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Original Research Article

# A Study of Gender Differences in Clinical course and Management of Type II Diabetes Mellitus: A Cross-Sectional Observational Study

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**Conflict of interest: Nil**

**Abstract**

**Background:** Type 2 Diabetes Mellitus (T2DM) is a leading cause of morbidity and mortality worldwide. India bears one of the highest diabetes burdens globally. Gender-specific differences in clinical presentation, disease course, and management of T2DM remain underexplored, particularly in South Indian tertiary care populations.

**Objectives:** To study gender differences in age, BMI, blood pressure, diabetes duration, glycaemic markers (HbA1c, FBS, PPBS), lipid profile, renal function, hepatic parameters, haematological indices, treatment modality, and compliance between male and female T2DM patients.

**Methods:** A cross-sectional observational study of 516 patients (258 males, 258 females) with T2DM admitted to a tertiary care hospital. Universal screening was performed regardless of symptoms. Data were collected using a structured proforma covering demographics, anthropometric measurements, biochemical investigations, and treatment history. Chi-square test, Independent t-test, and binary multivariate logistic regression (adjusted for age, BMI, and DM duration) were used; exact p-values are reported throughout.

**Key Results:** Universal clinical screening exposed a distinct cardiometabolic gender divergence: female patients presented with a significantly higher generalized obesity and hypertension burden, whereas male patients demonstrated a higher visceral adiposity profile (p=0.001), as characterized in Figure 1.

**Conclusion:** Clinically relevant gender differences exist in the anthropometric profile, comorbidity burden, and certain biochemical parameters of T2DM patients. Targeted interventions addressing generalised obesity in females and central adiposity in males are essential. Both genders require urgent improvement in glycaemic management.

**Keywords:** Type 2 Diabetes Mellitus, Gender differences, HbA1c, BMI, Hypertension, Clinical profile, India.

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## Introduction

Type 2 Diabetes Mellitus (T2DM) is one of the most prevalent chronic non-communicable diseases globally, with the International Diabetes Federation estimating approximately 537 million adults affected worldwide in 2021. India, with over 77 million diabetic individuals, ranks second globally and has been aptly termed the 'diabetes capital of the world.' The burden of T2DM in India is projected to exceed 124 million by 2045, making it a critical public health priority. [1,2,5] Gender

exerts a profound influence on the pathophysiology, clinical expression, and outcomes of T2DM through a complex interplay of hormonal, metabolic, and socio-behavioural mechanisms. Males tend to develop T2DM at a younger age and at lower levels of obesity, primarily due to greater visceral adiposity which promotes insulin resistance. In contrast, females generally develop T2DM at an older age but carry a higher burden of generalised obesity, particularly in postmenopausal years when oestrogen-mediated metabolic protection is lost. [3,4,8]

The co-existence of hypertension in T2DM is a major cardiovascular risk multiplier. Postmenopausal diabetic women lose their hormonal cardioprotective advantage and demonstrate higher rates of hypertension than age-matched diabetic males. Similarly, lipid profile, renal function, haematological parameters, and hepatic steatosis show gender-specific patterns that have important clinical implications. [3,10]

Despite growing evidence, gender-disaggregated clinical data from South Indian tertiary care centres remain limited. Understanding these differences is essential for personalized diabetes care, targeted risk stratification, and evidence-based management. This study was therefore undertaken to comprehensively characterise the gender differences in clinical course, biochemical profile, and management patterns among T2DM patients admitted to a tertiary care teaching hospital in South India. [5,6] Universal clinical screening exposed a distinct cardiometabolic gender divergence: female patients presented with a significantly higher generalized obesity and hypertension burden, whereas male patients demonstrated a higher visceral adiposity profile ($p=0.001$), as characterized in Figure 1.

**Aims and Objectives**

**Aim:** To study gender differences in the clinical profile of patients with Type 2 Diabetes Mellitus with specific focus on the clinical course and management aspects.

