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Original Research Article

# Prevalence of Impaired Glucose Tolerance and Diabetes Mellitus in Young Women with Polycystic Ovarian Syndrome

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**Abstract**

**Background:** Polycystic ovarian syndrome (PCOS) is a common endocrinal disorder in females. Recent pieces of evidence have indicated the women with PCOS also suffer from metabolic derangements and diabetes mellitus more commonly as compared to normal women. We in the current study tried to evaluate impaired glucose tolerance and diabetes mellitus in young women with PCOS to facilitate the prevention of long-term consequences. **Methods:** This cross-sectional study was done in the Department of Obstetrics and Gynecology, Government Medical College Mahabubnagar, Telangana State, India. Based on the inclusion and exclusion criteria n=100 cases aged between 15 to 25 years diagnosed to have polycystic ovarian syndrome were included. A detailed history along with measurement of BMI and OGTT was performed in all cases. **Results**: A positive history of PCOS in family members revealed n=14 cases had a positive history for PCOS and n=86 cases were with negative family history for PCOS. The OGTT test revealed out of n=100 cases n= 73 cases were with normal glucose tolerance. N=22 cases were with impaired glucose tolerance and n=5 cases were with Diabetes mellitus. Out of n=27 cases with WHpR of >0.85 abnormal glucose tolerance was revealed in n=11 cases and diabetes mellitus were found in n=3 cases. **Conclusion**: PCOS women have significantly increased prevalence rates of IGT and diabetes. The risk of glucose intolerance in PCOS patients seems to be 2-fold higher, increasing with the BMI, central obesity, and occurring at an earlier age than in the normal population.

**Keywords:** Polycystic ovarian syndrome (PCOS), Oral Glucose Tolerance Test (OGTT), Body Mass Index (BMI), Diabetes Mellitus (DM).



## Introduction

Polycystic Ovary Syndrome (PCOS) is one of the most common endocrine disorders in women of reproductive age, affecting approximately 5% to 10% of women worldwide. This familial disorder is inherited as a complex genetic trait. [1] It is characterized by a combination of hyperandrogenism (either clinical or biochemical), chronic anovulation, and polycystic ovaries. It is frequently associated with insulin resistance and obesity. [2] PCOS receives considerable

attention because of its high prevalence and possible reproductive, metabolic, and cardiovascular consequences. Studies in first-degree relatives of patients who have PCOS have shown that 24% of mothers and 32% of sisters are affected, suggesting a major genetic association. [3] The disease begins soon after puberty mostly 15-25 years of age and commonly manifests during the reproductive period. Health consequences of PCOS relate to insulin resistance and hyperandrogenism. They include diabetes, obesity, metabolic syndrome (MS), endometrial hyperplasia, anovulatory infertility, and depression. The risk for diabetes is higher in women and adolescents who have PCOS. Studies have shown that in women who have PCOS, 7.5% to 10% had type 2 diabetes and approximately 30% to 35% had impaired glucose tolerance. [4, 5] Impaired glucose tolerance is known to be a significant risk factor for developing diabetes, as was shown in the Diabetes Prevention Trial. The rate of conversion from IGT to type 2 DM is increased 5-15-fold in PCOS. [6] Multiple factors contribute to diabetes risk in women with PCOS. The risk factors are obesity, Insulin resistance, decreased peripheral insulin sensitivity, Centripetal fat distribution, Hyperinsulinemia, Beta-cell dysfunction, Chronic anovulation, Family history of type 2 diabetes, dyslipidemia. [7] It is crucial to diagnose PCOS early in its course since it has lifelong implications with increased risk for metabolic syndrome, Type II Diabetes Mellitus (T2DM), cardiovascular disease, endometrial hyperplasia, anovulatory infertility, and depression. Screening for the impaired glucose tolerance allows for proper and timely management to prevent complications. The present study aimed to evaluate impaired glucose tolerance and diabetes mellitus in young women with PCOS to facilitate the prevention of long-term consequences.

## Material and Methods

This cross-sectional study was done in the Department of Obstetrics and Gynaecology, Government Medical College Mahabubnagar, Telangana State, India. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study.

### *Inclusion criteria*

1. Patients aged between 15 to 25 years of age
2. Those diagnosed with PCOS as per the Rotterdam criteria [8]
3. Those willing to participate in the study voluntarily

### *Exclusion criteria*

1. Hypothyroidism
2. Hyperprolactinemia
3. Cushing's syndrome
4. Congenital adrenal hyperplasia
5. Adrenal tumors
6. Current or previous (within the last months) use of oral contraceptives, glucocorticoids, antiandrogens, ovulation induction agents, anti-diabetic drugs, sodium valproate, aspirin, statins, and other hormonal drugs.
7. Known Diabetic and on antidiabetic therapy.

