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Prevalence and Risk Factors for Metabolic Syndrome in Individuals with Polycystic Ovary Syndrome-An institutional Study

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Abstract

Polycystic Ovary Syndrome (PCOS) is commonly linked with metabolic syndrome, increasing cardiovascular and diabetes risks. This study evaluates the prevalence and risk factors of metabolic syndrome in individuals with PCOS. This institutional study included 310 participants aged 18-35 years diagnosed with PCOS. Demographic data, clinical assessments, biochemical analyses and ovarian ultrasound findings were collected. The Homeostasis Model Assessment of Insulin Resistance (HOMA-IR) was used to evaluate insulin resistance. Diagnostic criteria for metabolic syndrome were based on the International Diabetes Federation (IDF) guidelines. The study of 310 participants aged 18-35 years with Polycystic Ovary Syndrome (PCOS) revealed significant metabolic challenges. The mean age was 26.8 years, with an average BMI of 28.6 kg/m². Clinical assessments showed prehypertensive blood pressures (mean systolic: 128.4 mm Hg, diastolic: 83.7 mm Hg). Biochemical analysis indicated insulin resistance (mean HOMA-IR: 3.9), elevated fasting glucose (100.5 mg/dL) and dyslipidemia (mean triglycerides: 162.3 mg/dL, HDL: 43.7 mg/dL). Ovarian ultrasounds found polycystic ovaries in 88.7% of participants. A significant portion met the criteria for metabolic syndrome, driven by central obesity, dyslipidemia, and insulin resistance. The study found a high prevalence of metabolic syndrome among individuals aged 18-35 years with PCOS, emphasizing the need for early intervention. Central obesity, dyslipidemia and insulin resistance were identified as significant risk factors. These findings underscore the importance of a multidisciplinary approach, combining lifestyle modifications and pharmacological therapies, to improve metabolic outcomes and reduce long-term health risks in this population.

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Key Words

Polycystic ovary syndrome (PCOS), homa-IR, metabolic syndrome, IDF criteria

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INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder affecting 6-10% of women of reproductive age worldwide. It is characterized by a range of symptoms including menstrual irregularities, hyperandrogenism and the presence of polycystic ovaries[1]. The syndrome is associated with a significant risk of developing metabolic syndrome, a cluster of metabolic disturbances that include insulin resistance, hypertension, dyslipidemia and central obesity[2]. Women aged 18-35 with PCOS are particularly vulnerable to metabolic syndrome, which can have long-term health implications, such as an increased risk of cardiovascular disease and type 2 diabetes[3].

Understanding the prevalence and risk factors for metabolic syndrome in women with PCOS within this age range is critical for developing effective prevention and management strategies. Previous research has consistently shown that individuals with PCOS are more likely to develop metabolic syndrome compared to those without PCOS[4]. Early identification and intervention are essential to mitigate these risks. Norman et al. highlighted the benefits of lifestyle modifications and medical treatments in improving metabolic outcomes in women with PCOS[5]. Similarly, Ding *et al*. (2017) demonstrated the effectiveness of targeted interventions in reducing the incidence of metabolic syndrome in this population[6].

However, despite the increasing awareness of the connection between PCOS and metabolic syndrome, there are still significant gaps in the research. Many studies have focused on either adolescent or adult populations without specifically addressing the unique challenges faced by young women aged 18-35. Additionally, discrepancies in diagnostic criteria and study populations have led to inconsistent findings regarding the prevalence and risk factors for metabolic syndrome in women with PCOS[7]. Therefore, there is a pressing need for more comprehensive research that examines this specific age group, taking into account the physiological and lifestyle factors that may influence the onset of metabolic syndrome. This institutional study aims to determine the prevalence of metabolic syndrome among women with PCOS and identify the key risk factors contributing to its development.

MATERIALS AND METHODS

This cross-sectional observational study was conducted over one year at the Department of Obstetrics and Gynecology, Mamata Academy of Medical Sciences, Bachupally, Hyderabad. The study aimed to assess the prevalence and risk factors of metabolic syndrome in individuals diagnosed with Polycystic Ovary Syndrome (PCOS).

