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The Magnitude of Dyslipidemia & Associated Factors Among Patients with Type 2 DM Who Are in Follow-up in Adult Endocrine Clinic at SPHMMC, Addis Ababa, Ethiopia

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Abstract: Diabetes has been a rising health burden universally. It is defined as a group of metabolic disorders that result in high serum glucose levels which can be caused by a deficiency of insulin or a defect in its action. Cardiovascular complication is the main cause of death in the diabetic population. Of which, dyslipidemia is the principal factor associated with cardiovascular disease in the T2DM population. However, early detection and treatment of dyslipidemia in T2DM patients can prevent the progression of dyslipidemia & minimize the risk of CVS disease-related morbidity and death significantly. And for there is a paucity of data on the magnitude of dyslipidemia & associated factors among T2DM patients in Ethiopia, we conducted an institution-based cross-sectional analytic study at SPHMMC endocrinology clinic from January 1 to February 28 2022 G.C. The data for the study is collected by a structured checklist and it is entered, cleaned & analyzed using SPSS version 26.0. Descriptive analyses like frequency distribution, proportion and dispersion were calculated. And the finding is presented using frequency tables, graphs, and charts. Both univariate and multivariate analyses were done. The OR with 95% CI was used to show the strength of the association and a P value of $\leq$0.05 was considered statistically significant. In the study, a total of 270 type 2 DM patients were enrolled and all of them were included in the analysis. The magnitude of dyslipidemia revealed from the study was 93.7%. Out of those who have dyslipidemia, 13.7%, 64.8%, 70% and 34.8% of the participants had high TC, low HDL, high LDL and high triglyceride levels, respectively. In multiple regression analysis, only sex showed statistical significance at p-value < 0.05. The odds of having dyslipidemia was 7-fold increased (AOR=95% CI (1.251-43.421)) in type 2 DM patients. As a conclusion, the magnitude of dyslipidemia was found to be 93.7% of the total participants which is higher than most of the

studies which were done inside and outside Ethiopia. And being female was associated with a risk of developing dyslipidemia. Thus, health professionals should screen and monitor dyslipidemia in all type 2 DM patients especially females.

Keywords: T2DM, Dyslipidemia, FBG, HbA1C, Endocrinology Clinic, SPHMMC

1. Introduction

Diabetes mellitus is defined as a group of metabolic disorders that result in high serum glucose level. It can be caused by deficiency of insulin or defec in its action which is manifested as metabolic disorders of carbohydrates, lipids and proteins [1-3].

Diabetes has been a rising health burden universally. Around 80% of the diabetic population lives in developing countries [4, 5]. Roughly, 537 million people throughout the world were found to have diabetes in 2021, around 643 million people will be expected to be affected by diabetes in 2030 and 783 million people are predicted to be affected by 2045 [6]. Cardiovascular complication is the main cause of death in the diabetic population [7, 8]. The diabetic population has a 2- 4 times higher rate of mortality ascribed to cardiovascular causes than the non-diabetic population [9]. And dyslipidemia is the principal factor associated with cardiovascular disease in the T2DM population [10]. Dyslipidemia is a disorder of lipid metabolism that comprises one or a combination of high levels of LDL cholesterol, triglyceride and low HDL cholesterol levels [1, 11]. As WHO reported, dyslipidemia is related to greater than 50% of whole ischemic heart disease patients and accounts for greater than 4 million deaths yearly [1, 12]. Dyslipidemia has also appeared to be a major factor associated with ASCVD in sub-Saharan Africa [13].

Insulin resistance in T2DM patients causes dyslipidemia by different mechanisms. Primarily, free fatty acids from insulin-resistant adipose tissue are carried to the liver cells; there they are esterified into triglycerides and are further packaged to form VLDLs to be finally secreted to the blood vessels. Moreover, the elevated insulin by itself stimulates the larger production of free fatty acids by hepatocytes. Besides the large production of VLDL in the liver, insulin resistance also results in a variable decrement in the activity of LPL. This is through decreased transcription of LPL on skeletal muscle and adipose tissue as a result of tissue insulin resistance and, a larger production of apoC-III by hepatocytes. This decrement in the activity of LPL mostly intensifies the overproduction of VLDL and accounts for dyslipidemia observed in T2DM patients [14].

