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Comorbid cardiovascular diseases and predictors among adults with type 2 diabetes in Bahir Dar city, Ethiopia: a multicentre hospital-based cross-sectional study

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ABSTRACT

Objective The burden of comorbid cardiovascular disease (CVD) and its preventable factors in type 2 diabetes is not well acknowledged in Ethiopia. Therefore, this study aimed to identify the magnitude of comorbidity of CVD and predictors among individuals with type 2 diabetes.

Design A multicentre hospital-based cross-sectional study.

Setting Bahir Dar city Administration Public Hospitals, Ethiopia.

Methods Data on comorbid CVDs among individuals with type 2 diabetes were collected through patient chart reviews. To identify predictors of CVDs in type 2 diabetes, information on lifestyle and psychosocial characteristics, medication and dietary adherence, and disease management status was collected using standardised questionnaires. Statistical analyses were performed using SPSS V.26. The level of statistical significance was set at p<0.05, with ORs and 95% CIs.

Results The participants' mean age (±SD) was 51.5±10.9 years. The overall prevalence of comorbid CVDs among type 2 diabetes was 27.9% (95% CI 23.6% to 32.3%). Factors that statistically predicted the occurrence of comorbid CVDs in type 2 diabetes were: age >60 years (adjusted ORs (AORs)=2.6, 95% CI 1.1 to 6.6), non-adherence to diabetes-friendly diet (AOR=4.0, 95% CI 1.9 to 8.2), low medication adherence (AOR=2.8, 95% CI 1.5 to 5.3), being overweight (AOR=5.3, 95% CI 2.9 to 9.8), and diabetes duration >10 years (AOR=3.7, 95% CI 1.7 to 8.1).

Conclusion Comorbid cardiovascular disease is a significant issue among type 2 diabetic patients. Its prevalence is higher in patients over 60 years of age, with modifiable factors identified as key contributors. Appropriate interventions are recommended, including educating type 2 diabetic patients on dietary regimens, medication adherence, weight management, and the benefits of timely healthcare for effective disease management.

STRENGTHS AND LIMITATIONS OF THE STUDY

⇒ The study provides primary data for local policymakers and relevant stakeholders.
⇒ The authors used standard and validated instruments to identify predictors of cardiovascular diseases (CVDs) in patients with type 2 diabetes.
⇒ Key clinical variables, including haemoglobin A1c levels and renal function tests, were not included in this study.
⇒ The study's findings were limited to individuals with type 2 diabetes mellitus; consequently, the conclusions may not extend to those with type 1 diabetes mellitus.
⇒ The cross-sectional nature of the study limits the ability to establish a causal relationship between the predictors and CVDs.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) and cardiovascular diseases (CVDs) are distinct yet interconnected chronic conditions, sharing common risk factors. Their combined impact creates a synergistic effect, substantially increasing the likelihood of illness and death. Comorbid CVD among individuals with type 2 diabetes further strains healthcare systems, from preventive measures to complex, long-term care management, especially in resource-limited nations like Ethiopia.[1 2] Studies demonstrate that people with type 2 diabetes often have other cardiovascular conditions, such as ischaemic heart disease, hypertensive heart disease, stroke, heart failure and peripheral artery disease. These co-occurring conditions are a substantial cause of death worldwide and greatly reduce quality of life.[3 4]

A systematic literature review of scientific evidence concluded that globally CVD affects approximately 32.2% of all persons with T2DM. CVD is a major cause of mortality among people with T2DM, accounting for approximately half of all deaths.

Coronary artery disease and stroke were the major contributors,[5 6] which increase the direct costs due to hospitalisation[7 8] and substantially affect individuals, their families and society at large.[9] In sub-Saharan Africa, CVD combined with T2DM was the second leading cause of non-communicable disease burden, accounting for more than a million disability-adjusted life years.[10] A recent systematic review and meta-analysis conducted on 2953 patients with T2DM in Ethiopia revealed that the prevalence of CVD was 37.26%.[11] The high prevalence of CVD in Ethiopia was reported in the Harari region (42.51%)[12] and Dilla city (25%).[13]

