

Frequency of Impaired Oral Glucose Tolerance Test Results in Women with Polycystic Ovary Syndrome

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ABSTRACT

Objective: To determine the frequency of impaired Oral Glucose Tolerance Test (OGTT) results in women with Polycystic Ovary Syndrome (PCOS) attending a tertiary-care gynaecology outpatient clinic.

Study Design: A cross-sectional observational study.

Place and Duration of the Study: Department of Obstetrics and Gynaecology, MTI-Hayatabad Medical Complex, Peshawar, Pakistan, from June to December 2024.

Methodology: Consecutive women aged 18–45 years who met the Rotterdam criteria for PCOS were enrolled. Exclusion criteria included known diabetes mellitus, pregnancy, and use of medications affecting glucose metabolism, except for metformin. A standard 75-g OGTT was performed after an overnight fast (≥ 8 hours). Fasting and 2-hour plasma glucose levels were categorised using American Diabetes Association definitions. Demographic, clinical, and lifestyle variables were recorded. Associations between OGTT categories and categorical variables were tested using the chi-square test ($\alpha = 0.05$).

Results: A total of 360 participants were analysed (mean age: 30.44 ± 6.14 years; mean BMI: 28.30 ± 5.27 kg/m²). Normal glucose tolerance occurred in 50.0% ($n = 180$) participants, impaired glucose tolerance in 37.5% ($n = 135$), and diabetes in 12.5% ($n = 45$). No statistically significant associations were observed between OGTT category and menstrual regularity, family history of diabetes, hypertension, dyslipidaemia, physical activity, dietary pattern, insulin resistance, medication use, or smoking status (all $p > 0.05$).

Conclusion: Dysglycaemia is common in women with PCOS in outpatient care. Routine OGTT-based screening should be integrated into clinical assessment to enable early identification and management of metabolic risk.

Key Words: Polycystic ovary syndrome, Oral glucose tolerance test, Impaired glucose tolerance, Diabetes mellitus, Screening.

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INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is a prevalent endocrine disorder in reproductive-aged women, characterised by hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology, and is frequently accompanied by insulin resistance and dysglycaemia, with long-term cardiometabolic consequences.^{1,2}

Contemporary international guidance emphasises routine cardiometabolic assessment across PCOS phenotypes and body mass index categories, as glycaemic abnormalities can occur even in non-obese presentations.^{1,2} Among available glycaemic assessments, the 75-g Oral Glucose Tolerance Test (OGTT) is preferred for case-finding in PCOS, because isolated post-load hyperglycaemia may be missed by fasting plasma glucose or HbA1c alone, thereby delaying risk stratification and preventive management.^{1,3,4}

Synthesis of international evidence shows substantial heterogeneity in dysglycaemia among women with PCOS, with impaired glucose tolerance (IGT) commonly affecting roughly one-third to nearly one-half of patients, depending on population characteristics and diagnostic criteria.^{5,6} Evidence from South Asian and Pakistani cohorts indicates appreciable burdens of abnormal OGTT profiles, metabolic syndrome, and insulin resistance in tertiary-care settings, underscoring the local relevance of systematic screening.^{7,8} This study aimed to determine the frequency of impaired OGTT results among women with PCOS attending a tertiary-care gynaecology outpatient clinic.

METHODOLOGY

This cross-sectional observational study was conducted at the Department of Obstetrics and Gynaecology, MTI-Hayatabad Medical Complex, Peshawar, Pakistan, from June to December 2024. Ethical approval was obtained from the Institutional Review Board of the hospital (No. 2022-5644). Written informed consent was obtained from all the participants. Consecutive women aged 18–45 years attending the gynaecology outpatient clinic and meeting the Rotterdam criteria for PCOS—two of the following, with exclusion of related disorders: oligo-/anovulation, clinical or biochemical hyperandrogenism, and polycystic ovarian morphology on ultrasound—were invited to participate.