2. Method

2.1. Study Area and Period

Ethiopia, officially the Federal Democratic Republic of Ethiopia, is a country in the horn of Africa. It shares borders with countries like Eritrea, Djibouti, Somalia, South Sudan and Kenya. With up to 110 million inhabitants, Ethiopia is the most populous landlocked country in the world and the second most populous nation in the African continent [32].

SPHMMC is located in Addis Ababa, the capital city of Ethiopia. It is established in 1961 G.C. by Emperor Haile Selassie. In 2007 G.C., a medical college was also established. SPHMMC is now the main teaching hospital for both clinical and preclinical training of most disciplines. It is also an institution where specialized clinical services are rendered to the whole nation. Currently, SPHMMC has greater than 2800 clinical, academic & administrative and support stuffs dedicated to providing health care services, educating students and conducting researches. There are various clinical departments under it; one of which is Internal medicine. And under the department of internal medicine, there are a number of sub-specialties including gastroenterology, nephrology, endocrinology, cardiology & neurology. Endocrinology specialty unit is one of the core areas where both outpatient and inpatient services as well as academic activities are carried out despite the scarcity of human resource. As it is one of the largest hospitals where patients are referred from all over the country to get medical care including diabetic cases, it could be the best location to conduct this research. The study was conducted from January 1, 2022 to August 30, 2022 G.C.

2.2. Study Design

An institution based cross-sectional analytic study was conducted in T2DM patients who are on follow-up at SPHMMC adult endocrine clinic from January 1 to February 28, 2022 G.C.

2.3. Population

2.3.1. General Population

All T2DM patients living in Ethiopia are going to be taken as the general population.

2.3.2. Source Population

It refers to all T2DM patients on follow-up at SPHMMC adult endocrine clinic.

2.3.3. Study Population

The study population was all T2DM patients on follow-up at SPHMMC during the study period and those who fulfill the inclusion criteria.

2.3.4. Study Unit

Study unit was the individual subjects of the study population.

2.4. Inclusion & Exclusion Criteria's

2.4.1. Inclusion Criteria

1) Age ≥ 18 years

2) Patients who are diagnosed with T2DM on follow up in

adult Endocrine clinic of SPHMMC.

3) T2DM patients whose lipid profile and either FBG or HbA1C results are available at the time of data collection or 3 months before the time of data collection.

2.4.2. Exclusion Criteria

1) Health conditions that compromise the patient's ability to understand the interview.
2) Patients who are unable to stand which makes measurement of weight difficult.
3) Patients with type 1 DM (T1DM), gestational diabetes or secondary causes of diabetes.

2.5. Sample Size Determination and Sampling Technique

2.5.1. Sample Size Determination

Sample size is calculated by using the single population proportion formula

$$n = Z^2 p(1-p) / d^2$$

n= required sample size

Z= confidence level at 95% (standard value of 1.96)

d= margin of error = 5%

P= estimated prevalence of dyslipidemia in T2DM from previous study was 68.1% [2].

So, when we substitute the values in the formula, it gives us a sample size of 334.

$$n= (1.96)^2*0.681*0.319) / (0.05)^2$$

n=334

Since the study population is <10,000, there is a need to use population correction formula which is n=ni*N/N+ni

Where ni= initial sample size is 334

N= study population (T2DM patients at follow up in endocrine clinic in 2 months) is 920.

Because the source population is <10,000, the final sample size is determined as follows:

$$n_f = \frac{ni}{[1+ n/ N]}$$

nf =334/(1+334/920) = 245

This gives us a sample size of 245 patients.

When we add the 10% non-response rate, it gives us a final sample size of 270 patients.

2.5.2. Sampling Method

The total number of type 2 diabetic patients who were seen during the study period i.e. from January 1 to February 28 2022 G.C. was 920 according to the HMIS report. From these, 270 patients were selected by systemic random sampling. Sampling interval was determined by dividing the total number of study population who had follow up during the study period divided by the total number of sample size (920/270) which is 3.4. The first study subject was determined randomly, and after that every 4th patient was selected until the daily limit is achieved. This technique was continued until the final sample size is obtained. For a patient who is not eligible, we used the 5th patient.

