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ORIGINAL RESEARCH

Dyslipidemia and Its Associated Risk Factors Among Adult Type-2 Diabetic Patients at Jimma University Medical Center, Jimma, Southwest Ethiopia

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Background: Dyslipidemia is one of the major modifiable risk factors for cardiovascular diseases (CVD) in a type-2 diabetic (T2DM) patient. Dyslipidemia in T2DM patients is attributed due to increased free fatty acid flux secondary to insulin resistance. Despite its high prevalence and related complication of dyslipidemia in T2DM patients, there is a paucity of data on the prevalence of dyslipidemia in T2DM patients in Ethiopia.

Objective: To determine the prevalence of dyslipidemia and its associated risk factors among T2DM patients at Jimma medical center (JUMC) Jimma, Ethiopia.

Methods and Materials: An institution-based- cross-sectional study was conducted from June 1 to August 4, 2019. A convenience sampling technique was used to recruit 248 T2DM patients in the study. Data on socio-demographic characteristics, behavioral, and clinical factors were collected using a structured questionnaire through face to face interviews. Five milliliters of the fasting venous blood sample was collected for serum glucose and lipid profile analysis. Blood pressure, weight, and height were measured. Data were analyzed by SPSS version 21. Bivariate and multivariate logistic regression analyses were performed and p-value <0.05 was considered as statistically significant.

Results: The overall prevalence of dyslipidemia among study participants was 68.1%. Isolated lipid profile abnormality of hypertriglyceridemia was found in 48%, hypercholesterolemia in 13.7%, high level of low-density lipoprotein (LDL-C) in 28.6%, and low level of high-density lipoprotein (HDL-C) in 50.8% study participants. Being in an age group ≥30 years, physical inactivity, being obese, hypertension, and high blood glucose value were significantly associated factors with dyslipidemia.

Conclusion: High prevalence of dyslipidemia was found among T2DM in the study area. The findings of this study should be taken into account to conduct appropriate intervention measures on the identified risk factor, and implement routine screening, treatments, and prevention of dyslipidemia.

Keywords: type-2 diabetes, dyslipidemia, Jimma, Ethiopia

Introduction

Diabetes mellitus is a metabolic disorder characterized by the presence of chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion and action or both.[1] Diabetes mellitus is a global public health problem, affected nearly half a billion people (463 million) in the world and around 5 million adult people died from diabetes and diabetes-related complications in 2019.[2]

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Cardiovascular complication is one of the leading causes of diabetes-related morbidity and mortality.[3,4] Dyslipidemia is one of the major modifiable risk factors for CVD in a T2DM patient.[5] A study conducted in Ethiopia found that dyslipidemia, physical inactivity, and hypertension were the most common cardiovascular disease risk factors among diabetic patients.[6]

In T2DM patients the most common pattern of dyslipidemia was hypertriglyceridemia, reduced HDL cholesterol levels, and an increased concentration of LDL particles.[7–9] Dyslipidemia is involved in T2DM due to insulin resistance and increased free fatty acid flux secondary to insulin resistance. The etiology leading to hypertriglyceridemia in T2DM directly relates to insulin resistance and hyperglycemia, which results in an overproduction of triglyceride-rich lipoproteins from the liver, decreased clearance of triglyceride-rich lipoproteins, and, in some cases, an altered postprandial lipoprotein metabolism.[10,11] Insulin resistance in a T2DM is associated with reduced inhibition of hormone-sensitive lipase in adipose tissue by insulin, resulting in an increased lipolysis, and thereby augmented portal flux of free fatty acid to the liver. Elevated free fatty acids can directly disrupt the activity of lipoprotein lipase by causing it to detach from the endothelial surface.[12,13] Consequently, the increased hepatic availability of free fatty acids leads to decreased degradation of apoB, thus causing an overproduction of very-low-density lipoprotein in insulin-resistant states. An increase in triglyceride-rich lipoproteins is commonly associated with a reduction in HDL and an increase in small dense LDL levels.[4,14]

Globally burden of dyslipidemia in diabetic patients is continuously increasing due to increased consumption of unhealthy diets, reduced physical activity, and urbanization as well as obesity.[14–16] The studies reported, 88.9%, 90%, and 86.1% of the burden of dyslipidemia in Thailand,[17] Jordan,[18] and Kenya,[16] respectively.