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Women with known diabetes mellitus, current pregnancy, or on medications that alter glucose metabolism (other than metformin) were excluded. An upper age limit of 45 years was retained because PCOS persists into the late reproductive years, and women aged 40–45 commonly present in routine practice; age was recorded to allow assessment of potential confounding due to the perimenopausal transition, rather than excluding this group and biasing prevalence estimates downward.

All eligible participants underwent a standard 75-g OGTT following an overnight fast of at least eight hours. To standardise glycaemic assessment, those already using metformin were advised—after clinical review—to withhold metformin for 48 hours prior to the test and resume the routine dose thereafter. Venous blood was sampled at baseline (fasting) and 120 minutes after ingestion of 75 g anhydrous glucose dissolved in water. Plasma glucose was measured in the hospital laboratory using an enzymatic glucose-oxidase method with internal quality control. Glycaemic categories were assigned according to the American Diabetes Association definitions: normal glucose tolerance (fasting <100 mg/dL and 2-hour <140 mg/dL), IGT (2-hour 140–199 mg/dL), or diabetes (fasting \geq 126 mg/dL and/or 2-hour \geq 200 mg/dL).

Demographic, clinical, and lifestyle variables were recorded on a pre-piloted proforma. Body mass index (BMI) was calculated as weight (kg)/height (m²), and waist circumference was measured midway between the lowest rib and the iliac crest, with the participant standing. Menstrual regularity was defined as a cycle length of 21–35 days maintained for at least three consecutive months; other patterns were classified as irregular. Clinical hyperandrogenism was quantified using the modified Ferriman–Gallwey (mFG) score assessed by trained female staff and analysed as a continuous variable. Insulin resistance was operationalised using the Homeostatic Model Assessment (HOMA-IR = fasting insulin [μ U/mL] \times fasting glucose [mg/dL] / 405), with HOMA-IR >2.5 indicating insulin resistance in this South Asian cohort. Physical activity was classified as active (\geq 150 minutes/week of moderate-intensity activity or \geq 75 minutes/week of vigorous activity), moderate (60–149 minutes/week of moderate-intensity activity), or sedentary (<60 minutes/week), based on self-report for the preceding seven days. Dietary pattern was categorised as healthy if participants reported \geq 5 servings/day of fruit and vegetables on at least five days per week with sugar-sweetened beverages \leq 1 serving/day; all other patterns were classified as unhealthy. Smoking status (current smoker vs. non-smoker), family history of diabetes (first-degree relative), hypertension (documented blood pressure \geq 140/90 mmHg on at least two prior readings or current antihypertensive therapy), dyslipidaemia (recorded diagnosis or lipid-lowering medication), and current medication use (metformin or combined oral contraceptives) were abstracted from history and records.

The sample size was calculated using the single-proportion formula for a 95% confidence level, an anticipated prevalence of IGT ($p = 0.375$), and an absolute precision ($d = 0.05$), yielding a minimum of 360 participants, achieved through consecutive sampling. Continuous variables were summarised as mean (standard deviation) or median (interquartile range) according to distribution; categorical variables were presented as frequencies (percentages). Associations between OGTT categories and categorical predictors were examined using Pearson's chi-square test, with Fisher's exact test applied where expected cell counts were <5. All tests were two-tailed with a significance threshold of $\alpha = 0.05$. Data were analysed using SPSS version 26.

RESULTS

A total of 360 women with PCOS were analysed. The mean age was 30.44 ± 6.14 years; BMI was 28.30 ± 5.27 kg/m²; waist circumference was 88.62 ± 10.07 cm; fasting plasma glucose was 105.44 ± 21.09 mg/dL; 2-hour post-load plasma glucose was 141.51 ± 36.54 mg/dL; and mFG score was 10.14 ± 4.01 .

