

Cardiovascular diseases risk factors among adult diabetic patients in eastern Ethiopia

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Abstract

Objective: The aim of this study was to determine the magnitude of cardiovascular disease risk factors among adult diabetic patients at Hiwot Fana Specialized University Hospital and Jugal Hospital, eastern Ethiopia.

Methods: An institutional based cross sectional study was conducted on a total of 416 study participants (age ≥ 18 years) from February to March 2017. Data were collected using: structured questionnaires, measurements of weight, height, and blood pressure, and laboratory examination of blood lipids (total cholesterol, triglycerides, low-density lipoprotein, and high-density lipoprotein cholesterol) and fasting blood glucose. Data were analyzed using SPSS version 16.0 software packages. The association of cardiovascular disease risk factors with diabetes type, age, and sex was assessed by chi-square test.

Result: The mean age of study participants was 52 years and 44% were male. Dyslipidemia (90.6%), physical inactivity (76%), and hypertension (62.7%) were the most common cardiovascular disease risks factors identified among diabetic patients. It was also observed that 68.5% of the study participants had uncontrolled blood glucose level. Hypertension was significant in patients over 65 compared to those ≤ 65 years of age ($p < 0.023$). Females were considered to be significantly physically inactive compared to males ($p < 0.001$).

Conclusion: Dyslipidemia is the most common risk factor of CVD in individuals with Types 1 and 2 diabetes mellitus. Identification and treatment of lipid abnormalities is very important. Controlling hypertension among older patients and lifestyle modification among female diabetic patients are also recommended.

Keywords

Cardiovascular diseases, risk factors, diabetes mellitus, eastern Ethiopia

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Introduction

Cardiovascular disease (CVD) is an overarching term that refers to a group of diseases involving the heart or blood vessels. There are many diseases in this classification. Among people with CVDs, over 82% of the mortality is caused by ischemic or coronary heart disease (IHD), stroke (both hemorrhagic and ischemic), hypertensive heart disease or congestive heart failure (CHF), peripheral arterial disease and cardiomyopathy.¹

Cardiovascular complications are now the leading causes of diabetes-related morbidity and mortality. There is abundant evidence that indicates that patients with Type 1 or 2 diabetes mellitus are at high risk for several cardiovascular disorders. The public health

impact of CVDs is already enormous and has been increasingly reported among diabetes patients including in developing countries.² The problem had initially been very rare in Africa, but is becoming increasingly

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reported due to the adoption of western lifestyle behaviors and/or increase of diabetes mellitus in population. In a prospective study conducted in Ghana, 11.3% of the study participants had coronary artery disease and 22.5% of these patients had diabetes.³ Additionally, stroke is one of the leading causes of death and physical disability worldwide. Diabetes is a recognized risk factor for ischemic stroke.^{4,5} A study in Benin City Nigeria revealed that people with diabetes mellitus were more than three times likely to have a stroke.⁵

In the last few years, the lifestyle of the Ethiopian population has been changing due to urbanization and demographic transition.^{6,7} As a result, the burden of non-communicable diseases (NCDs) could be on the rise. A retrospective study conducted in Tikur Anbesa Hospital showed that CVDs were responsible for 16% of deaths among diabetic admissions.⁸

The global variations in CVD rates are related to temporal and regional variations in risk factors. The major risk factors for CVD include tobacco use, high blood pressure, high blood glucose levels, lipid abnormalities, obesity, and physical inactivity as reported in one global and regional analysis.⁹ A study conducted in Jimma, Ethiopia found that hypertension, obesity, physical inactivity, and dyslipidemia were common CVD risk factors among diabetes patients.¹⁰ Most of the CVD risk was attributable to lifestyle and behavioral patterns, and these behaviors can be modified given the right sensitization and education strategies. However, some risk factors, such as age, ethnicity, and gender, obviously cannot be modified. The hazards of alcohol use, smoking, high blood pressure, high cholesterol, and overweight/obesity are globally widespread and have large health effects.⁹

A few studies have been conducted to assess the burden of cardiovascular risk factors among diabetes patients in some parts of Ethiopia.^{8,10} Therefore this study tried to determine magnitude of cardiovascular disease risk factors among adult diabetes patients at the Hiwot Fana Specialized University Hospital and Jugal Hospital in eastern Ethiopia.