Dyslipidemia is prevalent among diabetic patients in different parts of Ethiopia, studies indicated 90.6% in eastern Ethiopia,[6] 65.6% in Durame,[19] 63.5% in Jimma,[20] 11.9% in Mekelle.[21] The major risk factors for dyslipidemia were hypertension, high body mass index, aging, high FBS, physical inactivates, and longer duration of diabetes mellitus.[19,20,22]

Without timely and effective control, the rate of dyslipidemia will continue to rise, leading to a heavy burden of CVD. Therefore, it is important to identify the potential associated factors of dyslipidemia, to manage this condition and reduce the burden of CVD. Despite its high prevalence and related complication of dyslipidemia in T2DM patients, there were few data available on the prevalence of dyslipidemia and associated factors in diabetic patients in Ethiopia as well as they cannot differentiates between type 1 and type 2 diabetes.[19] Timely detection and characterization of dyslipidemia in T2DM patients help clinicians to estimate future risk of cardiovascular disease and take appropriate preventive measures; also the determination of associated factors can help to reduce future complications and morbid effects of diabetic patients. As to our knowledge, there is no data available on the prevalence of dyslipidemia and associated risk factors among T2DM patients in Ethiopia. Therefore, this study aimed to determine the prevalence of dyslipidemia and its associated risk factors among T2DM patients at JUMC.

Methods and Materials

Study Design, Study Area, and Period

The institution-based cross-sectional study design was employed in JUMC, which is located 352 km far from the capital city of Ethiopia, Addis Ababa. Jimma Medical Center is the largest public hospital in the south-western part of Ethiopia and it provides teaching, diagnostic, and referral services. It provides services for approximately 15,000 inpatient and 160,000 outpatients in a year. The medical center catechumen's area population is estimated to more than 15 million people. The study was conducted on T2DM patients attending their follow up at the chronic illness clinic of JUMC from June 1 to August 4, 2019.

Sample Size and Sampling Technique

Sample size was determined by using a single population proportion formula ($n= Z\alpha/_2^2 pq/d^2$) considering a 19% estimated proportion(p) of hypertriglyceridaemia in T2DM patients,[8] a 95% confidence interval (CI), a 5% margin of error and a 5% non-response rate. We got a final sample size of 248. A convenient sampling technique was used to recruits adult T2DM patients (age ≥18years) who had attending JUMC chronic illness clinic for their follow-up.

Inclusion Criteria

Adult T2DM patients (age ≥18years) who had attending JUMC chronic illness clinic for their follow up were included.

Exclusion Criteria

Diabetic patients; who took lipid-lowering drugs, who were pregnant and who had a known history of cardiac problems, chronic liver, and renal diseases were excluded from the study.

Data Collection Techniques

Data on socio-demographic characteristics, behavioral, and clinical factors were collected using a structured questionnaire through interviews by trained nurses. The questionnaire was adopted from related literature and WHO's stepwise (STEPs) approach for non-communicable disease surveillance.

Anthropometric Measurements

Anthropometric measurements (height and weight) were measured based on World health organization (WHO) guideline from all study participants, and body mass index (BMI) was computed as weight in kilogram divided by the square of height in meter and categorized as underweight (BMI<18.5 kg/m^2), normal weight (BMI = 18.5–24.9 kg/m^2), overweight (BMI = 25–29.9 kg/m^2), and obese (BMI ≥ 30 kg/m^2) based on WHO guideline category.