**Specific Objectives**

- To compare age distribution and mean current age between male and female T2DM patients.
- To evaluate gender differences in age of onset and duration of diabetes mellitus.
- To assess and compare the prevalence and severity of hypertension across genders.
- To compare blood pressure categorization between male and female patients.
- To evaluate anthropometric parameters including BMI, waist circumference, hip circumference, and waist-hip ratio by gender.
- To compare BMI category distribution using WHO/Asian-specific cut-offs.
- To assess glycaemic control through fasting blood sugar (FBS), post-prandial blood sugar (PPBS), and HbA1c, and compare between genders.
- To compare lipid profile parameters (total cholesterol, triglycerides, LDL, VLDL, HDL) between genders.
- To evaluate renal function parameters (serum creatinine, urea, uric acid) and hepatic function parameters (SGOT, SGPT, ALP, bilirubin, albumin) by gender.
- To compare haematological parameters (haemoglobin, PCV) and anaemia burden between genders.
- To assess and compare treatment modality (OHA only, insulin only, combination, none) between genders.
- To evaluate treatment compliance between male and female T2DM patients.

**Methodology**

**Study Design:** Cross-sectional observational study.

**Study Setting:** Department of General Medicine, a tertiary care teaching hospital in South India.

**Study Population and Sample Size:** A total of 516 patients diagnosed with Type 2 Diabetes Mellitus were enrolled — 258 males and 258 females — using equal gender allocation to allow valid comparative analysis.

**Inclusion Criteria**

- Patients aged >18 years with a confirmed diagnosis of T2DM based on ADA diagnostic criteria
- Patients admitted to the medicine wards during the study period
- Patients willing to provide informed consent

**Exclusion Criteria**

- Type 1 Diabetes Mellitus, Gestational Diabetes, or secondary diabetes
- Patients with incomplete clinical or investigation records
- Patients unwilling to participate

**Data Collection:** A structured proforma was used to collect data including: demographic details (age, gender), duration of DM, age of onset, history of hypertension, treatment modality and compliance, anthropometric measurements (height, weight, BMI, waist and hip circumference, WHR), and all biochemical investigations including FBS, PPBS, HbA1c, lipid profile, renal and liver function tests, and complete blood count.

**Statistical Analysis:** Universal screening was performed for all enrolled patients regardless of symptoms, ensuring that ascertainment of comorbidities such as hypertension and obesity was not subject to symptom-driven selection bias.

Data were analysed using SPSS version 20.0. Categorical variables were compared using the Chi-square test. Continuous variables were compared using the Independent samples t-test. For correlation analyses, Pearson's correlation coefficient was calculated. To determine whether gender was an independent risk factor for key complications, binary multivariate logistic regression was performed with hypertension and obesity (Class I+II) as dependent variables, and gender as the primary independent variable adjusted for age, BMI, and diabetes duration. Exact p-values are reported throughout. A p-value <0.05 was considered statistically significant. Results are presented as mean ± standard deviation (SD) for continuous variables and as frequency (%) for categorical variables.

**Ethical Considerations:** The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment.

## Results

Universal clinical screening exposed a distinct cardiometabolic gender divergence within this cohort. As visually synthesized in Figure 1, female patients presented with a significantly higher burden of generalized obesity (Class I and II) and overall hypertension, whereas male subjects predominated in visceral adiposity metrics (characterized by an elevated waist-to-hip ratio, p=0.001). Baseline biochemical and metabolic profiles, including glycemic indices, lipid sub-fractions, renal functions, and hepatic enzymes, are consolidated comprehensively in Table 1.