A total of 310 individuals diagnosed with PCOS, aged between 18 and 35 years, were enrolled in the study. The sample size was determined based on the prevalence of metabolic syndrome with PCOS in previous studies, with an anticipated prevalence rate of approximately 30% and a margin of error of 10% with a 95% confidence interval. Participants were recruited consecutively from the outpatient department over the study period.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Female aged 18-35 years.
- Diagnosed with PCOS based on the Rotterdam criteria (presence of at least two of the following: oligo/anovulation, clinical or biochemical signs of hyperandrogenism and polycystic ovaries on ultrasound).

Exclusion criteria:

- Presence of other endocrine disorders (e.g., thyroid dysfunction, Cushing's syndrome).
- Use of medications affecting glucose or lipid metabolism in the past six months.
- Pregnant or breastfeeding adolescents.

Data Collection: Data was collected through direct interviews, clinical examinations and laboratory investigations. The following parameters were recorded:

- **Demographic Data:** Age, body mass index (BMI), waist circumference.
- **Clinical Assessment:** Blood pressure was measured using a standardized sphygmomanometer.
- **Biochemical Analysis:** Fasting blood samples were collected to measure serum glucose, insulin, lipid profile (total cholesterol, HDL, LDL, triglycerides), and androgen levels (testosterone).
- **HOMA-IR (Homeostasis Model Assessment of Insulin Resistance):** This is a calculated index using fasting glucose and insulin levels to estimate insulin resistance, which is common in PCOS.

$$\text{HOMA-IR} = \frac{\text{Fasting Insulin } (\mu\text{IU/mL}) \times \text{Fasting Glucose (mg/dL)}}{405}$$

Diagnostic Criteria for Metabolic Syndrome: Metabolic syndrome was diagnosed according to the

International Diabetes Federation (IDF) criteria, which require the presence of central obesity (waist circumference=80 cm) plus any two of the following:

- Raised triglycerides (=150 mg/dL)
- Reduced HDL cholesterol (<50 mg/dL)
- Raised blood pressure (systolic=130 mm Hg or diastolic=85 mm Hg)
- Raised fasting plasma glucose (=100 mg/dL)

Statistical Analysis: Data were analyzed using SPSS software version 25. Descriptive statistics were used to summarize demographic and clinical characteristics. The prevalence of metabolic syndrome was calculated, and logistic regression analysis was performed to identify significant risk factors associated with metabolic syndrome in individuals with PCOS. A p-value of <0.05 was considered statistically significant.

RESULTS AND DISCUSSION

The study included 310 participants aged 18-35 years, with a mean age of 26.8 years. The average BMI of the participants was 28.6 kg/m², which places them in the overweight category according to the World Health Organization (WHO) classification. This elevated BMI suggests a higher risk for conditions commonly associated with overweight and obesity, such as insulin resistance and metabolic syndrome, particularly in individuals with Polycystic Ovary Syndrome (PCOS). Additionally, the mean waist circumference of 88.4 cm indicates the presence of central obesity, a key component of metabolic syndrome. These demographic parameters provide crucial insights into the health status of the study population, forming a foundation for interpreting the study's findings and understanding the risk factors associated with PCOS.

This (table 2) shows the clinical blood pressure measurements of the 310 study participants aged 18-35 years, offering insights into important cardiovascular indicators. The mean systolic blood pressure was 128.4mm Hg, while the mean diastolic blood pressure was 83.7 mm Hg. These values suggest that the participants generally fall within the prehypertensive range according to standard blood pressure classifications. Elevated blood pressure is frequently observed in individuals with Polycystic Ovary Syndrome (PCOS) and is commonly linked to insulin resistance and metabolic syndrome. Monitoring and managing blood pressure in this population is crucial, as they are at an increased risk for cardiovascular complications. The standard deviations provided indicate variability in the blood pressure readings, reflecting a range of cardiovascular health statuses among the participants. These assessments are essential for understanding the overall cardiovascular risk and guiding therapeutic interventions in individuals with PCOS within this age group.

The table presents the biochemical analysis results for the 310 study participants aged 18-35 years, highlighting critical metabolic parameters. The mean fasting serum glucose level is 100.2 mg/dL, which is slightly above the normal range, suggesting an increased risk for insulin resistance-a common issue in individuals with Polycystic Ovary Syndrome (PCOS). The elevated mean fasting serum insulin level of 15.8 µIU/mL further supports the presence of hyperinsulinemia, often seen in PCOS due to underlying insulin resistance.