Blood Pressure Measurement

Blood pressure was measured digitally by Micro life BP A50 (Micro life AG, Switzerland) based on WHO guidelines. Blood pressure was taken using a mercury sphygmomanometer from the right upper arm after the subject was seated quietly for 5 minutes. Hypertension was defined as systolic blood pressure (SBP; ≥140 millimeters of mercury [mmHg]) or diastolic blood pressure (DBP; ≥90 mmHg) in diabetic patients.

Blood Specimen Collection and Analysis

After overnight fasting 5 milliliters, a venous blood specimen was collected from each study participants by a trained medical laboratory technologist following standard operating procedures. Then collected blood specimen was kept at room temperature for 30 minutes and centrifuged at a speed of 4000 rpm for 5 minutes using Rotanta 960 centrifuge. The final serum was separated from the whole blood and stored at −20°C before biochemical analysis. Serum glucose and lipid profiles (total cholesterol (TC), triglycerides (TG), HDL, and LDL) were analyzed by ABX Pentra 400 automated clinical chemistry analyzer (Horiba ABX SAS, Montpellier, France). Dyslipidemia was defined as the presence of at least one or more lipid profile abnormalities from the following; high TC ≥200 milligram per deciliter (mg/dl), high LDL ≥ 100 mg/dl, high TG ≥150 mg/dl, or low HDL ≤ 40 mg/dl) in T2DM patients.

Data Analysis

Data were cleaned, edited, entered, and analyzed by using SPSS version 21 (SPSS, Chicago, IL, USA). Frequency tables and descriptive summaries were used to describe the study variables. Both bivariate and multivariable logistic regression analyses were performed to identify associations between dyslipidemia and independent variables. Variables in bivariate analysis with P-value <0.25 were taken as candidates for multivariate analysis. Multiple logistic regression analysis was used to identify associated risk factors for the prevalence of dyslipidemia. P-value was set at <0.05 for statistical significance.

Results

Socio-Demographic, Behavioral, and Clinical Characteristics

A total of 248 types 2 diabetic patients, 52% (n=129) females, and 48% (119) males were enrolled in the current study; their mean age was 49.6 ± 13.3 years. The majority of the study participants 86.3% (214) were in ≥30years of age groups. About 52% (129), 82.7% (205), and 56% (139) participants were urban dwellers, married, and illiterate, respectively. As to the BMI level, 49.2% (122) of participants were overweight and 21.4% (53) were obese. The mean ±standard deviation (SD) of the fasting blood glucose and BMI was 154.9±62.9 and 26.5±3.8 respectively (Table 1).

Prevalence of Dyslipidemia Among Study Participants

The mean ±standard deviation (SD) of the TC, TG, LDL-C, and HDL-C were 150.7±48.3, 148.2±38.5, 87.7±21.4, and 48.6±11.2 respectively (Table 2). The overall prevalence of dyslipidemia among study participants was 68.1% (169). The prevalence of dyslipidemia was highest among

Table 1 Socio-Demographic and Other Characteristics of Adult Type-2 Diabetic Patients at Jimma University Medical Center; Jimma, Southwest Ethiopia, June 1–August 4, 2019

Variables	Categories	Frequency (Percentage)
Gender	Female Male	129(52) 119(48)
Age in years	<30 ≥30	34(13.7) 214(86.3)
Residence	Urban Rural	129(52) 119(48)
Marital status	Single Married Widowed Divorced	21(8.5) 205(82.7) 14(5.6) 8(3.2)
Educational status	Illiterate Primary Secondary Higher	139(56) 39(15.7) 44(17.7) 26(10.5)
Smoking cigarette	Yes No	25(10.1) 223(89.9)
Alcohol consumption	Yes No	44(17.7) 204(82.3)
Chewing chat	Yes No	76(30.6) 172(69.4)
Physical activities	Yes No	98(39.5) 150(60.5)
Body mass index (kg/m^2)	Underweight Normal Overweight Obese	13(5.2) 60(24.2) 122(49.2) 53(21.4)
Hypertension(mmHg)	Yes No	112(45.2) 136(54.8)
Fasting blood glucose (mg/dl)	<180mg/dl ≥180mg/dl	192(77.4) 56(22.6)

age groups ≥30 years 72.4% (155) and females74.4% (96). The proportion of dyslipidemia was 71.2% (99), 74% (111),77.4% (41), and 79.5% (89) in illiterate, physically inactive, obese, and hypertensive study participants, respectively (Table 3).