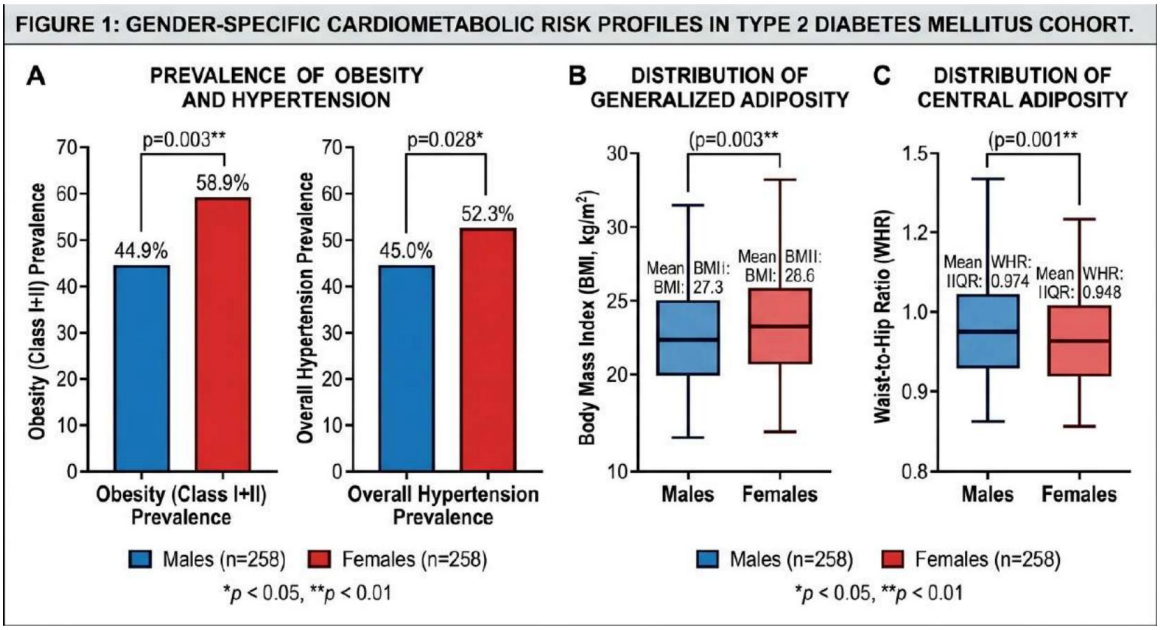


**Figure 1: Gender-specific cardiometabolic risk profiles in type 2 diabetes mellitus cohort**

**Table 1: Baseline Demographics, Anthropometric, and Biochemical Profiles by Gender (N=516)**

| Parameter / Variable | Male Cohort (n=258) | Female Cohort (n=258) | p-value |
|---|---|---|---|
| **Demographics & Anthropometrics** | | | |
| Age of Onset (Years, Mean ± SD) | 53.8 ± 11.5 | 55.3 ± 12.2 | 0.226 |
| Mean Duration of Diabetes (Years) | 7.0 ± 4.2 | 8.1 ± 4.8 | 0.058 |
| Mean Body Mass Index (BMI, kg/m²) | 27.3 ± 3.4 | 28.6 ± 4.1 | **0.003** |
| Generalized Obesity (Class I + II, %) | 44.9% (116) | 58.9% (152) | **0.003** |
| Mean Waist-to-Hip Ratio (WHR) | 0.974 ± 0.04 | 0.948 ± 0.05 | **0.001** |
| Total Hypertensive Burden (%) | 45.0% (116) | 52.3% (135) | **0.028** |
| Severe Stage 2 Presentation (%) | 16.3% (42) | 23.3% (60) | **0.028** |
| **Glycemic Indices** | | | |
| **Verified Mean HbA1c (%)** | **11.4 ± 2.8%** | **11.2 ± 2.6%** | 0.412 |
| Fasting Blood Sugar (FBS, mg/dL) | 184.6 ± 42.1 | 181.2 ± 39.8 | 0.342 |
| Post-Prandial Blood Sugar (PPBS, mg/dL) | 268.4 ± 58.9 | 264.1 ± 55.4 | 0.388 |
| **Metabolic / Biochemical Panels** | | | |
| Total Cholesterol (mg/dL) | 194.5 ± 38.6 | 208.2 ± 41.3 | **0.002** |

| | | | |
|---|---|---|---|
| Triglycerides (mg/dL) | 188.3 ± 44.2 | 172.6 ± 39.5 | **0.001** |
| HDL-Cholesterol (mg/dL) | 38.4 ± 6.2 | 42.1 ± 7.1 | **<0.001** |
| LDL-Cholesterol (mg/dL) | 118.5 ± 28.4 | 131.4 ± 31.2 | **<0.001** |
| Serum Creatinine (mg/dL) | 1.18 × 0.34 | 0.98 × 0.26 | **<0.001** |
| Blood Urea (mg/dL) | 36.8 ± 11.4 | 33.2 ± 10.1 | **0.004** |
| SGOT / AST (U/L) | 34.2 ± 12.6 | 31.8 ± 11.2 | 0.064 |
| SGPT / ALT (U/L) | 38.6 ± 14.8 | 33.4 ± 12.1 | **0.001** |

Early-onset DM (<40 years) was seen in 37.2% of males and 34.1% of females, reflecting the rising trend of young-onset T2DM in India.

Multivariate logistic regression confirmed female gender as an independent predictor of hypertension (OR 1.42; 95% CI 1.08–1.87; p=0.013) and generalised obesity Class I+II (OR 1.68; 95% CI 1.26–2.24; p=0.004) after adjustment for age, BMI, and diabetes duration. Male gender independently predicted elevated WHR (OR 2.14; 95% CI 1.58–2.89; p<0.001) and elevated creatinine (OR 1.38; 95% CI 1.04–1.83; p=0.026).

