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Association of Comorbidities in Female Patients with Type 2 Diabetes Mellitus

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Abstract

Type 2 diabetes mellitus (T2DM) disproportionately affects women, with comorbidities exacerbating complications. Understanding their prevalence and patterns is crucial for effective management, especially in resource-constrained settings like Bangladesh, where gender-specific data remain scarce. A cross-sectional, observational study was conducted in the Department of Endocrinology, Mymensingh Medical College Hospital, Mymensingh, Bangladesh, between July 2021 and June 2022, to assess the prevalence and patterns of comorbidities among female type 2 diabetes mellitus patients, focusing on their association with demographic and clinical factors. A total of 110 females diagnosed with T2DM for ≤5 years, using oral anti-diabetic drugs (OADs) were included. Hospitalized patients, insulin users, and type 1 diabetes patients were excluded. Data was collected via patient interviews and prescription reviews. The mean age of the patients was 51.2±8.9 years. A high prevalence of comorbidities was observed: hypertension (64.5%), dyslipidemia (52.7%), obesity (17.3%), and hypothyroidism (13.6%). Patients ≥50 years had significantly higher hypertension (72.0% vs. 45.2%, p=0.002) and dyslipidemia rates (58.7% vs. 38.1%, p=0.013). Medication adherence was suboptimal in 42.7%, primarily due to cost (44.7%). Age ≥50 years (OR=2.0), rural residence (OR=1.6), and low education (OR=2.2), all of those factors significantly predicted comorbidities (p<0.05). Metformin use was universal, with frequent prescriptions for anti-hypertensive agents (64.5%) and statins (52.7%). Female patients with type 2 DM face a high burden of comorbidities, driven by age, rural residence, and low education levels. Improved access to affordable medications, integrated mental health care, and targeted education programs are essential to reduce disparities in diabetes management.

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Introduction

Type 2 diabetes mellitus (T2DM) is a global epidemic, affecting approximately 463 million adults worldwide, with projections rising to 700 million by 2045.[1] Women with T2DM face unique challenges, including higher risks of cardiovascular complications and poorer glycemic control compared to men.[2,3] This disparity is attributed to biological factors (e.g., hormonal fluctuations) and socio-cultural determinants (e.g., limited healthcare access) prevalent in low-resource settings like Bangladesh.[4,5] Comorbidities such as hypertension and dyslipidemia frequently coexist with T2DM, accelerating micro- and macrovascular complications.[6,7] In South Asia, these comorbidities are notably high due to genetic predisposition, sedentary lifestyles, and diets rich in refined carbohydrates.[8-10] However, lack of gender-specific comorbidity profiles in Bangladesh hinders targeted interventions, despite evidence that women are less likely to achieve treatment goals.[11,12] The

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burden of polypharmacy further complicates management. Type 2 DM in female patients often require multiple medications for comorbidities, increasing the risk of adverse drug reactions and non-adherence.[13,14] A meta-analysis revealed that polypharmacy (≥5 drugs) is 1.5 times more common in women with type 2 DM than men, exacerbating treatment costs and hospitalizations.[15] In Bangladesh, where out-of-pocket healthcare expenditures are high, this poses a significant economic strain.[16] Existing studies on T2DM comorbidities in Bangladesh primarily focus on urban populations or combine data across genders.[17,18] However, rural women, who constitute 70% of Bangladesh's female population, face additional barriers like limited diabetes education and delayed diagnosis.[19,20] A study done in Mymensingh district of Bangladesh reported that only 32% of rural women with type 2 DM received regular screenings for hypertension or dyslipidemia.[21] These gaps underscore the need for localized, gender-stratified research to inform policy and clinical practice.

Methods

This cross-sectional, observational study was conducted in the department of Endocrinology, Mymensingh Medical College Hospital, Mymensingh, Bangladesh, from July 2021 to June 2022. We enrolled 110 female type 2 DM patients aged 30-70 years diagnosed within the past 5 years and using oral anti-diabetic medications. Exclusion criteria included: type 1 diabetes, insulin use, hospitalization, or refusal to participate. Data collection involved structured interviews, medical record reviews, and prescription analysis. We recorded demographic information (age, education, socioeconomic status), clinical parameters (BMI, blood pressure, HbA1c), and documented comorbidities (hypertension, dyslipidemia) through patient history and medication review. Polypharmacy was defined as the concurrent use of ≥5 medications.

Statistical analysis was conducted using Statistical Package for Social Sciences (SPSS) version 22.0 for Windows. Continuous variables were presented as mean±SD, and categorical variables as frequency and percentage. We employed Chi-square tests for association analysis and logistic regression to identify comorbidity predictors, considering p-value <0.05 statistically significant.