When isolated dyslipidemia components were analyzed, hypertriglyceridemia was found in 48% (119), hypercholesterolemia in 13.7% (34), high level of LDL-C in 28.6% (71), and low level of HDL-C in 50.8% (126) study participants (Table 2).

Correlation Analysis of Lipid Profile with Predictors Among Adult Type-2 Diabetic Patient

There was statistically positive correlation between serum TC with hypertension (r=0.15, p=0.016) and fasting blood glucose (r=0.15, p=0.013). In addition serum TG shows positive correlation with hypertension (r=0.2, p=0.001) and fasting blood glucose (r=0.013, p<0.001) (Table 4).

Factors Associated with Dyslipidemia

In bivarate analysis, increasing age (COR (95% CI) = 3.75 (1.78, 7.91), illiteracy (COR (95% CI) = 1.8 (0.76, 4.29), primary educational status (COR (95% CI) = 1.86 (0.65, 5.3), physical inactive (COR (95% CI) = 1.96 (1.14, 3.38), overweight (COR (95% CI) = 2.48 (0.78, 7.88), obese (COR (95% CI) = 3.98 (1.12, 14.13), hypertension (COR (95% CI) = 2.7 (1.52, 4.79), and high blood glucose level (COR (95% CI) = 2.99 (1.38, 6.48) were identified candidate variables to be tested for association with dyslipidemia in multivariate analysis by considering p-vale<0.25% (Table 3).

Multivariate Logistic Regression Analysis of Dyslipidemia Predictors

Multivariate logistic regression models were used to identify the independent predictors of dyslipidemia in diabetic patients. After adjusting for other variables: Older T2DM patients (age≥30 years) were ~ 4 times more likely to develop dyslipidemia (AOR: 3.9, 95% CI: 1.6–9.48) than lower age groups. Diabetic patients who had physical inactive were higher odds of dyslipidemia (AOR: 2.46, 95% CI: 1.3–4.5) than physically active diabetic patients. Obese T2DM patients were more likely to develop dyslipidemia (AOR: 5.6, 95% CI: 1.3–23.9) compared to non-obese diabetic patients. Hypertensive T2DM patients were higher odds of dyslipidemia compared to non-hypertensive patients (AOR: 2.65, 95% CI: 1.4–4.9). Diabetic patients with higher blood glucose values were 3 times more likely to develop dyslipidemia (AOR: 3.1, 95% CI: 1.3–7.2) than those with lower blood glucose values (Table 5).

Discussion

Dyslipidemia is one of the major modifiable risk factors for CVD in a T2DM patient, which was the leading cause of morbidity and mortality in these patients.[6] Without timely and effective control, the rate of dyslipidemia will continue to rise, leading to a heavy burden of CVD.

Table 2 Lipid Profile Classification and Their Levels by Gender

Lipid Profile	Total Mean±SD	Categories	n (%)	Male Mean ± SD	Female Mean ± SD	p-value
TC (mg/dl)	150.7±48.3	<200	214(86.3)	146.8±51.2	154.2±45.3	0.22
		≥200	34(13.7)			
TG (mg/dl)	148.2±38.5	<150	129(52)	145.5±40.3	150.7±36.8	0.28
		≥150	119(48)			
LDL-C (mg/dl)	87.7±21.4	<100	177(71.4)	86.1±23.4	89.2±19.4	0.26
		≥100	71(28.6)			
HDL-C (mg/dl)	48.6±11.2	≤40	126(50.8)	48.7±11.05	48.6±11.4	0.95
		>40	122(49.2)			

Note: P-value: independent *t*-test.