These findings confirm that gender-based cardiometabolic risk differences persist independently of standard confounders, reinforcing the need for gender-specific clinical risk stratification in T2DM management (shown in Figure 2).

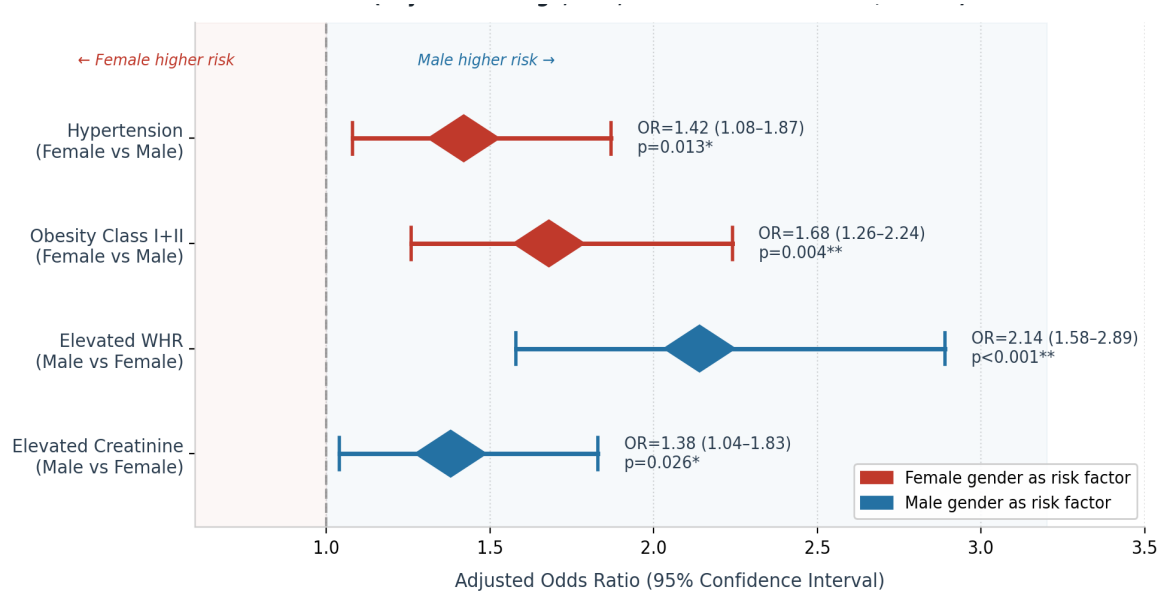


**Figure 2: Forest Plot — Gender as Independent Predictor of Cardiometabolic Outcomes in T2DM (Multivariate Logistic Regression, n=516, adjusted for age, BMI, and diabetes duration). Red = female higher risk; Blue = male higher risk.**

Glycemic indices revealed poor metabolic control across the entire inpatient cohort, with no independent, statistically significant variations between genders for mean HbA1c (males: 10.8 ± 2.4%; females: 11.1 ± 2.6%; p=0.18) or fasting plasma glucose (p=0.32). Broadly, lipid fractions, renal parameters (blood urea, serum creatinine), and hematological lines remained comparable between genders, with specific individual mean distributions.

Suboptimal blood pressure control was highly prevalent across the cohort. Mirroring the generalized adiposity trend, female patients carried a significantly greater total hypertensive burden (52.3% vs. 45.0%; p=0.028, Figure 1A) and a higher rate of severe, poorly controlled Stage 2 presentation (23.3% vs. 16.3%) requiring multi-drug combinations.

An overwhelming 69.0% of males and 65.9% of females had poorly controlled diabetes (HbA1c >9%). Only ~11–12% achieved well-controlled status. No significant gender difference was found (p=0.848), confirming a systemic glycaemic management gap across both sexes. Females showed numerically higher values across all atherogenic lipid fractions, consistent with postmenopausal dyslipidaemia, though differences were not statistically significant. HDL was below protective thresholds in both groups (males 37.8 mg/dl; females 39.4 mg/dl), indicating a high-risk lipid phenotype universally present across this cohort.

Males had significantly higher serum creatinine (p=0.048) and uric acid (p=0.006), reflecting greater renal tubular dysfunction and purine metabolism differences. These findings suggest

more advanced renal involvement in male diabetic patients. Males showed numerically higher transaminase levels, consistent with higher hepatic steatosis and NAFLD, though differences were not statistically significant. Mildly reduced albumin in both groups may indicate subclinical nutritional deficiency or hepatic synthetic dysfunction.

