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"LIPID PROFILE ANALYSIS OF TYPE 2 DIABETIC PATIENTS IN NAJRAN"

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Abstract:

The diabetic patients are at increased risk to develop lipid abnormalities (hyperlipidemia). Diabetic patients who have lipid abnormalities are more prone to develop cardiovascular diseases. The aim of the current study was to compare lipid profiles levels between male and female with type-2 diabetes mellitus at Najran area.

This study conducted between September to December, 2023. A total of 60 known cases of type-2 diabetic patients (30 male, 30 female) were investigated. About 5 ml of fasting venous blood sample was collected from each subject for biochemical analysis.

Out of 60 patients, 50% patients were male and 50% were female. The mean±SD for age of patients was (**42.34±14.56** years) versus (**45.46±16.02** years), respectively. Results shows significant increase of means of HbA1c and LDL – C in female compered with male (P. Value =0.02), (P. Value =0.03) respectively. Other parameters TC, FPG, TG and HDL-C did not show any significant differences between females and males with T2DM. The results show a significant positive correlation between TG and LDL, and show a significant positive correlation between Age/Year and LDL.

It will be concluded that the serum level of LDL-C and HbA1c are significantly increased in female, old females are more suspected to have risk of CVD than males.

Hyperlipidemia is a common complication of diabetes mellitus. Therefore, maintaining good lipid profile can prevent development and progression of related complications among patient with diabetes mellitus.

Chapter 1

1. Introduction

1.1 lipids and type II diabetes mellitus

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin, it produces. Insulin is a hormone that regulates blood sugar. Hyperglycaemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels [1]. The global diabetes prevalence in 2019 is estimated to be 9.3% (463 million people), rising to 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045[2]. The World Health Organization (WHO) has reported that Saudi Arabia ranks the second highest in the Middle East, and is seventh in the world for the rate of diabetes. It is estimated that around 7 million of the population are diabetic and almost around 3 million have pre-diabetes [3]

Complications of lipids in type II of diabetes mellitus

High blood sugar damages organs and tissues throughout your body. The higher your blood sugar is and the longer you live with it, the greater your risk for complications.

Complications associated with diabetes include:

Heart disease, heart attack, and stroke because increase of lipids in serum [4]. According to a study conducted in Bengaluru

Population at 2018, India demonstrated the existence of dyslipidemia in T2DM population which is major risk factor

For CVD. Greater LDL-C was observed in T2DM females compared to T2DM males suggests higher risk for CVD in

females compared to males. [5]

Although there was no significant difference in LDL and HDL cholesterol

levels between males and females, the levels of total cholesterol and HbA1c were significantly positive correlated in female group

and also for LDL cholesterol and non-HDL cholesterol respectively. Non-HDL cholesterol exhibited direct correlations with total cholesterol, TG and LDL; all these correlations were significant both in male and female groups. The findings of this study

showed that prevalence of dyslipidemia is high in female Saudi T2DM patients. Furthermore, it is concluded that there is an

association between Hb A1c and some lipid markers. Thus, HbA1c is not only a useful biomarker of long-term glycemic control

but also, can be a good predictor of lipid profile.[6]

1.2 Diabetes Mellitus.

1.2.1 Definition of Diabetes Mellitus:

Diabetes mellitus, commonly referred to as diabetes, it is a metabolic disease that causes high blood glucose . The hormone insulin moves sugar from the blood into your cells to be stored or used for energy. With diabetes, your body either doesn't make enough insulin or can't effectively use the insulin it does make[4].

1.2.2 Classification of Diabetes Mellitus:

In general, there are different types of diabetes:

Type 1 diabetes is an autoimmune disorder .The system attacks and destroys cells within the pancreas, where insulin is formed . It's unclear what causes this attack. About 10 percent of individuals with diabetes have this sort[4].Type 2 diabetes occurs when your body- becomes immune to insulin, and sugar builds up in your blood. Prediabetes occurs when your blood glucose is above normal, but it's not high enough for a diagnosis of type 2 diabetes [4].Gestational diabetes is high blood glucose- during pregnancy. Insulin-blocking hormones produced by the placenta cause this sort of diabetes[4]. A rare condition called diabetes isn't- associated with DM , although it's an identical name. It's a special condition during which your kidneys remove an excessive amount of fluid from your body. [4].

1.2.3 symptoms of Diabetes Mellitus:

Diabetes symptoms are caused by rising blood glucose.

The general symptoms of diabetes include:

increased hunger

increased thirst

weight loss

frequent urination

blurry vision

extreme fatigue

sores that don’t heal

Symptoms in men

In addition to the overall symptoms of diabetes, men with diabetes may have a decreased drive , male erecticle dysfunction (ED), and poor muscle strength.

Symptoms in women

Women with diabetes also can have symptoms like tract infections, yeast infections, and dry, itchy skin[4]..

1.2.4 Diagnosis of Diabetes Mellitus:

Anyone who has symptoms of diabetes or is in danger for the disease should be tested. Women are routinely tested for gestational diabetes during their second or third trimesters of pregnancy.