Evidence has demonstrated that CVD is a common comorbidity in T2DM because it shares similar and complex modifiable and non-modifiable predictors.[14–16] The two chronic conditions, CVD and T2DM, also have a bidirectional relationship, meaning that each condition can influence the development and progression of the other.[17] Evidence has demonstrated that T2DM contributes to CVD through mechanisms such as insulin resistance, dyslipidaemia, inflammation and endothelial dysfunction, which increase the risk of atherosclerosis and cardiovascular events. Conversely, CVD can exacerbate the progression of diabetes by impairing insulin sensitivity and promoting hyperglycaemia due to reduced blood flow to vital organs, including the pancreas. This bidirectional link worsens health outcomes, making managing both conditions critical.[18 19] T2DM confers a twofold increase in risk for a wide range of CVDs.[20] Prior studies have shown that unhealthy lifestyle factors, such as smoking, alcohol consumption, obesity (high body mass index (BMI)), unhealthy diet, physical inactivity, little health literacy and dyslipidaemia, are detrimentally related to an increased risk of T2DM, CVD and premature death.[10 12 13 19 21 22]

Previous studies have focused on the incidence and prevalence of CVD comorbidity in T2DM but have overlooked significant potential modifiable predictors.[12 13] Additionally, there is limited evidence on the comorbidity of CVDs in T2DM in Ethiopia, particularly in the study area, where sociodemographic health determinants may differ from those in other nations. Therefore, this study aimed to identify the magnitude of comorbidity with CVD and predictors among individuals with type 2 diabetes.

METHODS

Study setting and population

A cross-sectional study was carried out from 16 March to 15 April 2023, across three public hospitals in Bahir Dar city, Ethiopia: Felege Hiwot Comprehensive Specialized Hospital, Tibeb Ghion Referral Hospital, and Addis Alem Primary Hospital. These hospitals provide regular follow-up services for those who are diagnosed with chronic non-communicable conditions. Diabetes follow-up services are delivered by both nursing staff and doctors. Approximately 905 patients with type 2 diabetes attend monthly follow-up appointments across all healthcare facilities.

Our reference population includes all patients with T2DM who received follow-up care at any of the previously mentioned hospitals. Our study population included all adult patients with T2DM aged 18 years and above who had regular follow-ups and visited the outpatient clinics during the data collection period. Individuals with T2DM who were critically ill, those who could not complete the study questionnaire in one setting, or the data collectors who perceived them as too sick to participate were excluded. In addition, newly diagnosed patients with T2DM (≤6 months) were excluded from this study. Because of newly diagnosed T2DM patients are usually in the early stages of treatment, which may not involve lifestyle modifications or pharmacotherapy adherence of them. The variability in responses to initial treatment can introduce confounding factors, making it difficult to evaluate the true relationship between T2DM and CVD.

Sample size determination and sampling procedure

The sample size was determined using Epi Info V.7.2, which used double population proportions with 95% CI and 80% power statistical assumptions. The outcome and predictor variables were considered to maximise the sample size from the previous study.[12 13] Taking the OR and predictors of CVD in individuals with T2DM, the maximum sample size was determined to be 429, after accounting for a 10% non-response rate. The total sample size was allocated proportionally based on the number of patients from each hospital to select the study participants. The sampling frame was compiled from participant lists provided by each hospital's outpatient follow-up department. These patient records were systematically arranged according to their scheduled follow-up visit sequence. Respondents were then selected using a systematic sampling technique. The study employed systematic sampling with an interval of 2, calculated from the ratio of expected monthly participants (905) to the required sample size (429). Researchers systematically selected participants by interviewing every second patient arriving for follow-up care, continuing this pattern until reaching the predetermined sample size.

Data collection process and measurements

The questionnaire contains respondents' sociodemographic, lifestyle, psychosocial and clinical characteristics. The authors developed a participant chart review checklist by analysing a preliminary sample of medical records and drawing from prior studies.[12 13 23] Data were collected using a face-to-face interview questionnaire to acquire demographic information (online supplemental table 1) and lifestyle and psychosocial characteristics (online supplemental table 2).