2.6. Study Variables

2.6.1. Dependent Variable

Dyslipidemia

2.6.2. Independent Variables

1) Socio demographic factors: Age, sex
2) Anthropometric factors: BMI, waist to hip ratio
3) Disease related factors: Duration of diabetes mellitus, HgA1C, fasting blood glucose
4) Co morbidities related factors: Hypertension, stroke, ischemic heart disease
5) Other factor: Physical inactivity

2.7. Operational Definitions

1) Diabetes mellitus: DM is defined as fasting blood sugar >125 mg/dL, or HgA1c >6.5% or symptoms of hyperglycemia and random blood sugar >200mg/dL. Or two hour oral glucose tolerance test > 200mg/dL [33].
2) Elevated FBG: fasting blood sugar >125 mg/Dl [33].
3) Elevated HbA1c: HgA1c > 7% [33].
4) Hypertension: Blood pressure >/= 140/ 90 mmHg which is measured more than one time or participants with known hypertension [14].
5) Hypercholesterolemia: is defined as total cholesterol level greater than 200mg/dL [1].
6) High LDL: is defined as LDL level greater than or equal to 70 mg/dL [14].
7) Low HDL: is defined as HDL cholesterol level less than 40 mg/dL for men and less than 50 mg/dL for women [14].
8) Hypertriglyceridemia: a triglyceride level greater than or equal to 150 mg/dL [14].
9) Dyslipidemia: is defined as either a single or combination of lipid abnormalities (high total cholesterol, high LDL, low HDL and hypertriglyceridemia) [11].
10) BMI: The body mass index is a person's weight in kilograms divided by the square root of height in meters. And the BMI cut of value according to WHO classification (in Kg/m²) will be <18.5 (underweight), 18.5-24.99 (normal), 25- 29.99 (overweight), >30 (obese) [1].
11) Increased waist to hip ratio: is considered when the ratio of waist (cm) / hip (cm) is > 0.90 for men and >0.80 for females [25].

2.8. Data Collection, Analysis & Quality Control

First, the aim of the study was clearly explained to the participants. And then, data was collected by a questionnaire adopted from different literatures. The questioner consists of information on the socio demographic factors (age & sex), duration of diabetes & physical inactivity. The laboratory values (FBG, HbA1C&lipid profiles) were taken from the patient's chart. And, blood pressure was measured by using a well-calibrated digital sphygmomanometer. Moreover, anthropometric measurements were done by trained nurses in endocrine clinic. The height was measured by instructing each

patient to make his/her feet pointed outward; legs straight and knee together; arms at sides, head, shoulder, blades, buttocks, and heels touching measurement surface; looking straight ahead; and shoulder relaxed by using tape meter and weight is measured by using weight scale. The BMI was calculated by the formula weight (kg) over height (m) square, and the results were recorded. In addition, waist circumference was measured by using a tape midway between costal margin & iliac crest horizontally while the participant is standing and breathing normally. And hip circumference was measured by taking the widest portion of the buttocks by using tape mater in a horizontal plane. And waist to hip ratio which was a measure of abdominal obesity was done by taking the ratio of waist (cm)/ hip (cm) and it was recorded. The data collection was done from January 1, 2022 to February 28, 2022 G.C.

The collected data was entered into a computer using SPSS version 26.0 after checking for its completeness & consistency. And, data cleansing was done. Frequency tables & descriptive summary was done for the study variables. In addition, graphs & charts were used to illustrate findings. Bivariate logistic analysis was performed. And then, those variables in bivariate analysis with p value < 0.25 were taken as a candidate for multivariate logistic analysis. Multivariate logistic regression analysis was used to identify associated factors for the prevalence of dyslipidemia. p value was set <0.05 for statistical significance.

To ensure the quality of data, preceding data collection, training of the data collectors was carried out for one day by the principal investigator on the objective, relevance of the study and confidentiality of information.