Therefore, it is important to identify the potential associated factors of dyslipidemia, to manage this condition and reduce the burden of CVD.

The current study attempted to assess the prevalence of dyslipidemia and associated risk factors among T2DM patients in JUMC. The overall prevalence of dyslipidemia among T2DM patients in the current study was 68.1%. Older age, physical inactivity, obesity, and higher fasting blood glucose values were independent predictors of dyslipidemia in T2DM patients in our study. The individual lipid profile abnormality obtained in this was 13.3%, 48%, 28.6%, and 50.8% high TC, TG, LDL-C, and low HDL-C, respectively.

The overall prevalence of dyslipidemia among T2DM patients in the current study was 68.1%. The overall prevalence of dyslipidemia obtained in this study was comparable with a study done in Kembata Tembaro, Ethiopia (65.5%),[19] Jimma, Ethiopia (63.5%),[20] and Zaria, Nigeria (69.3%).[23] The reasons for the high prevalence of dyslipidemia in the current study might be partly attributed to the current trend toward urbanization, reduced physical activity, and obesity, which results in a higher incidence of T2DM with its metabolic abnormalities. Whereas, the overall prevalence of dyslipidemia reported in this study were lower than reports from Tanzania (83%),[24] Thailand (88.9%),[17] and Pokhara, Nepal (88.1%).[22] The variation in the prevalence of dyslipidemia might be attributed to dietary differences as well as variation in the genetic disposition of the population.

Diabetes mellitus causes a variety of derangements in oxidative/reduction in lipid metabolic and regulatory mechanisms that might be responsible for the accumulation of lipids particles. According to our findings, the prevalence of individual lipid profile abnormality of high TC, TG, LDL-C, and low HDL-C was 13.3%, 48%, 28.6%, and 50.8%, respectively.

Hypertriglyceridaemia and low HDL level was the most frequent lipid abnormality found in this study. This is consistent with a study conducted in China.[25] The prevalence of hypertriglyceridemia (48%) among T2DM patients in this study is higher than reported from Hawassa, Ethiopia (29.8%),[8] and Ethiopia (21%).[26] Elevated triglyceride levels in T2DM might be due to increased production and decreased clearance of triglyceride-rich lipoproteins as a result of insulin resistance and hyperglycemia. The findings of this study are similar to a study conducted in Egypt (47%)[26] but lower than a study conducted in Nepal (53.77%).[27] The difference in the pattern of dyslipidemia reported in T2DM patients might be due to differing cut points in some studies, cultural factors, and lifestyle of the population.

The current study finding revealed a higher prevalence of hypercholesterolemia compared to other studies conducted in Ethiopia (5.2%),[26] but comparable with a report from China (14.7%).[25] However, the findings of this study were lower than reports from Kembata, Ethiopia (27.3%),[19] Hawassa, Ethiopia (34.6)[8] and Egypt (57.3%).[28]

The prevalence of high LDL-C obtained in this study was (28.6%), which was consistent with a study conducted in China (28%),[25] but lower than the study conducted in Kembata, Ethiopia (43.8%),[19] Hawwassa, Ethiopia (34.9%)[8] and Nepal (73.8%).[22] The arise in LDL-C particle in T2DM patients might be due to lipolysis of very-low -density lipoprotein (VLDL) which after triglyceride supplementation by cholesteryl ester transfer protein, along with hepatic lipase mediated hydrolysis of triglyceride and phospholipids which leads to increased production of LDL-C.[13]

Table 3 Bivariate Analysis of Factors Associated with Dyslipidemia Among Adult Type-2 Diabetic Patients at Jimma University Medical Center; Jimma, Southwest Ethiopia, June 1- August 4, 2019