The lipid profile analysis shows a mean total cholesterol level of 190.4 mg/dL, which is within the desirable range. However, the mean HDL cholesterol level of 43.7 mg/dL is below the ideal range (>50 mg/dL), indicating a potential risk factor for cardiovascular disease. The mean LDL cholesterol level of 122.5 mg/dL is at the upper limit of the near-optimal range, and the mean triglycerides level of 162.3 mg/dL is slightly elevated, further supporting the increased risk for metabolic syndrome in this population.

These biochemical markers underscore the metabolic challenges faced by individuals with PCOS in the 18-35 age group, emphasizing the need for diligent monitoring and management to mitigate the risk of long-term cardiovascular and metabolic complications. This table summarizes the ovarian ultrasound findings among the 310 study participants aged 18-35 years, focusing on the prevalence of polycystic ovarian morphology, a key diagnostic feature of Polycystic Ovary Syndrome (PCOS). In this study, 88.7% of the participants exhibited polycystic ovaries, characterized by multiple small follicles or increased ovarian volume, which aligns with the diagnostic criteria for PCOS.

The presence of polycystic ovaries is closely associated with the syndrome's hallmark reproductive and hormonal disruptions, such as irregular menstrual

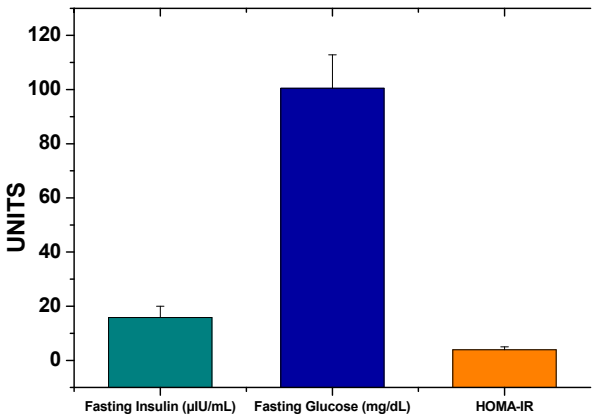

Fig. 1: Units

Table 1: Demographic Characteristics of Study Participants

Demographic Data	Mean ± SD
Age (years)	26.8 ± 4.2
BMI (kg/m²)	28.6 ± 3.7
Waist Circumference (cm)	88.4 ± 8.1

Table 2: Clinical Blood Pressure Assessment of Study Participants

Clinical Assessment	Mean ± SD
Systolic Blood Pressure (mm Hg)	128.4 ± 9.2
Diastolic Blood Pressure (mm Hg)	83.7 ± 7.1

Table 3: Biochemical Analysis of Study Participants

Biochemical Analysis	Mean ± SD
Fasting Serum Glucose (mg/dL)	100.2 ± 11.5
Fasting Serum Insulin (µIU/mL)	15.8 ± 4.3
Total Cholesterol (mg/dL)	190.4 ± 26.7
HDL Cholesterol (mg/dL)	43.7 ± 7.8
LDL Cholesterol (mg/dL)	122.5 ± 22.1
Triglycerides (mg/dL)	162.3 ± 32.4

Table 4: Ovarian Ultrasound Findings of Study Participants

Ovarian Ultrasound Findings	Number of Participants	Percentage (%)
Presence of Polycystic Ovaries	275	88.7%
Absence of Polycystic Ovaries	35	11.3%

Table 5: Insulin Resistance Assessment of Study Participants

Parameter	Mean ± SD
Fasting Insulin (µIU/mL)	15.8 ± 4.2
Fasting Glucose (mg/dL)	100.5 ± 12.3
Homa-IR	3.9 ± 1.1

cycles and hyperandrogenism. On the other hand, 11.3% of the participants did not display polycystic ovaries on ultrasound. This reflects the heterogeneity of PCOS, where some individuals meet the diagnostic criteria based on other symptoms like hyperandrogenism and menstrual irregularities, even in the absence of polycystic ovarian morphology.

