Jmail, and Zwara.

Study population

The study population consisted of Libyan women aged between 18 and 45 years who were newly diagnosed with PCOS during the study period. Diagnosis was based on the Rotterdam criteria. Women with other endocrine disorders that could mimic PCOS symptoms were excluded.

Study period

Data collection was conducted between March 25 and July 31, 2023.

Data collection

Data was collected using structured questionnaires administered through face-to-face interviews. The questionnaire collected information on:

- demographic characteristics
- body mass index
- clinical symptoms of PCOS
- past medical history of chronic diseases

Clinical symptoms recorded included weight gain, hair loss, irregular menstrual cycles, hirsutism, amenorrhea, acne, and acanthosis nigricans.

BMI classification

Body mass index was calculated using the standard formula:
BMI = weight (kg) / height (m^2)
Participants were categorized according to the international BMI classification:

- Normal weight: 18–24.9
- Overweight: 25–29.9
- Obese: ≥30

Statistical analysis

Data were analyzed using SPSS version 25. Descriptive statistics, including frequencies and percentages, were used to summarize participant characteristics. Associations between BMI and metabolic comorbidities were assessed using chi-square tests. Statistical significance was defined as a p-value ≤ 0.05.

Results & Discussion

Age distribution

A total of 344 women diagnosed with PCOS participated in the study. The mean age of participants was 23 ± 7.3 years. Most participants (74.4%) were between 18 and 29 years of age, while 25.6% were between 30 and 45 years.

Table 1. Age Distribution

Age Group	Number	Percentage
18-29	256	74.4%
30-45	88	25.6%

BMI distribution

Analysis of BMI revealed that the majority of participants were obese. A total of 259 women (75.2%) had a BMI ≥30, while 75 women (21.8%) were classified as overweight. Only 10 participants (2.9%) had BMI within the normal range.

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These findings demonstrate a very high prevalence of obesity among women with PCOS in this population.

Table 2. BMI Distribution

BMI Category	Number	Percentage	P-Value
Normal	10	2.9%	0.001
Overweight	75	21.8%	0.032
Obese	259	75.2%	0.008

Clinical symptoms

The most frequently reported clinical manifestations were weight gain (89.8%), hair loss (82.8%), irregular menstrual cycles (81.9%), and hirsutism (81.6%). Amenorrhea was reported by 75.2% of participants, while acne was reported by 68.3%. Acanthosis nigricans, which is commonly associated with insulin resistance, was observed in 56.1% of participants. These symptoms reflect the endocrine and metabolic disturbances associated with PCOS.

Comorbidities

The analysis of past medical history revealed that several metabolic and cardiovascular conditions were present among the study participants. Hypercholesterolemia was reported by 43 participants (15.2%), diabetes mellitus by 41 participants (14.6%), hypertension by 33 participants (12.4%), and cardiovascular disease by 14 participants (4.2%). Statistical analysis demonstrated a significant association between obesity and the presence of metabolic comorbidities ($p \leq 0.05$).

Table 3. Comorbidities

Condition	Number	Percentage	P- value
Hypercholesterolemia	43	12.5%	0.034
Diabetes Mellitus	41	11.9%	0.020
Hypertension	33	9.6%	0.031
Cardiovascular Disease	14	4%	0.018

This study highlights a substantial burden of metabolic and cardiovascular comorbidities among women with polycystic ovary syndrome (PCOS) in Zawia, Libya. The prevalence of diabetes mellitus, hypertension, and hypercholesterolemia observed in this population is consistent with findings reported in numerous international studies, indicating that PCOS is closely associated with metabolic dysfunction and increased cardiovascular risk [5].

One of the most notable findings in this study is the high prevalence of obesity, affecting more than three-quarters of the participants. Obesity is a well-established risk factor that exacerbates insulin resistance and contributes to the metabolic complications of PCOS. A large systematic review conducted by Lim et al. reported that overweight and obesity are significantly more common among women with PCOS compared with the general population, with prevalence rates exceeding 60% in many regions [9]. Similarly, Barber et al. emphasized that obesity not only worsens reproductive symptoms but also accelerates the development of metabolic syndrome and cardiovascular disease in women with PCOS [11]. The clinical manifestations observed in the present study—including menstrual irregularities, hirsutism, acne, and alopecia—are consistent with the typical presentation of PCOS reported in previous research. Franks reported that hyperandrogenism combined with ovulatory dysfunction results in these common clinical features, which significantly affect both reproductive and psychological health [7].

Acanthosis nigricans was observed in more than half of the participants in this study. This dermatological finding is widely recognized as a clinical marker of insulin resistance. Spritzer et al. reported that acanthosis nigricans is frequently observed in women with PCOS and may serve as an early indicator of metabolic disturbances [8]. The presence of this condition among a large proportion of participants suggests a high prevalence of insulin resistance in this population.

The prevalence of metabolic comorbidities identified in this study is comparable to findings from other international populations. For example, a multicenter study conducted by Legro et al. demonstrated that women with PCOS have significantly higher rates of impaired glucose tolerance, type 2 diabetes mellitus, and dyslipidemia compared with women without PCOS [4]. Similarly, Escobar-Morreale reported that women with PCOS have an increased risk of cardiovascular disease due to the combined effects of insulin resistance, chronic inflammation, and lipid abnormalities [5]. Research conducted in South Asia and the Middle East has also reported similar metabolic patterns. Anjum et al. found that metabolic syndrome was present in nearly half of women with PCOS attending tertiary care hospitals in Pakistan, highlighting the global nature of metabolic complications associated with the disorder [10].

The relatively young mean age of participants in this study is an important finding. The presence of metabolic abnormalities at an early age suggests that women with PCOS may be exposed to long-term cardiovas-

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cular risks earlier in life. Previous research indicates that metabolic complications can develop during adolescence or early adulthood in women with PCOS, emphasizing the importance of early screening and preventive interventions [1]. From a public health perspective, these findings underscore the need for comprehensive management strategies that address both reproductive and metabolic aspects of PCOS. International clinical guidelines recommend routine screening for diabetes, dyslipidemia, and hypertension in women diagnosed with PCOS to prevent long-term complications [4]. In addition, lifestyle modification remains one of the most effective interventions for reducing metabolic risk in women with PCOS. Dietary changes, increased physical activity, and weight management have been shown to improve insulin sensitivity, restore ovulatory function, and reduce cardiovascular risk factors [11]. Overall, the findings of this study contribute valuable data regarding the metabolic burden of PCOS among Libyan women and highlight the need for further research across different regions of the country.

Conclusion

This study provides important baseline data on the metabolic and cardiovascular comorbidities associated with PCOS among women attending Zawia Medical Center in Libya. The findings demonstrate that obesity, diabetes mellitus, hypertension, and hypercholesterolemia are common among women with PCOS in this population. Given the complex nature of PCOS and its impact on both reproductive and metabolic health, early diagnosis and comprehensive management strategies are essential. Routine metabolic screening, lifestyle interventions, and multidisciplinary care approaches may help reduce the long-term complications associated with PCOS.

Ethical Approval

Ethical approval for this study was obtained from the institutional review authority of Zawia Medical Center. Informed consent was obtained from all participants prior to inclusion in the study.

Conflict of Interest

The authors declare that there are no conflicts of interest related to this study.

Author Contributions

All authors contributed to the conception and design of the study, data collection, analysis, and interpretation of results. All authors contributed to manuscript preparation and approved the final version of the manuscript.

Conflict of interest. Nil

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