And during the time of data collection, at the end of each day, the data was checked manually for completeness, was organized, cleaned and later carefully coded and analyzed using SPSS version 26.0. The checklist was prepared in English then it was translated to Amharic during the interview; so that patients gave accurate answers with a better understanding. Pre-test was done two weeks prior to data collection using 5% of the total sample size to check its variability and it was assessed for its clarity, length and completeness.

2.9. Ethical Consideration

Prior to conducting the research, permission was obtained from SPHMMC Research Ethics committee. Patients were informed about the aim and benefit of the study. The information obtained from the interview as well as from the charts of the patients was kept confidential and was used only for the purpose of this study.

2.10. Dissemination of Results

At the end of the research, the output of the study was communicated to the department of Internal Medicine and Public Health, St. Paul's Hospital Millennium Medical College in partial fulfillment of the requirement for a specialty certificate in Internal Medicine. It will also be submitted to the hospital's Endocrinology unit. Moreover, it will be presented in scientific conferences including SPHMMC. And all efforts will be made to publish the results on local or international journals.

3. Result

3.1. Socio Demographic Characteristics of Respondents

A total of two hundred seventy participants with type 2 diabetes mellitus were enrolled in the study, and the response rate was 100%. 49.3% of the participants were females and 50.7% were male. The mean age was 54.02 (with a SD of 10.44).

Table 1. *Frequency of age in T2DM patients in study area & period.*

Age	Frequency	Percent
18 – 50	80	29.6
≥ 50	190	70.4

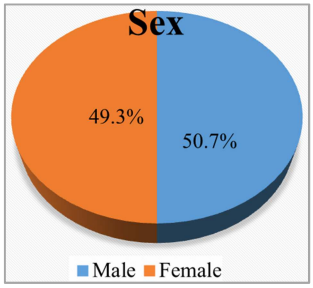

Figure 1. *Frequency of sex in T2DM patients in study area & period.*

3.2. Magnitude of Dyslipidemia Among Respondents

Out of the 270 study participants, 93.7% of the participants had dyslipidemia with one or more abnormal value of the four measured parameters of lipid profile. Out of those who had dyslipidemia, 13.7%, 64.8%, 70% and 34.8% of the participants had high total cholesterol, low HDL, high LDL and high triglyceride levels, respectively.

The most common lipid profile abnormality was elevated LDL-C level. Out of the 70% of patients who had high LDL-C, 28% has isolated elevation of LDL-C level. Out of the total number of participants, 37% had isolated abnormal value of a single lipid profile value while 7% of the participants had abnormal value on all four parameters of the lipid profile.

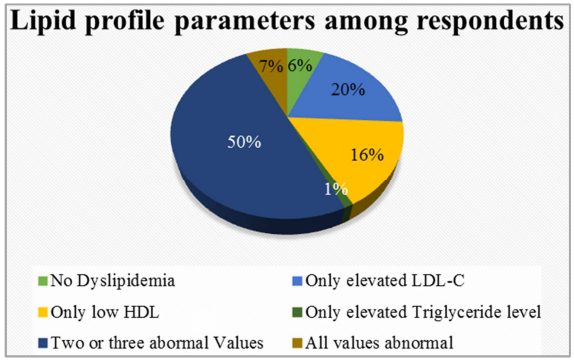

Figure 2. *Individual lipid profile parameters among T2DM patients in study area & period.*

Table 2. Magnitude of dyslipidemia among T2DM patients in study area & period.

Dyslipidemia	Normal Value n (%)	Abnormal Value n (%)	Isolated abnormal Value n (%)	Mean and SD of lipid profile parameter
Total cholesterol	233 (86.3)	37 (13.7)	0	153.4 ± 48.35
HDL Cholesterol	95 (35.2)	175 (64.8)	44 (16.3)	43.4 ± 11.19
LDL Cholesterol	81 (30)	189 (70)	53 (19.6)	93.5 ± 54.7
Triglyceride	176 (65.2)	94 (34.8)	3 (1.1)	154.9 ± 103.5

3.3. Factors Associated with Dyslipidemia Among Respondents

3.3.1. Anthropometric Factors Among Respondents

The anthropometric data collected showed that 44.4% and 9.3% of the participants were overweight and obese respectively while 45.9% had a normal BMI. Out of all the respondents, 83.21% of male participant had normal waist to hip ratio and all of the female participants had increased waist to hip ratio.