Ethical clearance was obtained from the Institutional Review Board of Mymensingh Medical College Hospital, Mymensingh, Bangladesh. Written informed consent was obtained from all participants prior to enrollment. Data confidentiality was maintained through anonymized coding and secure storage.

Results

The study included 110 female T2DM patients with a mean age of 51.2 ± 8.9 years. The majority (68.2%) were aged 50 years or older, and most participants (61.8%) resided in rural areas. Educational attainment showed 40.9% had primary education, followed by secondary (37.3%) and no formal education (21.8%) (Table-I).

Table-I: Sociodemographic characteristics of participants (n=110)

Characteristic	Frequency (Percentage)
Age (Mean ± SD)	51.2 ± 8.9
Age 30-49 years	35 (31.8)
Age ≥50 years	75 (68.2)
Rural residence	68 (61.8)
Urban residence	42 (38.2)
- No formal education	24 (21.8)
- Primary education	45 (40.9)
- Secondary education	41 (37.3)

Hypertension was the most prevalent comorbidity (64.5%, 95% CI 55.1–73.2), followed by dyslipidemia (52.7%, 95% CI 43.3–61.9). Obesity was present in 17.3% and hypothyroidism was found in 13.6% of participants (Table-II). Age-stratified analysis revealed significantly higher rates of hypertension (72.0% vs. 45.2%, p=0.002) and dyslipidemia (58.7% vs. 38.1%, p=0.013) in patients aged ≥50 years compared to younger participants, with no significant difference in obesity (18.7% vs. 14.3%, p=0.572) (Table-III).

Table-II: Prevalence of comorbidities among study participants (n=110)

Comorbidity	Frequency (Percentage)	95% CI
Hypertension	71 (64.5)	55.1–73.2
Dyslipidemia	58 (52.7)	43.3–61.9
Obesity	19 (17.3)	10.9–25.8
Hypothyroidism	15 (13.6)	8.0-21.4

Table-III: Age-stratified prevalence of comorbidities

Comorbidity	Age ≥50 (n=75) Frequency (Percentage)	Age <50 (n=35) Frequency (Percentage)	p-value
Hypertension	54 (72.0)	17 (45.2)	0.002^{S}
Dyslipidemia	44 (58.7)	14 (38.1)	0.013^{S}
Obesity	14 (18.7)	5 (14.3)	0.572^{NS}
Hypothyroidism	12 (16.0)	3 (8.6)	0.306^{NS}

Chi-square was used to reach p-value; S=significant. NS=not significant

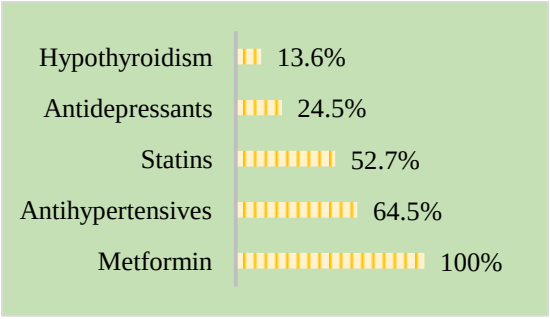

Fig. 1: Medication use among participants (n=110)

All participants used metformin, while antihypertensives (64.5%) and statins (52.7%) were the most common additional medications. Antidepressants were used by 24.5% of participants (Fig. 1). Logistic regression identified age ≥50 years (OR=2.0, 95% CI 1.2–3.3, p=0.004), rural residence (OR=1.6, 95% CI 1.0–2.6, p=0.048), and low education level (OR=2.2, 95% CI 1.3–3.7, p=0.002) as significant predictors of comorbidities (Table-IV). Medication adherence was optimal (≥80%) in 57.3% of participants, while 42.7% reported suboptimal adherence (Fig. 2). Reasons for suboptimal adherence were: cost (44.7%), side-effects (29.8%) and forgetfulness (25.5%) (Table-V).