Smoking status and alcohol consumption behaviours were evaluated using the 'WHO STEPS' questionnaire (online supplemental table 2). This tool provided an opportunity to assess both past and current smoking and

Table 1 Sociodemographic characteristics of patients with type 2 diabetes in Bahir Dar city public hospitals, Ethiopia, 2023 (n=416)

Variables	Categories	N (%)
Age in years	18–40	66 (15.9)
	60	225 (54.1)
	61–80	125 (30.0)
Sex	Male	220 (52.9)
	Female	196 (47.1)
Residence	Urban	357 (61.8)
	Rural	159 (38.2)
Marital Status	Married	180 (43.2)
	Widowed	100 (24.0)
	Divorced	78 (18.8)
	Single	58 (13.9)
Religion	Orthodox	210 (50.5)
	Muslim	114 (27.4)
	Protestant	92 (22.1)
Education status	Unable to read and write	87 (20.9)
	Read and write only	71 (17.1)
	Primary school	40 (9.6)
	Secondary school	52 (12.5)
	College and above	166 (39.9)
Occupation	Government employee	103 (24.8)
	Retired	37 (8.9)
	Housewife	79 (19.0)
	Merchant	63 (51.1)
	Farmer	75 (18.0)
	Private employee	59 (14.8)
Average monthly income	Above 2500 birr	187 (45)
	1000–2500 birr	151 (36.3)
	Less than 1000 birr	78 (18.8)
Healthcare cost coverage	Self Employee organisation	203 (48.8) 25 (6.0)
	Health insurance	181 (43.5)
	Non-governmental organisation	7 (1.7)

drinking habits, including the duration and quantity of tobacco and alcohol use. The current use of cigarettes and alcohol was defined as if the participants reported smoking and drinking any tobacco and alcohol product in the last 30 days. A past smoker and drinker was considered to have smoked any tobacco and drunk any alcohol product in the previous 12 months.[24 25] The authors used the Short-Form International Physical Activity Questionnaire (IPAQ) to assess participants' physical activity (online supplemental table 2). The IPAQ is reliable and valid, with a standard Cronbach's α coefficient of 0.80. Individuals with T2DM are to be considered physically active when the participants report one of the following: engage in vigorous physical activity for at least 3 days a week and accumulate a minimum of 1500 metabolic equivalent of task (MET) minutes per week or accumulate at least 3000 MET minutes per week through any combination of walking, moderate-intensity or vigorous-intensity activities over seven or more days or engage in moderate-intensity activity and/or walking for at least 30 min per day on five or more days a week.[25 26]

Depression among study participants was assessed through interviews using the nine-item Patient Health Questionnaire (PHQ-9), a tool known for its strong reliability and validity, with a standard Cronbach's α coefficient of 0.89. PHQ-9 is a criteria-based diagnostic tool for depressive disorders, and it is also a reliable and valid measure of depression severity. PHQ-9 Scores of 0–4 (minimal), 5–9 (mild), 10–14 (moderate), 15–19 (moderately severe) and 20–27 (severe) depression, respectively[25 27 28] (online supplemental table 3). Medication adherence was assessed using the Morisky Medication Adherence Scale-8 (MMAS-8), which demonstrated acceptable internal consistency with a Cronbach's α coefficient of 0.67. Based on the MMAS-8 Score, participants were considered to have good adherence if they scored 8, medium adherence if they scored 6–8 and low adherence if they scored <6 (online supplemental table 4).[29]

The researcher used the Perceived Dietary Adherence Questionnaire (PDAQ) to determine recommended dietary adherence. Based on the PDAQ Scale, patients were classified as adherent if they scored ≥4 and non-adherent if they scored <4 (online supplemental table 3).[25 30] The Oslo Social Support Questionnaire 3 (OSS-3) evaluated the level of social support, which demonstrates satisfying psychometric properties; Cronbach's α coefficient was 0.68. According to OSS-3, a patient with a score of 3–8 was considered as having 'poor social support', 9–11 as 'moderate social support' and 12–14 as 'strong social support' (online supplemental table 2).[28 31]