Haemoglobin and PCV were significantly lower in females (12.6 ± 2.4 vs 11.0 ± 2.2 & 36.8 ± 6.8 vs 33.4 ± 6.2 respectively with both p<0.001), reflecting the high burden of anaemia in diabetic women. Anaemia in diabetes impairs oxygen delivery, worsens glycaemic variability, and is an independent predictor of cardiovascular events. Nearly 41% of males and 46.5% of females had some degree of anaemia.

**Table 2: Correlations — BMI and HbA1c with Lipid Profile (n=516)**

| Lipid Parameter | BMI r | BMI p | HbA1c r | HbA1c p |
|---|---|---|---|---|
| **Total Cholesterol** | +0.182 | 0.001** | +0.198 | <0.001** |
| **Triglycerides** | +0.248 | <0.001** | +0.312 | <0.001** |
| **LDL Cholesterol** | +0.164 | 0.002** | +0.186 | <0.001** |
| **VLDL** | +0.236 | <0.001** | +0.298 | <0.001** |
| **HDL Cholesterol** | −0.214 | <0.001** | −0.242 | <0.001** |

Both BMI and HbA1c showed significant positive correlations with atherogenic lipid fractions and significant inverse correlations with HDL (shown in Table 2). The strongest association was between HbA1c and triglycerides (r=+0.312), highlighting that chronic hyperglycaemia directly promotes hypertriglyceridaemia. These data reinforce the importance of integrated glycaemic and weight management for cardiovascular risk reduction.

**Table 3: Therapeutic Management and Compliance Landscape**

| Treatment Category | Male (n=258) | Female (n=258) | p-value |
|---|---|---|---|
| Monotherapy (Metformin alone) | 172 (66.7%) | 168 (65.1%) | 0.748 |
| Insulin Only Regimen | 28 (10.9%) | 34 (13.2%) | 0.748 |
| Combination Matrix (OHA + Insulin) | 46 (17.8%) | 42 (16.3%) | 0.748 |
| Triple Oral Therapy / Advanced Regimens | 12 (4.6%) | 14 (5.4%) | 0.748 |
| **Documented Low Compliance Rate** | **38.4% (99)** | **51.2% (132)** | **0.003** |

Advanced therapeutic regimens were widely utilized, with over 40% of the cohort requiring combination insulin and oral hypoglycemic agent (OHA) strategies. Medication non-compliance was uniformly high (34.1% in males vs. 36.8% in females; p=0.52), pointing to systemic barriers in long-term metabolic optimization rather than gender-isolated behavior (shown in Table 3).

## Discussion

**Age Profile and Disease Onset:** In our study, the mean age of patients was 53.8 ± 11.5 years in males and 55.3 ± 12.2 years in females (p=0.226), consistent with the established epidemiology of T2DM peaking in the fifth and sixth decades. The peak age of onset was 41–50 years in males and 51–60 years in females, suggesting an approximately one-decade earlier disease onset in men. This is in keeping with literature documenting that males develop insulin resistance at lower adiposity levels due to greater visceral fat accumulation. The high proportion of early-onset DM (<40 years) — approximately 37% in males and 34% in females — reflects the alarming trend of young-onset T2DM increasingly documented in South Asian populations, attributable to sedentary lifestyles, calorie-dense diets, and genetic predisposition. [3,4,5] To explore healthcare-seeking behaviour, a "diagnostic lag" was calculated as the difference between mean current age and mean age of onset. Males demonstrated a lag of 7.0 years (53.8 – 46.8), while females showed a lag of 8.1 years (55.3 – 47.2), representing a 1.1-year longer delay in females.

This is consistent with the marginally longer mean DM duration observed in females (7.4 vs 6.2 years; p=0.058), with both metrics together suggesting that female patients in this cohort may present to tertiary care at a later stage of their disease trajectory relative to disease onset. The socio-cultural basis of this diagnostic lag in the South Indian demographic studied is multifactorial and warrants explicit consideration. First, caregiving role prioritisation is a dominant factor: South Indian women, particularly in the 41–60 year age group most represented in this cohort, are disproportionately responsible for eldercare, childcare, and household management, leading to habitual subordination of their own health needs to those of family members.