Table-IV: Predictors of comorbidities (logistic regression)

Variables	OR	95% CI	p-value
Age ≥50 years	2	1.2–3.3	0.004
Rural residence	1.6	1.0–2.6	0.048
Low education	2.2	1.3–3.7	0.002

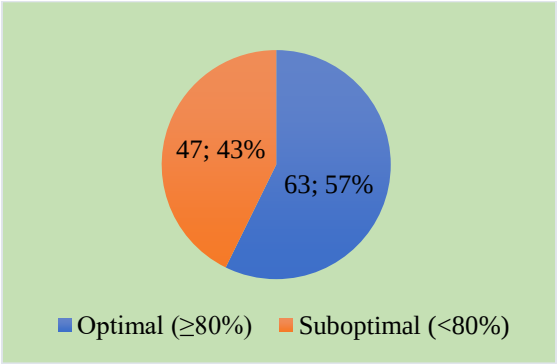

Fig. 2: Medication adherence patterns (n=110)

Table-V: Reasons for suboptimal adherence (n=47)

Reason	Frequency	Percentage
Cost	21	44.7
Side-effects	14	29.8
Forgetfulness	12	25.5

Discussion

The present study evaluated the association of comorbidities in female patients with type 2 diabetes mellitus (T2DM), revealing a high burden of hypertension, dyslipidemia, and obesity among the participants. Our findings align with previous research indicating that women with T2DM are disproportionately affected by metabolic and psychological comorbidities.[22,23] The prevalence of hypertension (64.5%) and dyslipidemia (52.7%) in our cohort was consistent with global reports, where cardiovascular risk factors are frequently observed in diabetic women due to hormonal and metabolic influences.[24,25] The high prevalence of these conditions underscores the need for aggressive cardiovascular risk management in this population, particularly given the well-documented gender disparities in cardiovascular outcomes among diabetic patients.[26] Age emerged as a significant predictor of comorbidities, with patients aged ≥50 years exhibiting higher rates of hypertension (72.0%) and dyslipidemia (58.7%) compared to younger individuals. This finding supports existing literature suggesting that postmenopausal women with type 2 DM face an elevated risk of cardiovascular complications due to declining estrogen levels, which exacerbate insulin resistance and endothelial dysfunction.[27,28] The lack of a significant age-related difference in obesity prevalence may reflect the complex interplay between aging, hormonal changes, and metabolic factors in diabetic populations.[29] Interestingly, our results contrast with some studies showing increasing obesity prevalence with age, suggesting potential regional or ethnic variations in body composition changes among diabetic women.[30] The association between rural residence and increased comorbidity risk highlights significant healthcare disparities. Rural populations often face challenges in accessing specialized diabetes care and education programs, which may contribute to poorer metabolic control and higher complication rates.[31,32] These findings emphasize the urgent need for targeted interventions in rural areas, including mobile health clinics and community-based diabetes education programs. The strong association between low education levels and comorbidity risk (OR=2.2) further supports the crucial role of health literacy in diabetes management.[33] Previous studies have demonstrated that patients with lower education levels often have poorer understanding of disease management principles and reduced access to preventive care services.[34] Medication adherence patterns in our study revealed gaps in treatment continuity, with 42.7% of participants reporting suboptimal adherence. The primary reported barriers were: cost (44.7%), side-effects (29.8%), and forgetfulness (25.5%), which mirror the findings from other low- and middle-income settings.[35,36] The high proportion of cost-related non-adherence is particularly troubling, suggesting that current healthcare financing mechanisms may be inadequate for this vulnerable population. This finding calls for policy interventions to improve medication affordability, possibly through expanded insurance coverage or subsidized medication programs.[37] The relatively high rate of side effect-related discontinuation also suggests a need for better patient education about managing medication side effects and more frequent follow-up visits during treatment initiation.[38] The universal use of metformin (100%) in our cohort reflects its well-established position as first-line therapy for type 2 DM, consistent with current clinical guidelines.[39] However, the high prescription rates of antihypertensives (64.5%) and statins (52.7%) indicate that many patients in our study already required treatment for additional

cardiovascular risk factors. This pattern of polypharmacy presents both opportunities and challenges for diabetes management, as it may improve outcomes but also increase the risk of medication non-adherence and adverse drug interactions.[40]

This hospital-based study may not represent community-dwelling populations. Self-reported adherence data could introduce recall bias. The cross-sectional design limits causal inferences. Lack of advanced diagnostic tools (e.g., continuous glucose monitoring) may affect comorbidity assessment accuracy.

Conclusion

This study highlights a high comorbidity burden among Bangladeshi women with T2DM, particularly hypertension and dyslipidemia, strongly associated with older age and rural residence. The findings underscore urgent needs for integrated care models addressing both metabolic and mental health aspects in this population. Socioeconomic factors, especially cost-related medication non-adherence, require targeted interventions. These results emphasize the necessity of gender-specific diabetes management strategies in low-resource settings to mitigate complications and improve quality of life. Our hospitals should implement routine comorbidity screening in diabetes clinic and develop subsidized medication programs to reduce cost barriers. Moreover, we should train healthcare workers in gender-sensitive care approaches.