Furthermore, BMI was evaluated using WHO guidelines. Weight was measured using a calibrated weighing scale, with the individual standing barefoot and wearing minimal clothing to ensure precision. The reading was recorded in kilograms to the nearest decimal place. Height, on the other hand, was measured using a stadiometer. The participants stood barefoot on a flat surface with their backs straight, heels together, and their heads positioned in the Frankfort horizontal plane (a line from the lower margin of the eye socket to the ear canal). Height was recorded in metres to the nearest decimal place. BMI was calculated by dividing the weight in kilograms by the square of the participant's height in metres. Once BMI is calculated, the result is interpreted using standardised categories defined by the WHO. A BMI below 18.5 indicates underweight, a BMI between 18.5 and 24.9 is classified as normal weight, a BMI of 25 to 29.9 suggests overweight, and a BMI of 30 or higher signifies obesity.[25 32]

Moreover, glycaemic status was categorised as controlled if the average (3-month average) fasting blood glucose (FBG) was 80–130 mg/dL (4.4–7.2 mmol/L) and uncontrolled if the 3-month average FBG was >130 mg/dL (>7.2 mmol/L) (online supplemental table 4).[12 25]

Finally, clinical-related data, such as CVDs, type of treatment modality, family history of CVD, diabetes-related complications, dyslipidaemia, fasting plasma glucose level, diabetes-related complications and duration of diabetes, were collected from the patient's records using pretested checklists. Comorbid CVD in T2DM was considered in this study when the participants had at least one of the following cardiovascular disorders: ischemic heart disease, hypertensive heart disease, coronary artery disease, heart failure, or stroke in the participants' medical records (online supplemental table 4).[4 12 13]

Since the questionnaire was prepared in English, it was translated into Amharic to facilitate ease of use during interviews with study participants in their native language. To ensure consistency, independent language experts back-translated the translated Amharic version into English. To assure data quality, 2 weeks before the data collection, the questionnaire was pretested on 21 participants in Injibara General Hospital, Awi Zone, Ethiopia, among patients with diabetes who were not included in the main study area. The data were collected by four qualified BSc nurses and two MSc nurse supervisors. Furthermore, the principal investigator and supervisors verified and assessed the collected data daily to ensure their completeness.

Data analysis

The data were checked manually for completeness and consistency and entered into EpiData V.4.6, then exported and analysed using SPSS V.26 for Windows. Descriptive statistics were used to display the variables as N (%) and mean±SD. A logistic regression model was applied to assess whether associations exist between the outcome and predictor variables. Variables showing a value of p<0.2 in the binary logistic regression were retained for further analysis in the multivariable logistic regression model. In the multivariable logistic regression, statistically significant associations (p<0.05) were identified using the adjusted OR (AOR) and its 95% CI. The final model was constructed using the backward likelihood ratio approach for variable selection.[33] The model fit was assessed using the Hosmer-Lemeshow goodness-of-fit test.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

Sociodemographic characteristics of the study participants

For this study, 429 people with diabetes were contacted, and 416 completed the interviews, resulting in a 97% response rate. Of these respondents, 52.9% were men. The average age of the participants was 51.53 years (±10.92 SD) (table 1).

Table 2 Lifestyle and psychosocial characteristics of patients with type 2 diabetes mellitus in Bahir Dar city public hospitals, Ethiopia, 2023

Variables	Categories	N (%)
Social support	Poor	151 (36.30
	Moderate	116 (27.9)
	Strong	149 (35.8)
Physical activity	Physically inactive	211 (50.7)
	Physically active	205 (49.3)
Smoking status	Past smoker	8 (1.9)
	Current smoker	5 (1.2)
	Non-smoker	403 (96.9)
Alcohol drinking	Past drinker	35 (8.4)
	Current drinker	16 (3.8)
	Non-drinker	365 (87.7)
Dietary adherence	Non-adhered	59 (14.2)
	Adhered	357 (85.8)
Medication adherence	Low	129 (31.0)
	Medium	105 (25.2)
	Good	182 (43.8)
Depression	Moderately severe	6 (1.4)
	Moderate	38 (9.1)
	Mild	152 (36.5)
	Minimal	220 (52.9)

Lifestyle and psychosocial characteristics of the study participants

Among the study participants, 35.8% reported receiving strong social support from their family, friends and neighbours. Nearly half (50.7%) of the participants were physically inactive, while the majority (96.9%) were non-smokers (table 2).

Clinical characteristics of the study participants

Oral hypoglycaemic medications were the most frequently used treatments (65.14%). Nearly 29.0% of patients had hypertension, and 14.4% experienced acute complications related to diabetes (table 3).