Table 3. Anthropometric characteristics of T2DM patients in study area & period.

BMI	Frequency	Percent
Underweight	1	0.4%
Normal	124	45.9%
Overweight	120	44.4%
Obese	25	9.3%
Total	270	100%

3.3.2. Exercising Habits of Respondents

75.6% of the participants performed walking slowly, cooking or doing light house work for at least 30 min in most days of the week while none of the participants were involved in jogging, running or biking (≥16km/hr). 78.1% of the respondents were physically inactive and 29.9% were doing aerobic exercise by walking quickly, biking, dancing or swimming.

Table 4. Exercising habit of T2DM patients in study area & period.

Physical activity done for at least 30min in most days of the week?	Frequency	Percent
Sitting, lying or watching television	7	2.6%
Walking slowly, cooking or doing light housework	204	75.6%
walking quickly (4-6km/hr) or biking (8-14km/hr) or dancing or swimming	59	21.9%
Jogging, running or biking (≥16km/hr).	0	0
Total	270	100%

3.3.3. Other Factors Associated with Dyslipidemia Among Respondents

Out of the total participants, 34.8% of them had no other comorbid conditions, 62.6% of them had hypertension only & 0.7% of them had only ischemic heart disease. Besides, those who had hypertension with a history of stroke & those who had hypertension with ischemic heart disease were 1.1% & 0.7% respectively.

The mean duration of type 2 DM among participants was 9.5 years (SD=6.007). 31.1% of the participants have diabetes for longer than 10 years.

Based on the laboratory HbA1c value, 58.9% of the participants had elevated HbA1C & 79.6% of the respondents had elevated fasting blood glucose levels.

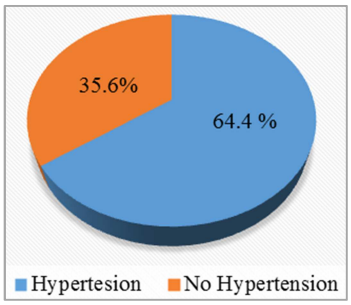

Figure 3. Hypertension prevalence among T2DM patients in study area & period.

Table 5. Past medical conditions among T2DM patients in study area & period.

Chronic Medical Illness	Frequency	Percent
None	94	34.8%
Hypertension	169	62.6%
Ischemic Heart Disease	2	0.7%
Hypertension and Stroke	3	1.1%
Hypertension and Ischemic Heart Disease	2	0.7%
Total	270	100%

Table 6. Duration of illness among T2DM patients in study area & period.

Duration of Illness	N (%)
1-5 years	72 (26.7)
6-10 years	114 (42.2)
≥ 11 years	84 (31.1)

Table 7. HbA1c values among T2DM patients in study area & period.

Diabetes Control (HbA1c)	Frequency	Percent
HbA1C ≤ 7%	111	41.1%
HbA1C > 7%	159	58.9%
Total	270	100%

Table 8. FBG values among T2DM patients in study area & period.

FBG (mg/dl)	Frequency	Percent
FBG ≤ 125	55	20.4%
FBG >125	215	79.6%
Total	270	100%

3.4. Bivariate and Multivariate Analysis

Binary logistic regression was done for assessment of association between the dependent variable which is dyslipidemia and the individual independent variables using SPSS version 26. And the variables found to have statistical significance at p-value < 0.25 were sex, age, BMI, waist to hip ratio and duration of diabetes.

Then, those variables with p-value < 0.25 were further

analyzed using multivariate logistic regression and only sex had statistical significance at p-value < 0.05. The odds of having dyslipidemia was 7-fold increased (AOR=95% CI (1.251-43.421)) in type 2 DM patients.