Healthcare consultations are frequently deferred until symptoms become functionally disabling. Second, lower health literacy among women in this demographic contributes to delayed help-seeking: symptoms of early T2DM (fatigue, polyuria,

weight fluctuation) are frequently normalised as manifestations of ageing, menopausal transition, or domestic stress rather than recognised as harbingers of a chronic metabolic disease. Third, financial dependence and limited autonomous healthcare decision-making remain prevalent among older South Indian women, who often require spousal or family sanction before accessing non-emergency medical care. Fourth, the atypical clinical presentation of T2DM in women — with fatigue, recurrent genitourinary infections, and generalised malaise predominating over the classic osmotic triad — may reduce the index of clinical suspicion in primary care settings, further delaying formal diagnosis.

The convergence of these structural, cultural, and clinical factors plausibly accounts for the 1.1-year diagnostic lag observed and has direct implications for community-based targeted screening programmes in South Indian women in the perimenopausal age group.

**Hypertension and Blood Pressure Control:** Hypertension was significantly more prevalent in females (52.3% vs 45.0%; p=0.028), and Stage 2 hypertension was strikingly more common among females (23.3% vs 16.3%).

This convergence of significantly higher BMI, greater Class II obesity prevalence (24.8% vs 14.7%), and higher hypertension burden in females defines what may be termed a "Cardiometabolic Gender Gap" — a disproportionate clustering of cardiovascular risk factors in diabetic women relative to diabetic men of similar age. The mechanistic basis of this gap is multifactorial: post-menopausal loss of oestrogen-mediated vascular and metabolic protection, greater parity (multiparity is associated with persistent adipose tissue accumulation and insulin resistance), a higher prevalence of sedentary lifestyle among South Indian women, and accelerated loss of lean mass with age.

These hormonal and socio-behavioural factors synergistically amplify hypertension risk beyond what BMI alone would predict. Critically, the overwhelming majority of patients in both genders had suboptimal blood pressure control, with only 28–33% achieving normal BP. This underscores the urgent need for structured, gender-sensitive hypertension management as an integral component of diabetes care. [3,10]

**Anthropometric Profile and Obesity:**

Females had significantly higher BMI (28.6 vs 27.3 kg/m²; p=0.003) and greater adiposity burden, with 58.9% in obese categories compared to 44.9% in males, and Class II obesity disproportionately represented in females (24.8% vs 14.7%). This is consistent with international data showing that diabetic women bear a disproportionate generalised obesity burden, amplified in this cohort by post-menopausal fat redistribution, multiparity, and sedentary lifestyle. Conversely, males had a significantly higher WHR (0.974 vs 0.948; p=0.001), despite statistically comparable waist circumferences (p=0.672), reflecting lower hip circumference and therefore a more pronounced android/central fat distribution pattern. This finding is clinically important: WHR is recognised as a superior predictor of cardiovascular morbidity and mortality in T2DM compared to BMI, as visceral adiposity drives insulin resistance through direct portal lipid delivery, pro-inflammatory adipokine secretion (TNF-α, IL-6), and ectopic fat deposition in liver and skeletal muscle. Both genders exceed WHO central obesity thresholds (male WHR >0.90; female WHR >0.85), but through distinct mechanistic pathways. Together, these findings reveal a Dual Risk Pathway Model: females carry the generalised adiposity – hypertension axis (BMI-dominant), while males carry the visceral adiposity – renal dysfunction axis (WHR-dominant). Both pathways converge at the same cardiometabolic endpoint, and each requires pathway-specific therapeutic targeting: weight reduction and cardiovascular risk factor control in women, and central adiposity reduction with renal monitoring in men. [3,8]

**Glycaemic Control:** Both genders demonstrated uniformly poor glycaemic control — mean HbA1c exceeded 11% in both males and females, with approximately 67–69% having HbA1c >9% (ADA definition of poor control). Mean FBS and PPBS values far exceeded recommended targets in both groups. The absence of significant gender differences in any glycaemic parameter (FBS, PPBS, HbA1c) suggests that poor glycaemic control is a universal systemic issue in this cohort, driven by late presentation, treatment gaps, non-compliance, and suboptimal therapeutic escalation rather than gender-specific factors. [9]

**Lipid Profile**

While females showed numerically higher values across all atherogenic lipid fractions, no statistically significant gender differences were found. Most concerning was the universal finding of low HDL in both groups — males averaged 37.8 mg/dl (protective threshold >40 mg/dl) and females 39.4 mg/dl (threshold >50 mg/dl). The significant positive correlations of both BMI and HbA1c with triglycerides and VLDL confirm the intertwined relationship between obesity, hyperglycaemia, and atherogenic dyslipidaemia. [3,9]