Common comorbid CVD among individuals with type 2 diabetes

Our findings indicated that 27.9% (95% CI 23.6% to 32.3%) of T2DM had at least one comorbid CVD. Among these, 8.9% had hypertensive heart disease and 6.3% had ischaemic heart disease (figure 1).

Table 3 Clinical characteristics of patients with type 2 diabetes in Bahir Dar city public hospitals, Ethiopia, 2023

Variables	Category	N (%)
Type of treatment modality	Oral hypoglycaemic with insulin	145 (34.9)
	Only oral hypoglycaemic	271 (65.1)
Duration of diabetes	>10 years	129 (31.0)
	5–10 years	172 (41.3)
	<5 years	115 (27.6)
Family history of CVD	No	337 (81.0)
	Yes	79 (19.0)
DM-related complications	Yes	98 (23.6)
	No	318 (76.4)
DM-related complications	Acute complications*	60 (14.4)
	Retinopathy	16 (3.8)
	Neuropathy	2 (0.5)
	Diabetic foot ulcer	13 (3.1)
	Nephropathy	13 (3.1)
	Sexual dysfunction	6 (1.4)
Fasting blood glucose	Controlled	91 (21.90
	Uncontrolled	325 (78.1)
Have dyslipidaemia	Yes	90 (21.6)
	No	326 (78.4)
Have hypertension	Yes	121 (29.0)
	No	295 (71.0)
Body mass index (BMI)	Obese	27 (6.5)
	Overweight	173 (41.6)
	Healthy weight	216 (51.9)

*Hyperglycaemic hyperosmolar state/hyperosmolar hyperglycaemic non-ketotic syndrome.
CVD, cardiovascular disease; DM, diabetes mellitus.

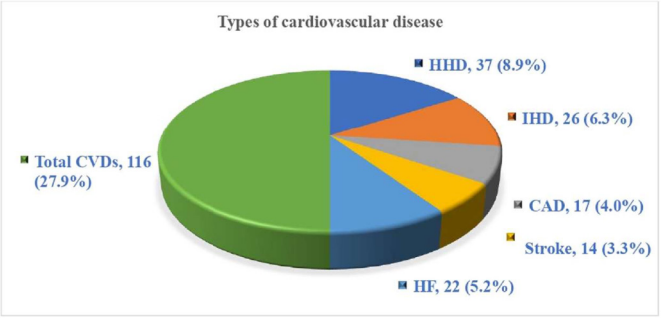

Figure 1 Comorbid CVDs among adult patients with T2DM in Bahir Dar city public hospitals, Ethiopia, 2023. CVD, cardiovascular disease; T2DM, type 2 diabetes mellitus; HHD:Hypertensive Heart Disease; ICD, Ischemic HeartDisease; CAD, Coronary Heart Disease; HF, Heart failure.

Predictors of comorbid CVD among individuals with type 2 diabetes

The bivariable analysis revealed that age, social support, diabetic complications, blood sugar management, dyslipidaemia, dietary and medication compliance, length of diabetes diagnosis, BMI, and hypertension were all significantly associated with comorbid CVD among individuals with T2DM with a value of p<0.2. After adjusting for potential confounding factors, respondents who were older than 60 years, had poor dietary compliance, lower medication adherence, were overweight, and had a diabetes duration of more than 10 years were found to be significantly associated with CVD among T2DM with a value of p<0.05 and 95% CI.

The odds of developing CVD among patients with T2DM older than 60 years were more than twice as high compared with those younger than 40 years (AOR=2.6, 95% CI 1.1 to 6.6). Similarly, the odds of CVD were four times higher among patients with type 2 diabetes who did not adhere to dietary recommendations compared with their counterparts (AOR=4.0, 95% CI 1.9 to 8.2). In addition, patients with type 2 diabetes with lower medication adherence had more than twice the odds of developing CVD compared with those with good medication adherence (AOR=2.8, 95% CI 1.5 to 5.3). Overweight patients were five times more likely to develop CVD compared with those with a healthy weight (AOR=5.3, 95% CI 2.9 to 9.8). Furthermore, patients with type 2 diabetes with a diabetes duration of more than 10 years had over three times higher odds of developing CVD compared with those with a duration of less than 5 years (AOR=3.7, 95% CI 1.7 to 8.1) (table 4).