Table 9. *Bivariate logistic regression of dependent & independent variables in study area & period.*

Variables	No Dyslipidemia	Dyslipidemia	Crude Odds Ratio	P- Value
Socio demographic characteristics of Respondents				
Sex				
Female	2 (1.5)	131 (98.5)	8.053 (1.804 - 35.944)	.006
Male	15 (10.9)	122 (89.1)	1	
Age				
18 - 49 Years	2 (2.5)	78 (97.5)	1	.115
≥ 50 Years	15 (7.9)	175 (92.1)	0.299 (0. 067 - 1.340)	
Anthropometric factors among Respondents				
Body Mass Index (BMI)				
Normal	11 (8.9)	113 (91.1)	1	.151
Overweight	5 (4.2)	115 (95.8)	2.219 (0.747- 6.590)	.432
Obese	1 (4)	24 (96)	2.316 (0.285 - 18.796)	
Waist to Hip Ratio (W/H Ratio)				
Normal W/H Ratio	5 (21.7)	18 (78.3)	1	.007
Increased W/H Ratio	12 (4.9)	234 (95.1)	4.854 (1.554 - 15.160)	
Past Medical Diseases among Respondents				
Blood Pressure				
No Hypertension	6 (4.7)	121 (95.3)	1	.291
Hypertension	11 (7.7)	132 (92.3)	.538 (0.171 – 1.7)	
Any Chronic Comorbid Conditions?				
No Comorbid Conditions	4 (4.3)	90 (95.7)	1	.319
Has Comorbid Conditions	13 (7.4)	163 (92.6)	0.557 (0.176 – 1.760)	
Disease related factors among Respondents				
Duration of Diabetes Mellitus				
1-5 years	2 (2.9)	70 (97.1)	1	.168
6-10 years	9 (8.6)	105 (91.4)	0.333 (0.070 – 1.589)	.234
≥ 11 years	6 (7.7)	78 (92.3)	0.371 (0.073 – 1.900)	
Diabetic Control (HbA1c)				
Controlled DM	7 (6.3)	104 (93.7)	1	.995
Uncontrolled DM	10 (6.3)	149 (93.7)	1.003 (0.370 – 2.720)	
FBG level				
Normal FBG level	4 (7.3)	51 (92.7)	1	.739
Elevated FBG level	13 (6.1)	202 (93.9)	1.219 (0.381 – 3.859)	
Other Factors				
Exercise Habit of Participants				
Physical Inactivity	14 (6.6)	197 (93.4)	0.754 (0.209 - 2.716)	.666
Aerobic Exercise	3 (5.1)	56 (94.9)	1	

Table 10. *Multivariate logistic regression of T2DM patients in study area & period.*

Variables	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	P- Value (AOR)
Sex			
Male	1	1	.027
Female	8.053 (1.804 - 35.944)	7.371 (1.251 - 43.421)	
Age			
18 - 49 Years	1	1	.244
≥ 50 Years	0.299 (0. 067 - 1.340)	0.381 (0.075 - 1.933)	
Body Mass Index (BMI)			
Normal	1	1	.330
Overweight	2.219 (0.747- 6.590)	1.769 (0.562 – 5.568)	.533
Obese	2.316 (0.285 - 18.796)	0.448 (0.036 – 5.595)	
Waist to Hip Ratio (W/H Ratio)			
Normal W/H Ratio	1	1	.117
Increased W/H Ratio	4.854 (1.554 - 15.160)	2.643 (0. 784 – 8.914)	
Duration of Diabetes Mellitus			
1-5 years	1	1	.272
6-10 years	0.333 (0.070 – 1.589)	0.397 (0.076 – 2.066)	.424
≥ 11 years	0.371 (0.073 – 1.900)	0.488 (0.084 – 2.832)	

4. Discussion

This study was conducted at SPHMMC adult outpatient endocrine clinic with the aim of assessing the magnitude of dyslipidemia and identifying association between dyslipidemia being the dependent variable and 9 different independent variables.

The overall magnitude of dyslipidemia among T2DM patients in the current study was 93.7%. The individual lipid profile abnormalities obtained in this study were 13.7%, 64.8%, 70%, & 34.8% which were high TC, low HDL, high LDL and high triglyceride, respectively. And, Sex was found to be an independent predictor of dyslipidemia in T2DM patients in this study.