Variables	Categories	Dyslipidemia		COR (95% CI)	p-value
		No	Yes		
Age in years	<30 ≥30	20(58.8) 59(27.6)	14(41.2) 155(72.4)	1 3.75(1.78–7.91)	0.01*
Gender	Female Male	33(25.6) 46(38.7)	96(74.4) 73(61.3)	1.83(1.06–3.14) 1	0.28
Residence	Urban Rural	38(29.5) 41(34.5)	91(70.5) 78(65.5)	1.25(0.73–2.14) 1	0.399
Marital status	Single Married Widowed Divorced	5(23.8) 67(32.7) 4(28.6) 3(37.5)	16(76.2) 138(67.3) 10(71.4) 5(62.5)	1.92(0.33–11.03) 1.23(0.28–5.32) 1.5(0.23–9.46) 1	0.46 0.77 0.66
Educational status	Illiterate Primary Secondary Higher	40(28.8) 11(28.2) 17(38.6) 11(42.3)	99(71.2) 28(71.8) 27(61.4) 15(57.7)	1.8(0.76–4.29) 1.86(0.65–5.3) 1.16(0.43–3.12) 1	0.17* 0.24* 0.76
Smoking cigarette	Yes No	9(36) 70(31.4)	16(64) 153(68.6)	0.8(0.34–1.93) 1	0.63
Alcohol consumption	Yes No	12(27.3) 67(32.8)	32(72.7) 137(67.2)	1.3(0.63–2.69) 1	0.47
Chewing chat	Yes No	27(35.5) 52(30.2)	49(64.5) 120(69.8)	0.78(0.44–1.39) 1	0.41
Physical activities	Yes No	40(40.8) 39(26)	58(59.2) 111(74)	1 1.96(1.14–3.38)	 0.015*
Body mass index	Underweight Normal Overweight Obese	7(53.8) 21(35) 39(92) 12(22.6)	6(46.2) 39(65) 83(68) 41(77.4)	1 2.16(0.64–7.28) 2.48(0.78–7.88) 3.98(1.12–14.13)	 0.21 0.12 0.032*
Hypertension	Yes No	23(20.5) 56(41.2)	89(79.5) 80(58.8)	2.7(1.52–4.79) 1	0.01*
Fasting blood glucose	<180mg/dl ≥180mg/dl	70(36.5) 9(16.1)	122(63.5) 47(83.9)	1 2.99(1.38–6.48)	 0.005*

Notes: 1 = Referent category. *Candidate variables for multivariate analysis p-value <0.25, mg/dl milligram per deciliter.

Our study showed a lower prevalence of low HDL-C compared to reports from Ethiopia (41.9–68.7%)[19,26] and Nepal (64%),[27] whereas higher than reports from Hawassa, Ethiopia.[8]

In the current study both serum, TC, and TG showed a significant positive correlation with fasting blood levels and hypertension in T2DM patients. Different studies were reported similar findings.[22,29–31]

Socio-demographic factors can play role in determining dyslipidemia in diabetic patients. In the current study, dyslipidemia was significantly associated with increasing age (age≥30 years). This finding is in agreement with the study done in Ethiopia,[19] China,[25] and Thailand.[17]

The current study revealed that there is a statistically significant association between dyslipidemia and physical activities. Similar findings were reported from Kenya[16] and China.[25]

In this study, dyslipidemia was significantly associated with obesity. Study participants who had obese were 5.6 times more likely to be dyslipidemic compared to their

Table 4 Correlation Analysis of Lipid Profile with Predictors Among Adult Type −2 Diabetic Patients

Predictors	TC		TG		LDL-C		HDL-C	
	r	p	r	p	r	p	r	p
Age	0.51	0.42	0.08	0.17	0.07	0.24	−0.06	0.30
Gender	−0.07	0.22	−0.06	0.28	−0.07	0.26	0.004	0.94
Smoking cigarette	0.008	0.89	0.005	0.93	−0.07	0.91	0.30	0.64
Alcohol consumption	−0.29	0.64	0.14	0.02	−0.08	0.9	−0.12	0.05
Chewing chat	−0.014	0.82	0.09	0.13	0.004	0.94	−0.08	0.18
Physical activities	−0.051	0.42	−0.06	0.33	−0.11	0.07	0.07	0.26
BMI	0.11	0.06	0.09	0.12	0.01	0.81	−0.04	0.47
Weight	0.08	0.17	0.04	0.46	−0.07	0.21	0.07	0.24
Hypertension	0.15	0.01	0.2	0.001	0.25	<0.001	0.01	0.84
Fasting blood glucose	0.15	0.013	0.24	<0.001	0.09	0.14	−0.03	0.58