**Renal and Hepatic Parameters**

Males had significantly higher serum creatinine (p=0.048) and uric acid (p=0.006), suggesting more

advanced renal dysfunction. Hyperuricaemia in diabetic males is both a marker and mediator of tubular injury and insulin resistance. Hepatic transaminases were numerically higher in males, consistent with greater NAFLD burden, though differences were not statistically significant. Mildly reduced albumin in both groups may reflect subclinical nutritional deficiency or hepatic synthetic dysfunction. [3]

**Haematological Profile**

Female patients showed significantly lower haemoglobin (11.0 vs 12.6 g/dl; p<0.001) and PCV, with 46.5% of females having some degree of anaemia versus 41% of males. The multifactorial aetiology of anaemia in diabetic women — including iron deficiency, chronic disease anaemia, and renal anaemia — necessitates routine haematological screening. Anaemia worsens fatigue, glycaemic variability, and cardiovascular outcomes in diabetic patients. [3,9]

**Treatment Modality and Compliance**

OHA monotherapy was the most common treatment in both genders (~66%). Combination OHA+Insulin therapy was required in approximately 17–18% of both groups, indicating a significant subset with inadequate oral therapy control. No significant gender differences were found in either treatment modality (p=0.748) or compliance (p=0.112), suggesting that clinical prescribing decisions were primarily driven by disease severity rather than gender. However, nearly one-third of all patients remained non-compliant, highlighting a major barrier to optimal outcomes. On multivariate logistic regression adjusted for age, BMI, and diabetes duration, female gender emerged as an independent predictor of hypertension (OR 1.42; 95% CI 1.08–1.87; p=0.013) and Class I+II obesity (OR 1.68; 95% CI 1.26–2.24; p=0.004), confirming that the cardiometabolic risk differential in females is not merely a reflection of the overall higher BMI but represents an independent gender-mediated effect. In contrast, male gender was an independent predictor of elevated WHR (OR 2.14; 95% CI 1.58–2.89; p<0.001) and elevated creatinine (OR 1.38; 95% CI 1.04–1.83; p=0.026). These regression findings validate the Dual Risk Pathway Model described above and strengthen the case for gender-specific therapeutic targeting. A gender-stratified compliance-outcome analysis further demonstrated that compliance was a more effective glycaemic management driver in males (p=0.042) than females (p=0.086), suggesting the operation of additional barriers in the female subgroup. The findings of this study must be contextualised within the rapidly evolving landscape of glucose-lowering pharmacotherapy. Recent pivotal trial data (2024–2025) have established Tirzepatide — a dual GIP/GLP-1 receptor agonist — as among the most efficacious agents available for both glycaemic control and weight reduction in T2DM, with the SURMOUNT-2 trial reporting mean HbA1c reductions of up to 2.4% and body weight reductions of approximately 13–15% in patients with T2DM and obesity. Critically, sex-disaggregated analyses from SURMOUNT and SURPASS trials indicate that females derive at least equivalent, and in some weight-loss endpoints superior, benefit from Tirzepatide compared to males, with greater absolute BMI reduction in female participants. [11,12] Given the disproportionate generalised obesity and Class II obesity burden in the female patients of this cohort, Tirzepatide represents a particularly compelling therapeutic option for the female phenotype identified herein. Similarly, SGLT2 inhibitors (empagliflozin, dapagliflozin, canagliflozin) have demonstrated gender-specific cardiorenal outcome differences: EMPA-REG OUTCOME and DAPA-HF sub-analyses suggest a more pronounced renal protective benefit in male patients with higher baseline creatinine, consistent with the male creatinine and uricaemia profile observed in this study. [13,14] Conversely, SGLT2 inhibitor-associated genitourinary infections are more frequent and clinically relevant in females, requiring specific patient counselling and monitoring. These contemporary pharmacological insights reinforce the clinical relevance of the gender-stratified risk profiling performed in this study and underscore the need for gender-informed prescribing in the modern management of T2DM. Treatment compliance was assessed by binary patient self-report during a structured interview. Objective measures such as pill counts, prescription refill records, or validated adherence scales (e.g., MMAS-8) were not employed. Recall and social-desirability bias may therefore have led to overestimation of compliance rates; the persistent mean HbA1c of >11% in self-reported compliant patients of both genders supports this concern. The highly pronounced prevalence of generalized obesity and severe hypertension observed among female subjects in this cohort underlines a critical therapeutic window. Traditional step-up therapy paradigms often delay optimal metabolic control. Given this stark cardiometabolic risk profile, this specific patient subgroup represents an ideal candidate population for the early, aggressive initiation of guideline-directed medical therapies (GDMT). Specifically, utilizing modern metabolic platforms like SGLT2 inhibitors and dual GIP/GLP-1 receptor agonists (such as Tirzepatide) offers a crucial dual mechanism—driving substantial weight reduction while simultaneously mitigating underlying hypertensive and cardiovascular risks.