DISCUSSION

This study evaluated the magnitude of comorbid CVD and its predictors among individuals with T2DM in public hospitals in Bahir Dar city. The findings revealed that 27.9% of respondents were diagnosed with comorbid CVD. Specifically, 8.9% had hypertensive heart disease, 6.3% had ischaemic heart disease, 5.2% had heart failure, 4.0% had coronary artery disease and 3.3% had a stroke.

The findings of this study were higher than those reported in studies conducted in Morocco,[34] Iraq[35] and Saudi Arabia[36] (22.4%, 16.0%, 18%, respectively). This discrepancy may be attributed to differences in care settings, genetic predispositions and patient characteristics among the countries. Additionally, variations in socioeconomic development, treatment protocols, follow-up mechanisms and control measures between the countries may explain this difference. It is well recognised that economic status influences the type of healthcare facility individuals choose, with those of lower socioeconomic status often using public healthcare facilities.[37]

The findings of this study were comparable to those reported in studies conducted in Dilla, Ethiopia (25%),[13] India (31.2%)[38] and China (30.1%),[23] likely due to the shared global burden of T2DM and its established link

Table 4 Bivariable and multivariable logistic regression analysis results of factors associated with CVD among patients with type 2 diabetes in Bahir Dar city public hospitals, Ethiopia, 2023

Variable	CVD		COR (95% CI), AOR (95% CI), P value		
	Yes, No				
Age in years					
61–80	65	60	6.8 (3.1 to 15.1)	2.6 (1.1 to 6.6)	**0.037**
41–60	42	183	1.4 (0.7 to 3.2)	0.8 (9.4 to 2.1)	
18–40	9	57	1	1	
Dietary adherence					
Non-adherent	32	27	3.8 (2.2 to 6.8)	0 (1.9 to 8.2)	**0.001***
Adherent	84	273	1	1	
Medication adherence					
Low	62	67	3.7 (2.3 to 6.2)	2.8 (1.5 to 5.3)	**0.001***
Medium	18	87	0.8 (0.4 to 1.6)	0.7 (0.36 to 1.60)	
Good	36	146	1	1	
DM-related complication					
Yes	41	57	2.3 (1.4 to 3.6)*		
No	75	243	1		
Fasting blood glucose					
>130 mg/dL	31	60	1.4 (0.9 to 2.4)*		
80–130 mg/dL	85	240	1		
Dyslipidaemia					
Yes	41	49	2.71 (1.7 to 4.6)		
No	75	251	1		
Hypertension					
Yes	50	71	2.4 (1.6 to 3.8)		
No	66	229	1		
BMI					
Obese	6	21	1.8 (0.7 to 4.9)	2.0 (0.7 to 6.5)	
Overweight	81	92	5.6 (3.5 to 9.3)	5.3 (2.9 to 9.8)	**0.001***
Healthy weight	29	187	1	1	
DM duration in a year					
>10	68	61	7.4 (3.9 to 14.1)	3.7 (1.7 to 8.1)	**0.001***
5–10	33	139	1.5 (.8, 3.1)	1.2 (0.7, 2.7)	
<5	15	100	1	1	

Bold values are statistically significant variables.
*p<0.001
AOR, adjusted OR; BMI, body mass index; COR, crude OR; CVD, cardiovascular disease; DM, diabetes mellitus .

to CVD, as highlighted by the WHO in its report on non-communicable diseases.[39] However, the prevalences reported in this study were lower than those observed in studies conducted in the Harari region, Iran and Brazil, which reported prevalence rates of 42.5%, 37.4% and 43.9%, respectively.[12 40 41] This discrepancy may partly be explained by the ongoing trend of urbanisation and the high prevalence of risky lifestyle behaviours in these regions, both of which contribute to a greater susceptibility to developing CVD. Urbanisation often leads to significant lifestyle changes, such as reduced physical activity and increased consumption of processed and high-calorie foods. Additionally, urban areas are associated with a higher prevalence of smoking, alcohol consumption and obesity, further compounding the risk. These factors, in combination, can elevate the incidence of cardiovascular comorbidities, particularly among individuals with T2DM, who are already predisposed to cardiovascular complications.[42 43]