The magnitude of dyslipidemia among the patients on follow up was comparable to studies done in other African countries such as South Africa (93.5%) [15] and slightly higher than the studies done in Maputo, Mozambique (86.7%) and Turbo, Kenya.(86%) [27, 30]. But the prevalence in studies done in other cities with in Ethiopia like Jimma and Mekelle was found to be 68.1% and 66.6% respectively which is much lower than what is seen in this [2, 11]. This difference may be due to the difference in the life style of the patients with increasing trend of urbanization and reduced physical activity.

The most common abnormally affected parameter on laboratory lipid profile was elevated LDL-C which is also the case in studies done in Durame, Ethiopia; Mekelle, Ethiopia; and Central South Africa but the percentage of patients with elevated LDL-C level is much higher in this study (70%) compared to the studies mentioned above whose LDL-C level is 48%, 43.8% and 49.5% [1, 11, 26]. The possible explanation for the above mentioned results could be the difference in the cutoff value used for defining elevated LDL [1, 11, 26].

The data shows that it is statistically significant that females are 7.3 times more likely to develop dyslipidemia than their male counterparts (Adjusted Odds Ratio [AOR] 7. 371; 95%CI = 1.251 - 43.421). Out of the 49.3% of the participants who were female, 98.5% of them have dyslipidemia. This finding is consistent with other studies done in Spain, Thailand, United Arab Emirates and Mozambique [9, 23, 29, 30].

5. Strength and Limitations

5.1. Strength

1) The data collectors were careful and diligent toward using the validated tools in collecting the data and with regards to keeping the collected information confidential.
2) The study was conducted in accordance with the coronavirus disease 2019 protocols insuring the safety of the data collectors and the participants of the study.

5.2. Limitations

1) It is difficult to generalize the results of our study to the rest of the country as the study was conducted on a single hospital in Addis Ababa. If more time and resources are available, it's better to do such studies in multiple referral hospitals throughout the country.
2) The study participants in SPHMMC endocrine clinic came from different parts of the country& speak different languages. For this reason, the questioner was prepared in English and was translated to their respective language during interview other than the laboratory variables and the anthropometric measurements. And, the language barrier could affect the result.

6. Conclusion

In our study, the magnitude of dyslipidemia was found to be higher than most studies done inside and outside Ethiopia. While assessing for relationship between dyslipidemia and independent variables, being female was associated with 7.3 times more risk of developing dyslipidemia than being male. Otherwise, age, anthropometric factors, presence of chronic medical conditions, duration of diabetes mellitus, exercising habits & degree of control of diabetes were not associated with the development of dyslipidemia among type 2 DM patients.

7. Recommendation

To health professionals

To screen for dyslipidemia and monitor serum lipid levels in all T2DM patients with special emphasis on female T2DM patients

To policy makers

1) To work toward the availability of screening laboratory tools in diabetic follow up clinics.
2) To give emphasis on creating awareness about the importance of screening for dyslipidemia in T2DM patients both for the health professionals as well as the patients.

To researchers

More researches should be done on the magnitude of dyslipidemia and associated factors in different parts of the country to assess the different factors that could affect its magnitude with in different parts of the country.

To endocrine follow up clinic

A system in which patients could be diagnosed early and treated properly should be established. Furthermore, much attention should be given on monitoring the progression of dyslipidemia in each visit.

Authors' Contribution

All authors equally involving in the process of conceptualization, proposal writing, data collection and trimming and statistical analysis. Finally, all of the authors agreed on to which journal to submit the paper work.

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Abbreviations and Acronyms

ADA: American Diabetic Association
BMI: Body Mass Index
CVD: cardiovascular disease
FBG: Fasting Blood Glucose
HbA1C: Hemoglobin A1C/ Glycated hemoglobin
HDL: C: High Density Lipoprotein Cholesterol
HMIS: Health Management Information System
HTN: Hypertension
LDL: C: Low Density Lipoprotein Cholesterol
LPL: Lipoprotein Lipase
SPHMMC: Saint Paul's Hospital Millennium Medical College
SPSS: Statistical Package for Social Sciences
SSA: Sub Saharan Africa
T2DM: Type 2 Diabetes Mellitus
TG: Triglyceride
TC: Total cholesterol
WHO: World Health Organization.

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