Based on the inclusion and exclusion criteria n=100 cases aged between 15 to 25 years diagnosed to have polycystic ovarian syndrome were included. A detailed history regarding their age, place, socioeconomic status, health status, menstrual history, hirsutism, acne, weight gain, height, weight, food habits, lifestyle, menstrual history, obstetric history, use of meditations including oral contraceptive pills, family history of PCOS, diabetes mellitus is taken. Height is measured barefoot to the nearest 0.5 cms. On a wall-mounted Harpenden stadiometer. Weight is measured to the nearest to 0.5 Kg. Body Mass Index (BMI), a measure of relative obesity was calculated as a mathematical function of weight and height (kilograms per meter squared).

Waist and hip circumference (in centimeters) were measured in duplicate with an inelastic tape at midway between the lowest part of the ribcage and highest point on the iliac crest and maximum diameter respectively. The waist/hip ratio is calculated as waist circumference divided by hip circumference. The presence of hirsutism was noted in every woman quantitating the presence of terminal hairs over nine body areas (Upper Lip, Chin, Chest, Upper and Lower Abdomen, Upper and lower back, upper arm, and thighs) according to the Ferriman-Gallway score. [9] The presence or absence of acne, androgenic alopecia, acanthosis nigricans was recorded. After a 3-day carbohydrate diet (150 g/day) and overnight fasting for 8 to 10 hours, a standard Oral glucose tolerance test (OGTT) [1.75 g/Kg or a maximum of 75 gms of glucose] was performed for all subjects. *Statistical analysis:* Data analysis- observations were tabulated on a sheet by using Microsoft excel. Statistical analysis of the patients was carried out with a chi-square test using SPSS version 21 software. The p-value of <0.05 was considered statistically significant.

## Results

A total of n=100 cases were included in the present study based on the inclusion and exclusion criteria. Out of the cases, n=19 cases were aged between 16 – 20 years and n=81 cases were between the age group 21 – 25 years. Based on the domicile n=35 cases were from rural areas and n=65 cases were from the urban background. The socio-economic status was classified as class I n=18, class II n=43, Class III n=18 and class IV n=21 cases. The distribution of cases based on BMI is depicted in table 1.

**Table 1: Distribution of patients based on BMI**

| *BMI Kg/m2* | *Frequency* |
|---|---|
| Underweight (<18.5) | 4 |
| Normal weight (18.5 to 24.99) | 41 |
| Over-weight (25 to 29.99) | 29 |
| Obese I (30 to 34.99) | 17 |
| Obese II (35 to 39.99) | 9 |

A positive history of PCOS in family members revealed n=14 cases had a positive history for PCOS and n=86 cases were with negative family history for PCOS. Similarly, a family history of diabetes mellitus revealed n=29 cases with a positive history and n=71 cases with negative history of diabetes mellitus. The distribution of cases based on waist-hip circumference ratio (WHpR) revealed n=73 cases with WHpR of < 0.85 and n=27 cases were with WHpR of > 0.85. The distribution of patients based on signs and symptoms is given in table 2.

**Table 2: Distribution of patients based on signs and symptoms**

| *Symptom* | *Frequency* |
|---|---|
| Oligomenorrhoea | 87 |
| Hirsutism | 55 |
| Acne | 44 |
| Infertility | 61 |
| Acanthosis nigricans | 34 |
| PCOS on USG | 80 |

Based on the marital status n=21 cases were unmarried and n=79 cases were married. The OGTT test revealed out of n=100 cases n= 73 cases were with normal glucose tolerance. N=22 cases were with impaired glucose tolerance and n=5 cases were with Diabetes mellitus.

**Table 3: Prevalence of glucose intolerance by age in PCOS**

| *Age in years* | *PCOS frequency* | *Normal Glucose tolerance* | | *Impaired Glucose tolerance* | | *Diabetes Mellitus* | |
|---|---|---|---|---|---|---|---|
| | | *Frequency* | *%* | *Frequency* | *%* | *Frequency* | *%* |
| 16 – 20 | 19 | 14 | 73.68 | 5 | 26.31 | 0 | 0 |
| 21 – 25 | 81 | 59 | 72.84 | 17 | 20.98 | 5 | 6.1 |

The comparative analysis of the cases based on the BMI and glucose tolerance revealed greater numbers of overweight and obese cases were having impaired glucose tolerance and diabetes mellitus as compared to the normal weight cases the details have been depicted in table 4. The prevalence of abnormal glucose tolerance based on the family history of PCOS revealed those with a positive family history of PCOS had impaired glucose tolerance in n=4 cases and n=1 case was with diabetes mellitus.