In this study, advanced age is identified as a significant sociodemographic predictor of comorbid CVD in individuals with T2DM. This finding aligns with studies

conducted in the Harari region and China.[12 23] The link between ageing and CVD can be explained by the complex changes the heart experiences with age, particularly in individuals with T2DM. These changes include shifts in cellular composition, such as increased oxidative stress, inflammation, cell death (apoptosis), and the deterioration and degeneration of heart tissue.[44] Furthermore, the prevalence of atherosclerosis and arteriosclerosis is notably higher in older individuals with T2DM, highlighting that the progression of diabetes increases the incidence of cardiac events.[45 46]

Our study revealed that individuals with T2DM who did not adhere to a diabetes-friendly diet were more likely to develop CVD compared with those who adhered. Evidence demonstrated that dietary habits influence a myriad of cardiometabolic risk factors, including blood pressure, glucose-insulin homoeostasis, lipoprotein concentrations and function, inflammation, endothelial health, cardiac function, metabolic expenditure, pathways of weight regulation, visceral adiposity, and the microbiome. Focus on single surrogate outcomes can be misleading. Based on these diverse effects, diabetes-friendly diet quality is more relevant than quantity, and the primary emphasis should be on cardiovascular and metabolic health.[47] In addition, poor cellular uptake of blood glucose leads to persistently elevated postprandial glucose levels over prolonged periods, resulting in glucose-induced tissue toxicity and systemic inflammation, which primarily affects macrovascular structures, such as the coronary arteries, and contributes to the development of coronary artery disease.[48]

This study demonstrated that being overweight is a predictor of CVD in individuals with T2DM. Individuals with T2DM who are overweight have higher odds of developing CVDs compared with those within a normal weight range. This finding aligns with previous studies conducted in the Harari region of Ethiopia[12] and Pakistan.[49] The previous evidence showed that high BMI is a significant predictor of cardiovascular disorder and T2DM.[50] Additionally, sharing powerful genetic and environmental features in their pathogenesis, overweight amplifies the impact of genetic susceptibility and environmental factors on comorbid CVDs in T2DM, and overweight is a notable risk factor for T2DM and CVDs.[51–53]

This study identifies the duration of diabetes as a predictor of comorbid CVD in individuals with T2DM. This finding aligns with studies conducted in Dilla, Ethiopia and Pakistan.[13 49] A longer duration of the disease may directly contribute to the progression of atherosclerotic lesions, thereby increasing the risk of recurrent cardiovascular events.[54] Additionally, prolonged oxidative stress in patients with T2DM may increase their susceptibility to CVDs. Poor glycaemic control further exacerbates the risk by accelerating atherosclerosis and contributing to direct glucotoxic effects.[15]

According to this finding, low medication adherence was a potential predictor of comorbid CVD in individuals with T2DM. This finding was supported by a study conducted in Dilla, Ethiopia.[13] This might be due to low medication adherence, which is more likely to lead to clinical complications and repeated hospitalisations. Low medication adherence leads to hyperglycaemia, and chronic hyperglycaemia has been shown to interfere with multiple metabolic pathways, resulting in vascular complications.[55]

CONCLUSION

In this study, comorbid CVD was found to be a significant problematic issue in individuals with T2DM. Modifiable clinical predictors such as overweight, medication and dietary adherence, and non-modifiable predictors such as diabetes duration and age were essential clinical and public health factors in comorbid CVD in individuals with T2DM. Diabetes-centred care is pivotal in promoting optimal medical outcomes and psychological well-being. Therefore, healthcare providers should be aware of a social network of family and friends (because family and friends support medication and dietary adherence), provide diabetes education to address diabetes-friendly diets, maintain healthy body weight, and promote self-management skills. Research will include biological parameters like HbA1c (Hemoglobin A1C) and renal function tests for future studies. Using a prospective cohort study design is the best alternative to identify the incidence of cardiac events in T2DM.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s)

Ethics approval This study involves human participants. Ethical clearance was obtained from the Institutional Research Board (IRB) of Bahir Dar University's College of Medical and Health Sciences (Protocol number: 766/2023). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information.

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