Methods

Study design and setting

Institutional-based cross-sectional study was conducted from February to March 2017 at Hiwot Fana Special University Hospital and Jugal Hospital. They are both located in the city of Harar, which is located 515 km east of Addis Ababa, the capital of Ethiopia. Harar is one of the most popular historical towns in the eastern part of Ethiopia.

Sample size and sampling techniques

Sample size was determined by using a single population proportion formula considering an estimated proportion of cardio vascular diseases (hypertension) of 46.5%,¹⁰ a precision of 95%, and a non-response rate of 5%. The final sample size was 420. During the study, 424 DM patients were attending the diabetes clinics—216 at Hiwot Fana Specialized University Hospital and 208 at Jugal Hospital. Among them, a total of 416 DM patients were included in this study who were adults (≥ 18 years of age) and not pregnant women.

Data collection methods

One trained internist, four BSc clinical nurses, and two medical laboratory technologists collected data. Data were collected through:

Face-to-face interviews: interviews were conducted using structured questionnaires adopted from WHO steps instrument (WHO STEPS) and translated to local languages (Amharic and Afaan Oromo). It was used to collect variables like socio-demographic characteristics (i.e. age, sex, marital status, etc.), and lifestyle behaviors including physical activity. DM patients who reported regular aerobic exercise (i.e. walking, jogging) of at least 30 min for five days per week or whose occupation required daily physical exertion were considered to be physically active. Collected data were checked for completeness and consistency daily. The questionnaire was pretested on 5% of the study participants on diabetes patients at Dilchora Hospital and modifications were made on the basis of the findings.

Anthropometric measurements: height was measured to the nearest 0.5 cm using a stadiometer by standing study participants erect against the wall with their heels together (without shoes) and their heads held in upright position. Weight was measured to the nearest 0.5 kg with minimal clothing and no footwear using a standardized digital scale with a capacity of 0–130 kg. The scale was calibrated to zero before each measurement. Body mass index (BMI) was calculated using the formula: weight (kg)/height (m²). Weight was interpreted as underweight (BMI < 18.5), normal (BMI 18.5–24.9), overweight (BMI 25.0–29.9), and obese (BMI ≥ 30.0).

Blood pressure measurement: before measuring blood pressure (BP), data collectors ensured that the study participants had not consumed any hot beverages, smoked/chewed tobacco, or undertaken vigorous physical activity in the 30 min preceding the interview. Three separate BP measurements were obtained from the left arm of each study participant using calibrated

and regularly inspected mercury column type sphygmomanometer with appropriate sized cuff. The study participants rested for at least 5 min in a seated position between each measurement. The average of the readings of systolic blood pressure (SBP) and diastolic blood pressure (DBP) were taken as the BP of the participant. Hypertension was defined as a sustained high blood pressure (SBP \geq 140 or DBP \geq 90 mmHg) or a history of treatment with anti-hypertensive agent.

Laboratory examination of blood: the study participants were asked to fast overnight for at least 12 hours before coming to the diabetes clinic during their regular appointment. Then about 5ml of venous blood was collected using a Palin test tube. All the blood samples were transported to Hiwot Fana Specialized University Hospital and Jugal Hospital clinical chemistry laboratory departments for analysis. The serum separated within 2 hours of collection.

A trained technologist analyzed the samples to determine blood glucose, total cholesterol, triglycerides, low-density lipoprotein cholesterol (LDL), and high-density lipoprotein cholesterol (HDL) levels. Serum glucose was estimated using enzymatic reaction by glucose oxidase. Lipid profile tests (cholesterol, HDL, LDL, and triglyceride) were carried out by methods described by the manufacturers of the test kits (BioSystem S.A. Costa Brava, 30, Barcelona, Spain). Dyslipidemia was defined as the presence of at least one of the following: high plasma total cholesterol (\geq 200 mg/dl), high LDL (\geq 97 mg/dl), low HDL ($<$ 40 mg/dl in men or $<$ 50 mg/dl in women), and/or high triglyceride level (\geq 150 mg/dl). Uncontrolled glycaemia (blood glucose) was defined as having fasting blood glucose level of $>$ 126 mg/dl for those $<$ 60 years of age and $>$ 140 mg/dl for those \geq 60 years old.