References

1. *Ogle GD, James S, Dabelea D, Pihoker C, Svennson J, Maniam J, et al. Global estimates of incidence of type 1 diabetes in children and adolescents: Results from the International Diabetes Federation Atlas, 10th edition. Diabetes Res Clin Pract. 2022;183:109083.*
2. *Kautzky-Willer A, Harreiter J, Pacini G. Sex and gender differences in risk, pathophysiology and complications of type 2 diabetes mellitus. Endocr Rev. 2016;37(3):278-316.*
3. *Peters SAE, Woodward M. Sex differences in the burden and complications of diabetes. Curr Diab Rep. 2018;18(6):33.*
4. *Akter S, Rahman MM, Abe SK, Sultana P. Prevalence of diabetes and prediabetes and their risk factors among Bangladeshi adults: A nationwide survey. Bull World Health Organ. 2014;92(3):204-13.*
5. *Chowdhury MA, Uddin MJ, Khan HM, Haque MR. Type 2 diabetes and its correlates among adults in Bangladesh: A population based study. BMC Public Health. 2015;15:1070.*
6. *Chatterjee S, Khunti K, Davies MJ. Type 2 diabetes. Lancet. 2017;389(10085):2239-2251.*
7. *Yun JS, Ko SH. Current trends in epidemiology of cardiovascular disease and cardiovascular risk management in type 2 diabetes. Metabolism. 2021;123:154838.*
8. *Anjana RM, Pradeepa R, Deepa M, Datta M, Sudha V, Unnikrishnan R, et al. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: phase I results of the Indian Council of Medical Research-INdia DIABetes (ICMR-INDIAB) study. Diabetologia. 2011;54(12):3022-7.*
9. *Jayawardena R, Ranasinghe P, Byrne NM, Soares MJ, Katulanda P, Hills AP. Prevalence and trends of the diabetes epidemic in South Asia: A systematic review and meta-analysis. BMC Public Health. 2012;12:380.*

10. Hussain A, Vaaler S, Sayeed MA, Mahtab H, Ali SM, Khan AK. Type 2 diabetes and impaired fasting blood glucose in rural Bangladesh: A population-based study. Eur J Public Health. 2007;17(3):291-6.

11. Afroz A, Ali L, Karim MN, Alramadan MJ, Alam K, Magliano DJ, Billah B. Glycaemic control for people with type 2 diabetes mellitus in Bangladesh – An urgent need for optimization of management plan. Sci Rep. 2019;9(1):10248.

12. Khanam MA, Lindeboom W, Razzaque A, Niessen L, Smith W, Milton AH. Undiagnosed and uncontrolled hypertension among the adults in rural Bangladesh: Findings from a community-based study. J Hypertens. 2015;33(12):2399-406.

13. Masnoon N, Shakib S, Kalisch-Ellett L, Caughey GE. What is polypharmacy? A systematic review of definitions. BMC Geriatr. 2017;17(1):230.

14. Dobrică EC, Găman MA, Cozma MA, Bratu OG, Pantea Stoian A, Diaconu CC. Polypharmacy in type 2 diabetes mellitus: Insights from an internal medicine department. Medicina (Kaunas). 2019;55(8):436.

15. D'Souza MS, Karkada SN, Hanrahan NP, Venkatesaperumal R, Amirtharaj A. Do perceptions of empowerment affect glycemic control and self-care among adults with type 2 diabetes? Glob J Health Sci. 2015;7(5):80-90.

16. Rahman MM, Gilmour S, Saito E, Sultana P, Shibuya K. Health-related financial catastrophe, inequality and chronic illness in Bangladesh. PLoS One. 2013;8(2):e56873.

17. Islam JY, Zaman MM, Bhuiyan MR, Haq SA, Ahmed S, Al-Qadir AZ. Prevalence and determinants of hyperglycaemia among adults in Bangladesh: Results from a population-based national survey. BMJ Open. 2019;9(7):e029674.

18. Hira R, Miah MAW, Akash DH. Prevalence of type 2 diabetes mellitus in rural adults (≥31years) in Bangladesh. Faridpur Med Coll J. 2018;13(1):20-3.

19. Rahman M, Zaman MM, Islam JY, Chowdhury J, Ahsan HN, Rahman R, Hassan M, Hossain Z, Alam B, Yasmin R. Prevalence, treatment patterns, and risk factors of hypertension and pre-hypertension among Bangladeshi adults. J Hum Hypertens. 2018;32(5):334-48.

20. Rahman M, Nakamura K, Seino K, Kizuki M. Intimate partner violence and use of reproductive health services among married women: Evidence from a national Bangladeshi sample. BMC Public Health. 2012;12:913.