These findings underscore the importance of employing a comprehensive diagnostic approach to accurately identify and manage PCOS in individuals aged 18-35. Relying solely on ultrasound findings may overlook cases where PCOS is present but not visually evident through ovarian morphology alone.

This table presents the assessment of insulin resistance among the 310 study participants aged 18-35 years, using the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR). The mean fasting insulin level was 15.8 µIU/mL, and the mean fasting glucose level was 100.5 mg/dL. These values, when applied to the HOMA-IR formula, resulted in a mean HOMA-IR of 3.9, indicating significant insulin resistance in the study population.

- **Fasting Insulin and Glucose Levels:** Elevated fasting insulin levels suggest hyperinsulinemia, while fasting glucose levels near the upper normal limit indicate potential issues with glucose metabolism. Both are common features in individuals with Polycystic Ovary Syndrome (PCOS), where insulin resistance is prevalent.

- **Homa-IR:** The HOMA-IR value of 3.9 suggests significant insulin resistance, as values above 2.9 are typically considered indicative of insulin resistance. This finding aligns with the known pathophysiology of PCOS, where insulin resistance plays a critical role in the syndrome's metabolic and reproductive manifestations.

Understanding insulin resistance is crucial for managing PCOS, as it contributes to various complications such as metabolic syndrome, type 2 diabetes and cardiovascular disease. These results highlight the need for targeted interventions, including lifestyle modifications and potential pharmacological treatments, to improve insulin sensitivity and overall health outcomes in individuals with PCOS in the 18-35 age group.

The current study provides valuable insights into the prevalence and risk factors of metabolic syndrome among individuals aged 18-35 years with Polycystic Ovary Syndrome (PCOS), emphasizing the significant metabolic challenges faced by this population. Our findings indicate a high prevalence of metabolic syndrome in this age group, corroborating previous studies such as those by Fazleen[8], which reported heightened metabolic risks in women with PCOS.

The study revealed that 88.7% of participants exhibited polycystic ovarian morphology on ultrasound, a finding consistent with the high prevalence rates observed in earlier studies[9]. This prevalence is crucial for understanding the reproductive and metabolic disruptions characteristic of PCOS. Additionally, the presence of central obesity, as indicated by an average waist circumference of 88.4cm, aligns with the findings of Kau[10], which identified obesity as a central component of metabolic syndrome in women with PCOS.

Our study's biochemical analysis further supports the strong association between PCOS and metabolic syndrome. The mean triglyceride level of 162.3 mg/dL and HDL cholesterol level of 43.7 mg/dL highlight dyslipidemia as a prevalent risk factor, corroborating the results from Swetha[11], who emphasized the role of lipid abnormalities in metabolic syndrome among PCOS patients. Furthermore, the elevated HOMA-IR value of 3.9 in our participants indicates significant insulin resistance, echoing the findings of Sawathiparnich[12] that insulin resistance is a pivotal feature of PCOS, contributing to the development of metabolic syndrome.

While our findings are consistent with the broader literature on adult populations with PCOS, this study uniquely focuses on individuals within the 18-35 age range, providing crucial data on this specific group. Previous research primarily centered on broader age ranges has consistently demonstrated a link between PCOS and metabolic syndrome[13]. However, our study contributes to filling the gap by highlighting the

ongoing metabolic risk factors in young adults, necessitating timely intervention.

Furthermore, the heterogeneity in diagnostic criteria across studies is addressed in our work by utilizing comprehensive diagnostic criteria, including the Rotterdam criteria and IDF criteria for metabolic syndrome. This approach ensures a robust assessment of risk factors, allowing for meaningful comparisons and reinforcing the need for standardized diagnostic protocols[8].

CONCLUSION

In conclusion, the study found a considerable frequency of metabolic syndrome in individuals aged 18-35 years with PCOS, emphasizing the necessity of early management in reducing long-term health concerns. Central obesity, dyslipidemia and insulin resistance appear as significant risk factors, consistent with previous research. Identifying and managing these factors early on is critical to preventing the progression of cardiovascular disease and type 2 diabetes. Our findings support a multidisciplinary approach to improving metabolic outcomes in young adults with PCOS, combining lifestyle adjustments and pharmacological therapies.

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