Data analysis

Data were cleaned, edited, and entered into a computer to be analyzed using SPSS, version 16.0 software package. A chi-square test was done to see the association between dependent variables (CVD risk factors: hypertension, dyslipidemia, obesity, smoking, physical inactivity, and family history) and independent variables (type of diabetes, age, and sex). Variables with p values of $<$ 0.05 at 95% confidence intervals were considered to have a statistically significant association.

Result

Study participants characteristics

A total of 416 patients participated in the study. They ranged in age from 18 to 90 years, with a mean of

52 years (SD \pm 14.7). Most of the study participants were female (56%) and had type 2 diabetes (69.2%). All of the participants were currently undergoing treatment, and 58.2% of them were on oral anti-diabetic drugs. The mean fasting blood glucose (FBG) level was 177.7 mg/dl (SD \pm 82.1), and the majority (68.5%) of participants had uncontrolled (high) fasting blood glucose levels. The mean BMI was 24.7 kg (SD \pm 4.79), and only 11.5% of the study participants were considered obese (BMI \geq 30) (Table 1).

CVD risk factors in diabetic patients

A total of 377 (90.6%) study participants had dyslipidemia. The occurrence of dyslipidemia did not significantly differ with type of diabetes, sex, and age of study participants. It was also reported that 316 (76%) were not practicing regular walking or any fitness exercises (Table 2). More women were considered to be physically inactive as compared to males (83.7% vs. 66.1%). The difference was statistically significant ($p <$ 0.001). But there was no statistically significant difference between physical inactivity with type of diabetes and age of the participants (Table 3).

Most of the DM patients had hypertension (62.7%), and only 5.7% of them were taking treatment to lower their blood pressure. The proportion of hypertension was higher among study participants over 65 years of age (72.8%) compared to those 65 or less (59.9%). The difference was statistically significant ($p <$ 0.023). But there was no statistically significant difference between hypertension with type of DM and sex of the participants (Table 3).

Only 11.5% of the study participants were found to be obese. The proportion of obesity was higher among female (15%) compare to males (7.1%). The difference was statistically significant ($p <$ 0.012). But there was no statistically significant difference between obesity and type of diabetes and sex of the study participants. Family history of CVD was found among 8.2% of participants and there was no statistically significant difference between family history and type of diabetes, sex, and age of the participants. The proportion of smoking habit was reported to be 7% of participants. It was significantly higher among males ($p <$ 0.001) and those with type 1 diabetes ($p <$ 0.011) (Table 3).

Discussion

Hypertension, dyslipidemia, and physical inactivity were common among diabetic patients in Hiwot Fana Specialized University Hospital and Jugal Hospital, while obesity, family history of CVD, and cigarette smoking was uncommon. Dyslipidemia was not significantly associated with type of diabetes, sex, or age of

Table 1. Characteristics of diabetes mellitus patients in Hiwot Fana Specialized University Hospital and Jugal Hospital, Eastern Ethiopia, 2017 ($n = 416$).

Variable	Number	Percentage
Sex		
Male	183	44
Female	233	56
Age in years		
<30	31	7.5
30–39	48	11.5
40–49	72	17.3
50–59	108	26.0
≥60	157	37.7
Religion		
Orthodox	204	49.0
Muslim	183	44.0
Protestant	24	5.8
Catholic and Adventist	5	1.2
Education status		
Illiterate	145	34.9
Able to read and write	27	6.5
Primary school	108	26.0
Secondary school	102	24.5
Above secondary	34	8.2
Marital status		
Married	201	48.3
Single	111	26.7
Divorced	26	6.2
Widowed	78	18.8
Occupational status		
Governmental employee	77	18.5
Private employee	52	12.5
Farmer	64	15.4
Student	15	3.6
Daily laborer	33	7.9
Jobless	9	2.2
House wife	80	19.2
Retired	86	20.7
Current treatment		
Oral anti-DM	242	58.2
Insulin	174	41.8
Fasting blood glucose level		
Normal	131	31.5
Uncontrolled (high)	285	68.5
Type of DM		
Type 1	128	30.8
Type 2	288	69.2
BMI		
<18.5 (Underweight)	34	8.2
18.5–24.9 (Normal)	203	48.8
25–29.9 (Overweight)	131	31.5
≥30 (Obese)	48	11.5