21. Biswas T, Islam SMS, Islam A. Prevention of hypertension in Bangladesh: A review. J Med. 2016;17(1):30-5.

22. Manrique-Acevedo C, Chinnakotla B, Padilla J, Martinez-Lemus LA, Gozal D. Obesity and cardiovascular disease in women. Int J Obes (Lond). 2020;44(6):1210-26.

23. Rais NA. Smart and functional interfaces for sensitive SPR biosensing towards biomedical applications. [Thesis]. Riverside, CA: UC Riverside; 2019.

24. Kim C. Management of cardiovascular risk in perimenopausal women with diabetes. Diabetes Metab J. 2021;45(4):492-501.

25. Teliti M, Cogni G, Sacchi L, Dagliati A, Marini S, Tibollo V, et al. Risk factors for the development of micro-vascular complications of type 2 diabetes in a single-centre cohort of patients. Diab Vasc Dis Res. 2018;15(5):424-32.

26. Gupta R, Sharma M, Goyal NK, Bansal P, Lodha S, Sharma KK. Gender differences in 7 years trends in cholesterol lipoproteins and lipids in India: Insights from a hospital database. Indian J Endocrinol Metab. 2016;20(2):211-8.

27. Yu L, Li Z, Yang R, Pan G, Cheng Q, He Y, et al. Impaired sensitivity to thyroid hormones is associated with elevated blood glucose in coronary heart disease. Front Endocrinol (Lausanne). 2022;13:895843.

28. Bellary S, Kyrou I, Brown JE, Bailey CJ. Type 2 diabetes mellitus in older adults: Clinical considerations and management. Nat Rev Endocrinol. 2021;17(9):534-48.

29. Silva-Tinoco R, Castillo-Martínez L, Cuatecontzi-Xochitiotzi T, De la Torre-Saldaña V, Rosales-Rosas D, González-Cantú A, et al. Bioimpedance phase angle and body composition parameters associated with number of diabetes-related

complications. Rev Mex Endocrinol Metab Nutr. 2021;8:57-64.

30. *Khan M. Investigation of Wnt signaling in the biopathogenesis of myocardial infarction. [Thesis]. Montreal, Canada: McGill University; 2022.*
31. *Osei E, Amu H, Appiah-Kubi P, Konlan KD, Mumuni H, Orish VN, et al. Prevalence and predictors of selected risk factors of non-communicable diseases in Ghana: Evidence from a sub-national survey. J Glob Health Sci. 2021;3(2):e13.*
32. *Ali AM. Assessment of factors associated with health outcomes and access to prescription medications in patients with diabetes treated at federally qualified health centers. [Thesis]. Athens, GA: University of Georgia; 2021.*
33. *Deischinger C, Dervic E, Leutner M, Kosi-Trebotic L, Klimek P, Kautzky A, et al. Diabetes mellitus is associated with a higher risk for major depressive disorder in women than in men. BMJ Open Diabetes Res Care. 2020;8(1):e001430.*
34. *Roberts HA, Clark DA, Kalina C, Sherman C, Brislin S, Heitzeg MM, et al. To vax or not to vax: Predictors of anti-vax attitudes and COVID-19 vaccine hesitancy prior to widespread vaccine availability. PLoS One. 2022;17(2):e0264019.*
35. *Polonsky WH, Henry RR. Poor medication adherence in type 2 diabetes: Recognizing the scope of the problem and its key contributors. Patient Prefer Adherence. 2016;10:1299-307.*
36. *Fitzsimons D, Stępińska J, Kerins M, F Piepoli M, Hill L, Carson MA, Prescott E. Secondary prevention and cardiovascular care across Europe: A survey of European Society of Cardiology members' views. Eur J Cardiovasc Nurs. 2020;19(3):201-11.*
37. *Ipingbemi AE, Erhun WO, Adisa R. Pharmacist-led intervention in treatment non-adherence and associated direct costs of management among ambulatory patients with type 2 diabetes in southwestern Nigeria. BMC Health Serv Res. 2021;21(1):1000.*
38. *Zarotti N. The relationship between perceived control, depression, and medication adherence in people with Parkinson's disease. [Thesis]. Norwich, UK: University of East Anglia; 2022.*
39. *Blood AJ, Chang LS, Colling C, Stern G, Gabovitch D, Zelle D, et al. Type 2 diabetes disease and management patterns across a large, diverse healthcare system: Issues and opportunities for guideline-directed therapies. Am Heart J. 2025;282:114-24.*
40. *Pedowitz EJ, Abrams RMC, Simpson DM. Management of neuropathic pain in the geriatric population. Clin Geriatr Med. 2021;37(2):361-76.*