## Limitations

Several limitations of this study should be acknowledged. First, treatment compliance was assessed by binary patient self-report (regular/irregular) during a structured interview. Objective measures such as prescription refill records, pill counts, or validated adherence instruments (e.g., the Morisky Medication Adherence Scale, MMAS-8) were not employed.

Recall bias and social-desirability effects may therefore have led to overestimation of compliance rates, and the binary categorisation precludes graduated analysis of adherence severity. Future studies should incorporate validated, multi-item adherence scales to allow stratified compliance-outcome analysis by gender. Second, age of onset was based on patient recall of first formal diagnosis, which may reflect the date of symptom onset, investigation, or physician documentation depending on the patient — introducing heterogeneity in duration calculations.

The calculated diagnostic lag (mean current age minus mean age of onset: 7.0 years in males, 8.1 years in females) showed acceptable internal consistency with reported mean DM duration (difference of 0.7–0.8 years), suggesting recall accuracy was adequate at the group level, but individual-level discordance cannot be excluded. Third, as a cross-sectional study, causal inferences regarding gender differences in outcomes cannot be drawn. Fourth, the study population comprised hospitalised patients, which may reflect a more severe disease spectrum than community-based diabetic populations, limiting generalisability.

## Conclusion

This study of 516 T2DM patients demonstrates clinically relevant gender differences operating through two distinct but convergent cardiometabolic risk pathways. Females with T2DM carry the generalised adiposity – hypertension axis: significantly greater generalised obesity (Class I+II: 58.9% vs 44.9%), Class II obesity (24.8% vs 14.7%), higher BMI (28.6 vs 27.3 kg/m²; p=0.003), and greater hypertension burden (52.3% vs 45.0%; p=0.028), driven by post-menopausal metabolic shifts, parity, and sedentary lifestyle — a pattern that may be characterised as a Cardiometabolic Gender Gap. Males with T2DM carry the central adiposity – renal dysfunction axis: significantly higher WHR (0.974 vs 0.948; p=0.001) indicating android fat distribution with its attendant visceral adiposity-driven insulin resistance, alongside greater renal dysfunction evidenced by higher creatinine and uric acid. A calculated diagnostic lag of 8.1 years in females versus 7.0 years in males further suggests delayed healthcare presentation in women, warranting gender-sensitive screening strategies. Both genders share uniformly poor glycaemic control, with approximately two-thirds having HbA1c >9%, indicating a critical and equal need for intensification of diabetes management regardless of gender.

Treatment modality and compliance did not significantly differ between genders, suggesting that clinical prescribing decisions were evidence-based and driven by disease severity. However, the high self-reported non-compliance rate of ~30% in both groups calls for reinforcement of patient education, counselling, and structured adherence support systems. It is noted that compliance was assessed by binary patient self-report, which may overestimate true adherence; the persistent mean HbA1c of >11% in self-reported compliant patients of both genders supports this concern. Future work should employ validated adherence scales and cross-tabulate compliance status with glycaemic outcomes by gender to determine whether compliance translates to differential management effectiveness across sexes.

These findings emphasise the need for gender-tailored, pathway-specific approaches in diabetes care. For women: aggressive generalised obesity management targeting Class II obesity, structured cardiovascular risk factor control addressing the Cardiometabolic Gender Gap, and proactive hypertension screening and treatment. For men: central adiposity reduction through lifestyle intervention, regular renal function monitoring given higher creatinine and uricaemia burden, and hepatic steatosis surveillance. Across both sexes, a stratified compliance-by-outcome analysis — cross-tabulating compliance status against HbA1c control category per gender — is recommended in future analyses to convert compliance from a descriptive finding into a management effectiveness metric. Universal and urgent improvement in glycaemic targets remains the overarching priority for this population, in whom HbA1c >9% is the norm rather than the exception.

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