**Table 4: Prevalence of glucose intolerance by BMI in PCOS**

| *BMI category* | *PCOS frequency* | *NGT* | | *IGT* | | *Diabetes mellitus* | |
|---|---|---|---|---|---|---|---|
| | | *n* | *%* | *n* | *%* | *n* | *%* |
| Underweight (<18.5) | 4 | 3 | 75 | 1 | 25 | 0 | 0 |
| Normal weight (18.5 -24.9) | 41 | 39 | 95.12 | 2 | 4.87 | 0 | 0 |
| Overweight (25.9-29.9) | 29 | 19 | 65.51 | 9 | 65.51 | 1 | 3.44 |
| Obese I (29.9 - 34.9) | 17 | 10 | 58.82 | 6 | 35.29 | 1 | 5.88 |
| Obese II (34.9 – 39.9) | 9 | 2 | 2.22 | 4 | 44.44 | 3 | 33.33 |

Based on the family history of diabetes mellitus n=29 abnormal glucose tolerance was found in n=9 cases and n=4 cases were detected with diabetes mellitus. Out of n=27 cases with WHpR of >0.85 abnormal glucose tolerance was revealed in n=11 cases and diabetes mellitus were found in n=3 cases. The prevalence of Acanthosis nigricans was found in n=3 cases of diabetes mellitus and n=12 cases of impaired glucose tolerance.

## Discussion

PCOS is most frequently encountered in women of reproductive age. Having the disorder may significantly impact the reproductive years. It contributes to morbidity and mortality by the time of menopause. It has been found that PCOS women are at significantly higher risk for impaired glucose tolerance (IGT) and type 2 diabetes mellitus compared to normal women. In general women with PCOS, and especially those with glucose intolerance, often have a normal Fasting Blood Glucose. Currently, guidelines from the Androgen Excess Society recommend that a 2-hour OGTT be performed on all women with PCOS. This is because NIDDM imposes extraordinary health and economic costs. In the current study, we found out of n=100 cases 22% cases were with impaired glucose tolerance 5% were with diabetes mellitus. In a similar study Samantha et al., [10] found 35% cases with impaired glucose tolerance and 8% with diabetes mellitus. Weerakiet et al., [11] found 22.8% of PCOS with impaired glucose tolerance and 15.2% cases with diabetes mellitus. Age and BMI are risk factors for impaired glucose metabolism. In the present study, the subjects were young, with an average age of 23.05 years. As age was identified as a confounder for BMI and BMI is related to insulin resistance, the young age of our study population may explain the low

incidence of IGT in the present study. The mean BMI of the current study was 26.32 kg/m2. Maida Yousif et al., [12] have reported the mean age of PCOS women as 29 years and the mean BMI was 30 and 28% with impaired glucose tolerance and 7% with diabetes mellitus. Palmert et al., [13] have reported a lesser number of PCOS n=27 with IGT in 29.62% cases and diabetes mellitus in 3.7% cases. The difference between our study and this study could be due to the smaller number of PCOS cases included in the study. The Present study found an about 1.7-fold increased risk of glucose intolerance in PCOS women with a positive family history of T2DM. Thus, our findings are consistent with a genetic basis for metabolic disturbances in PCOS. The higher prevalence in this study compared to Elisabeth et al., [14] study could be a result of our smaller sample size. Legro RS et al., [4] observed a borderline significant difference in disturbed glucose metabolism that was prevalent in 52.6% of PCOS women with a family history of T2DM and 34% of PCOS women with negative family history among n=254 women with PCOS. DA Ehrmann et al., [15] found a 2.6-fold higher prevalence of first-degree relatives with T2DM in n=12 PCOS women with T2DM compared with n=67 PCOS women with normal glucose tolerance (83 vs 31%). That study again differed from the present study concerning BMI (mean BMI 33.4, 36.9, and 41.0 kg/m2 for women with normal glucose tolerance, IGT, and T2DM respectively. PCOS women with a positive family of both T2DM and PCOS had the highest prevalence of metabolic disturbances and hyperandrogenism. In clinical routine, the simple question of whether relatives are affected by T2DM and/or PCOS might be a useful screening tool to identify PCOS women at high metabolic risk. Further, the assumption of a common genetic background of PCOS and T2DM is strengthened by our results showing that both obese, as well as non-obese PCOS women with a positive T2DM family history, are more likely to have a positive PCOS family history. First and clinically most important, the simple assessment of whether a relative is affected by T2DM or not might allow risk stratification of PCOS women. It might help identify PCOS women at high metabolic risk in whom further evaluation including a regular follow-up as well as intensified treatment is indicated.

## Conclusion

PCOS women have significantly increased prevalence rates of IGT and diabetes. The risk of glucose intolerance in PCOS patients seems to be 2-fold higher, increasing with the BMI, central obesity, and occurring at an earlier age than in the normal population. PCOS women with a positive T2DM Family history have an adverse metabolic profile, whereas women with a positive PCOS Family history have an increased prevalence of clinical and biochemical hyperandrogenism. A two-hour OGTT level is a better indicator of abnormal glucose tolerance in PCOS cases as compared to fasting blood glucose levels.

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