Clinical and lifestyle characteristics are summarised in Table I. Menstrual regularity was reported by 216 (60.0%) participants and irregularity by 144 (40.0%). A family history of diabetes was present in 237 (65.8%). Hypertension and dyslipidaemia were recorded in 108 (30.0%) and 125 (34.7%), respectively. Physical activity was classified as active in 90 (25.0%), moderate in 145 (40.3%), and sedentary in 125 (34.7%). Dietary pattern was healthy in 216 (60.0%) and unhealthy in 144 (40.0%). Insulin resistance was identified in 144 (40.0%). Regarding medication use, 145 (40.3%) participants used metformin, 90 (25.0%) combined oral contraceptives, and 125 (34.7%) reported no current medication. Current smoking was reported by 72 (20.0%). On OGTT, normal glucose tolerance was observed in 180 (50.0%), IGT in 135 (37.5%), and diabetes in 45 (12.5%; Table I).

Table I: Clinical characteristics of patients (n = 360).

Variables	Categories	n (%)
Menstrual regularity	Regular	216 (60%)
	Irregular	144 (40%)
Family history of diabetes	Yes	237 (65.8%)
	No	123 (34.2%)
Diet	Healthy	216 (60%)
	Unhealthy	144 (40%)
Hypertension	Yes	108 (30%)
	No	252 (70%)
Dyslipidaemia	Yes	125 (34.7%)
	No	235 (65.3%)
Physical activity	Active	90 (25%)
	Moderate	145 (40.3%)
	Sedentary	125 (34.7%)
Insulin resistance	Yes	144 (40%)
	No	216 (60%)
Medication	Metformin	145 (40.3%)
	None	125 (34.7%)
	Oral contraceptives	90 (25%)
Smoking status	Non-smoker	288 (80%)
	Smoker	72 (20%)
OGTT result	Diabetes	45 (12.5%)
	Impaired	135 (37.5%)
	Normal	180 (50%)

Table II: Association between categorical variables and OGTT result (n = 360).

Variables	Groups	OGTT result			Total	*p-values
		Diabetes	Impaired	Normal		
Menstrual regularity	Irregular	19 (13.2%)	56 (38.9%)	69 (47.9%)	144 (100%)	0.809
	Regular	26 (12.0%)	79 (36.6%)	111 (51.4%)	216 (100%)	
Family history of diabetes	Yes	30 (12.7%)	86 (36.3%)	121 (51.1%)	237 (100%)	0.802
	No	15 (12.2%)	49 (39.8%)	59 (48.0%)	123 (100%)	
Hypertension	Yes	11 (10.2%)	43 (39.8%)	54 (50.0%)	108 (100%)	0.643
	No	34 (13.5%)	92 (36.5%)	126 (50.0%)	252 (100%)	
Dyslipidaemia	Yes	12 (9.6%)	47 (37.6%)	66 (52.8%)	125 (100%)	0.452
	No	33 (14.0%)	88 (37.4%)	114 (48.5%)	235 (100%)	
Diet	Healthy	29 (13.4%)	87 (40.3%)	100 (46.3%)	216 (100%)	0.227
	Unhealthy	16 (11.1%)	48 (33.3%)	80 (55.6%)	144 (100%)	
Physical activity	Active	11 (12.2%)	32 (35.6%)	47 (52.2%)	90 (100%)	0.991
	Moderate	18 (12.4%)	56 (38.6%)	71 (49.0%)	145 (100%)	
	Sedentary	16 (12.8%)	47 (37.6%)	62 (49.6%)	125 (100%)	
Insulin resistance	Yes	14 (9.7%)	61 (42.4%)	69 (47.9%)	144 (100%)	0.202
	No	31 (14.4%)	74 (34.3%)	111 (51.4%)	216 (100%)	
Medication	Metformin	18 (12.4%)	54 (37.2%)	73 (50.3%)	145 (100%)	0.983
	None	16 (12.8%)	49 (39.2%)	60 (48.0%)	125 (100%)	
	Oral contraceptives	11 (12.2%)	32 (35.6%)	47 (52.2%)	90 (100%)	
Smoking status	Non-smoker	41 (14.2%)	108 (37.5%)	139 (48.3%)	288 (100%)	0.114
	Smoker	4 (5.6%)	27 (37.5%)	41 (56.9%)	72 (100%)	

*Chi-square test was used to determine p-values.