Notes: r, Pearson correlation coefficient; p, p-value for correlation.

underweight counterparts. A similar observation was reported from Ethiopia,[19] Kenya[16] and China.[25]

Hypertension was significantly associated with dyslipidemia in this study. Hypertensive diabetic patients were 2.65 times more likely to develop dyslipidemia compared with non-hypertensive counterparts. This finding is in agreement with a study done in Ethiopia[20] and Pokhara, Nepal.[22]

The current study revealed that there is a statistically significant association between dyslipidemia and fast

Table 5 Multivariate Analysis of Factors Associated with Dyslipidemia Among Adult Type-2 Diabetic Patients at Jimma University Medical Center; Jimma, Southwest Ethiopia, June 1–August 4, 2019

Variables	Categories	Dyslipidemia		AOR(95% CI)	p-value
		No	Yes		
Age in years	<30	20(58.8)	14(41.2)	1	
	≥30	59(27.6)	155(72.4)	3.9(1.6–9.48)	0.003**
Educational status	Illiterate	40(28.8)	99(71.2)	1.4(0.5–3.8)	0.49
	Primary	11(28.2)	28(71.8)	1.37(0.42–4.47)	0.59
	Secondary	17(38.6)	27(61.4)	1.25(0.4–3.79)	0.68
	Higher	11(42.3)	15(57.7)	1	
Physical activities	Yes	40(40.8)	58(59.2)	1	
	No	39(26)	111(74)	2.46(1.3–4.5)	0.004**
Body mass index	Underweight	7(53.8)	6(46.2)	1	
	Normal	21(35)	39(65)	2.46(0.6–9.8)	0.2
	Overweight	39(92)	83(68)	2.8(0.7–10.8)	0.12
	Obese	12(22.6)	41(77.4)	5.6(1.3–23.9)	0.018**
Hypertension	Yes	23(20.5)	89(79.5)	2.65(1.4–4.9)	0.002**
	No	56(41.2)	80(58.8)	1	
Fasting blood glucose	<180mg/dl	70(36.5)	122(63.5)	1	
	≥180mg/dl	9(16.1)	47(83.9)	3.1(1.3–7.2)	0.007**

Notes: 1.00 = Referent category. **Statistically associated p-value <0.05.

blood glucose of ≥180 mg/dl in diabetic patients. Similar findings have been reported in a study conducted in Jimma, Ethiopia.[20]

Limitation of the Study

The cross-sectional nature of the study design was prohibited to establish causal links between dyslipidemia and independent predictors. We also did not perform HBA1c and liver enzymes due to logistic constraints.

Conclusions

A high prevalence of dyslipidemia was found among T2DM patients in the study area. Age, physical inactivity, obesity, hypertension, and high blood glucose levels were significantly associated with dyslipidemia among T2DM patients. The findings of this study should be taken into account to conduct appropriate intervention measures on identified risk factor reduction and implement routine screening, treatments, and prevention of dyslipidemia.

Data Sharing Statement

The original data for this study is available from the corresponding author on a reasonable request.

Ethical Consideration

Ethical clearance was obtained from the Jimma University Institutional Review Board (IRB)/committee with reference number JHRPGD/551/2019. A letter of cooperation was written to JUMC administrative offices. Written informed consent was obtained from each study participants after explaining the purpose and procedures of the study before enrolling in the study and those willing to participate were included. The entire study groups were informed that their response will be kept confidential. The study was conducted in accordance with the Declaration of Helsinki.

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Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declared that they have no competing interests.

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