FBG: fasting blood sugar; mg/dl: milligram per deciliter; BMI: body mass index; DM: diabetes mellitus.

study participants. Hypertension was significantly higher in participants >65 years of age while physical inactivity was significantly higher in female participants.

Table 2. Cardiovascular disease risk factors among diabetic patients in Hiwot Fana Specialized University Hospital and Jugal Hospital, Eastern Ethiopia, 2017 ($n = 416$).

CVD risk factors	Number	Percentage
Hypertension	261	62.7
Dyslipidemia	377	90.6
Obesity	48	11.5
Currently smoking	29	7
Physical inactivity	316	76
Family history of CVD	34	8.2

CVD: cardiovascular disease.

The prevalence of hypertension (62.7%) among diabetes patients in this study is higher than reported from Jimma, Ethiopia (46.5%) and India (37.9%).^{10,11} The findings of this study are similar to a study conducted in India (61.7%), but lower than a study conducted in Spain (74.5%).^{11,12} Hypertension is approximately twice as frequent in patients with diabetes compared to patients without the disease.¹³ Hypertension amplifies the already high cardiovascular disease risk in diabetes.

In this study, participants >65 years have significantly higher risk of hypertension. This is consistent with findings from other studies.^{10,14–16} An interaction between biological and behavioral factors could be used to explain our results. Regarding biological factors, a possible explanation would be the natural processes related to ageing, such as autonomous imbalance and vessels stiffening. In relation to behavioral factors, previous studies show that older people's level physical activity decreases,¹⁷ which might increase risks for non-communicable diseases.

More than three-fourth of the participants had dyslipidemia. This is similar with a Nigerian report of adults with diabetes.³ Low HDL level was the most frequent lipid abnormality found in this study. This is consistent with a study conducted in Jimma⁸ but different than a study conducted at Tikur Anbesa Hospital where cholesterol level was the most frequent lipid abnormality.¹⁸ This difference may be due to the fewer number of diabetic patients (100) included in the Tikur Anbesa Hospital study.

The prevalence of obesity in this study was much lower than other earlier studies,^{10,19} though there was a significantly higher magnitude of obesity among female participants. This is consistent with other studies.^{10,19} The observed high rate of obesity, particularly among women, may be due to lack of physical activity. This was indicated in a study in which physical activity was significantly lower among female participants. In addition, obesity was significantly higher among DM patients in this study.

The prevalence of physical inactivity was 58.5% and 55.1% among DM patients in Nigeria and

Table 3. Cardiovascular disease risk factors by type of diabetes mellitus, sex and age group among diabetic patients in Hiwot Fana Specialized University Hospital and Jugal Hospital, Eastern Ethiopia, 2017 (n = 416).