In bivariate analysis (Table II), no statistically significant associations were observed between OGTT category and menstrual regularity ($p = 0.809$), family history of diabetes ($p = 0.802$), hypertension ($p = 0.643$), dyslipidaemia ($p = 0.452$), dietary pattern ($p = 0.227$), physical activity ($p = 0.991$), insulin resistance ($p = 0.202$), medication use ($p = 0.983$), or smoking status ($p = 0.114$).

DISCUSSION

Dysglycaemia was common in this cohort, with IGT in 37.5% and diabetes in 12.5% of women with PCOS. These estimates fall within the ranges reported internationally, where IGT commonly affects roughly one-third to nearly one-half of women with PCOS, depending on the population and criteria.^{9,10}

The findings support routine case-finding with the 75-g OGTT, which is recommended in contemporary guidance because post-load hyperglycaemia may be missed by fasting plasma glucose or HbA1c alone, leading to under-recognition of risk.¹¹⁻¹³

Comparative evidence from South Asia, including Pakistan, also shows a substantial metabolic burden in women with PCOS in tertiary care, with abnormal OGTT profiles and clustering of cardiometabolic risk factors, which aligns with the present estimates and underscores the need for systematic screening pathways in local clinics.^{14,15}

No statistically significant associations were observed between OGTT category and menstrual regularity, family history of diabetes, hypertension, dyslipidaemia, physical activity, dietary pattern, insulin resistance, medication use, or smoking status. Previous literature has linked dysglycaemia in PCOS to age, adiposity (including central obesity), biochemical hyperandrogenism, and family history; however, differences in study design, population structure, statistical power for subgroup analyses, and medication exposure (e.g., metformin) can attenuate detectable associations in cross-sectional settings.^{16,17}

Lifestyle modification remains the cornerstone of metabolic risk reduction in PCOS, with diet and physical activity recommended as first-line therapy; however, causal effects are

difficult to demonstrate in cross-sectional data and are better assessed in longitudinal or interventional studies.¹⁸

Hypertension and dyslipidaemia frequently co-occur with dysglycaemia in PCOS as part of an adverse cardiometabolic profile, yet the absence of associations here may reflect the cohort's relatively young age, treatment effects, and the limited power for detecting modest differences across categories.¹⁹

Strengths of the study include an adequately powered sample and the use of a standardised OGTT protocol, which enhance the internal validity of the prevalence estimates. Limitations include the cross-sectional design (precluding causal inference), single-centre sampling from a tertiary outpatient setting (potentially limiting generalisability), self-reported lifestyle exposures (risk of recall bias), and unmeasured confounding factors (such as socio-economic status, stress, and sleep).

The high burden of dysglycaemia in women with PCOS supports integrating OGTT-based screening into routine gynaecology outpatient care, coupled with structured lifestyle interventions and targeted risk-factor management consistent with current guidance.²⁰

CONCLUSION

Women with PCOS in outpatient care demonstrated a high burden of dysglycaemia, supporting the incorporation of routine OGTT-based screening into standard assessment. As no individual clinical or lifestyle factor was associated with glucose intolerance in this cohort, selective screening is not justified. Early identification, alongside structured lifestyle counselling and cardiometabolic risk management, may help prevent progression to type 2 diabetes and reduce cardiovascular risk.

ETHICAL APPROVAL:

Ethical approval was obtained from the Institutional Review Board of MTI-Hayatabad Medical Complex, Peshawar, Pakistan (No. 2022-5644).

PATIENTS' CONSENT:

Written informed consent was obtained from all the participants prior to enrolment and testing.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

SZ: Conception of the study, data acquisition, and drafting of the manuscript.

RS: Study design, literature review, and critical revision of the manuscript.

NR, FQ: Research supervision, assurance of ethical compliance, and critical revision of the manuscript.

MA: Data collection and writing of the methodology and results sections.

NW: Statistical analysis, data interpretation, and manuscript editing.

All authors approved the final version of the manuscript to be published.

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