CVD risk factors	Total no. (%)	Type 1 DM no. (%)	Type 2 DM no. (%)	p value
Hypertensive				
No	155 (37.3)	53 (41.4)	102 (35.4)	0.244
Yes	261 (62.7)	75 (58.6)	186 (64.6)	
Dyslipidemia				
No	39 (9.4)	12 (9.4)	27 (9.4)	1.000
Yes	377 (90.6)	116 (90.6)	90.6 (90.6)	
Obese				
No	368 (88.5)	118 (92.2)	250 (86.8)	0.113
Yes	48 (11.5)	10 (7.8)	38 (13.2)	
Currently smoking				
No	387 (93)	113 (88.3)	274 (95.1)	0.011
Yes	29 (7)	15 (11.7)	14 (4.9)	
Physically inactive				
No	100 (24)	36 (28.1)	64 (22.2)	0.193
Yes	316 (76)	92 (71.9)	224 (77.8)	
Family history of CVD				
No	382 (91.8)	118 (92.2)	264 (91.7)	0.858
Yes	34 (8.2)	10 (7.8)	24 (8.3)	
CVD risk factors	Total	Male	Female	
Hypertensive				
No	155 (37.3)	70 (38.3)	85 (36.5)	0.711
Yes	261 (62.7)	113 (61.7)	148 (63.5)	
Dyslipidemia				
No	39 (9.4)	15 (8.2)	24 (10.3)	0.465
Yes	377 (90.6)	168 (91.8)	204 (89.7)	
Obese				
No	368 (88.5)	170 (92.9)	198 (85.)	0.012
Yes	48 (11.5)	13 (7.1)	35 (15)	
Currently smoking				
No	387 (93)	160 (87.4)	227 (97.4)	0.000
Yes	29 (7)	23 (12.6)	6 (2.6)	
Physically inactive				
No	100 (24)	62 (33.9)	38 (16.3)	0.000
Yes	316 (76)	121 (66.1)	195 (83.7)	
Family history of CVD				
No	382 (91.8)	171 (93.4)	211 (90.6)	0.286
Yes	34 (8.2)	12 (6.6)	22 (9.4)	
CVD risk factors	Total	18–65 years	>65 years	
Hypertensive				
No	155 (37.3)	130 (40.1)	25 (27.2)	0.023
Yes	261 (62.7)	194 (59.9)	67 (72.8)	
Dyslipidemia				
No	39 (9.4)	29 (9)	10 (10.9)	0.577
Yes	377 (90.6)	295 (91)	82 (89.1)	
Obese				
No	368 (88.5)	290 (89.5)	78 (84.8)	0.211
Yes	48 (11.5)	34 (10.5)	14 (15.2)	
Currently smoking				
No	387 (93)	300 (92.6)	87 (94.6)	0.512
Yes	29 (7)	24 (7.4)	5 (5.4)	
Physically inactive				
No	100 (24)	80 (24.7)	20 (21.7)	0.559
Yes	316 (76)	244 (75.3)	72 (78.3)	
Family history of CVD				
No	382 (91.8)	301 (92.9)	81 (88)	0.133
Yes	34 (8.2)	23 (7.1)	11 (12)	

DM: diabetes mellitus; CVD: cardiovascular disease. The significance of bold values is to show statistically significant.

Jimma, respectively.^{3,18} In this study, rates of inactivity were even higher—three-fourth of study participants did not engage in physical activities regularly. Diabetes mellitus patients in our study setting should be motivated to walking or engage in other fitness activities for at least 30 min, five days per week.

In the present study, it was observed that the majority (68.5%) of patients had uncontrolled blood sugar level despite of taking medicines or insulin. This finding is similar with studies carried out in Jimma (74.2%) and India (75.5%).^{10,11} This implies that, in addition to receiving treatment, DM patient need to get counseling and motivation for lifestyle modification.

Limitations

This study is limited by its cross sectional design. Thus, the findings only refer to associations, and do not imply causality.

Conclusion

Dyslipidemia is the most common of all risk factors of CVD in individuals with Type 1 and 2 DM. Despite the high prevalence of these risk factors, patients were not tested for lipid profiles during their regular follow-up. Uncontrolled hyperglycemia and hypertension are also common in DM patients despite taking medication for both problems. Most of the study participants, especially females, were not practicing regular walking or any fitness activities. Therefore, health personnel in diabetes clinics should advise their patients (and give special emphasis for female patients) on lifestyle modifications like regular walking or other fitness activities for at least 30 min. In addition there is a need to strengthen the monitoring of dyslipidemia and hyperglycemic hypertension among DM patients to reduce further risk of CVD.

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Ethical approval

Ethical clearance was obtained from Haramaya University Colleges of Health and Medical Sciences Institutional Health Research Ethical Review Committee (12/2015). Then a permission letter was obtained from the medical officers at both participating hospitals. Respondents were fully informed about the purpose of the study and signed their consent. Information obtained during the study was kept confidential.


Guarantor

Not applicable.

Contributorship

TA, FW, HM, and ZT participated in the study design, data collection, analysis, interpretation, and write-up, drafted the manuscript, and critically revised the manuscript. All authors read and approved the final manuscript.

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