Doctors use these blood tests to diagnose prediabetes and diabetes:

The fasting plasma glucose (FPG) test measures your blood glucose after you’ve fasted for 8 hours.

The HBA1C test provides a snapshot of your blood glucose levels over the previous 3 months.

To diagnose gestational diabetes, your doctor will test your blood glucose levels between the 24th and 28th weeks of your pregnancy.

During the glucose challenge test, your blood glucose is checked an hour after you drink a sugary liquid.

During the three-hour **glucose tolerance test,** your blood glucose is checked after you fast overnight then drink a sugary liquid.
The earlier you get diagnosed with diabetes, the earlier you'll start

treatment. determine whether you ought to get tested, and obtain more information on tests your doctor might perform.

In addition to the overall symptoms of diabetes, men with diabetes may have a decreased sex drive , erecticle dysfunction (ED), and poor muscle strength. [4].

1.2.5 Diabetes complication

General complications related to diabetes include:

heart disease, attack , and stroke-

neuropathy-
nephropathy-
retinopathy and vision loss-

hearing loss-

foot damage like infections and sores that don't heal-

skin conditions like bacterial and fungal infections

depression-
dementia[4]. -

A-Microvascular Complications:

1-Neuropathy:

Almost half of people with diabetes have some form of peripheral neuropathy (PN), whether it is diabetic neuropathy or mono diabetic neuropathy.[9] People with diabetes also have autonomic neuropathy, including autonomic cardiovascular impairment. , Which is manifested by an abnormal heart rate (HR) and vascular control [10]

2-Diabetic Retinopathy:

Diabetic retinopathy (DR) may be a microvascular complication which will affect the peripheral retina, the macula, or both and may be a leading explanation for visual disability and blindness in people with diabetes[11]

3-Diabetic Nephropathy:

Diabetic nephropathy (DN) may be a serious and progressive complication of both type 1 DM and sort 2 DM. the primary manifestation of DN is usually microalbuminuria, which progresses to overt albuminuria (ie, increased albumin levels within the urine, indicating more severe renal dysfunction) and eventually to kidney failure[12]

B-Macro vascular complications:

1- Cerebrovascular Disease

Stroke is that the third leading explanation for death within the us , after CVD and cancer,[13] and is an occasion very familiar to physical therapists. Diabetes is an independent risk factor across all ages for stroke; the danger in people with diabetes is up to 2- to 4-fold greater, more so in White race and ladies .[13] Diabetes is additionally a risk factor for sudden and eventual death from stroke,[14]and other people who have diabetes and who have a stroke have more severe neurological deficits and disability,[15] a poorer long-term prognosis ,and a better incidence of stroke recurrence than people without diabetes.[16]

2- Peripheral Artery Disease:

Currently within the us , quite 3.5 million people (African-American > white > Hispanic people) with diabetes have peripheral artery disease (PAD).[17] Peripheral artery disease is characterized by occlusion of the lower-extremity arteries, which may cause lameness and pain, especially upon exercise and activity, and which may end in functional impairments and disability.[18] Physical therapists frequently encounter people with diabetes-related PAD due to these functional impairments and since of common events of more severe PAD: foot ulceration and lower-extremity amputation).[18]

1.3 Lipids

1.3.1 Definition

A lipid is chemically defined as a substance that's insoluble in water and soluble in alcohol, ether, and chloroform.
Lipids are a crucial component of living cells. along side carbohydrates and proteins, lipids are the most constituents of plant and animal cells [7].

1.3.2 Classification of lipids

A-cholesterol

two major type of cholesterol:

-LDL, sometimes referred to as "bad cholesterol," is formed by your body and also absorbed by your body from cholesterol-rich foods like meat and dairy products. LDL can combine with other fats and substances in your blood, creating blockages in your arteries. Blockages in your arteries can reduce your blood flow and cause serious health problems like heart condition , attack , or stroke. due to its potential effects, doctors recommend lower levels of LDL. [7]

-HDL, sometimes referred to as "good cholesterol," features a protective effect on your heart. HDL transports harmful cholesterol out of your arteries. Doctors usually recommend that you simply have a better level of HDL cholesterol . [7]

B-Triglycerides , may be a sort of fat you get mostly from the food you eat. Your body also produces it when it converts excess calories to fat for storage. Some triglycerides are necessary surely cell functions, but an excessive amount of is unhealthy. like LDL, lower levels of triglycerides are considered healthier.[7]

C-fatty acid **,** they are a part of a lipid, are a various group of molecules synthesized by chain-elongation of an acetyl-CoA primer with malonyl-CoA or methylmalonyl-CoA groups during a process called fatty acid synthesis.[20]

D-Glycerolipids , are composed of mono-, di-, and tri-substituted glycerols,[21] the best-known being the carboxylic acid triesters of glycerol, called triglycerides. The word "triacylglycerol" is usually used synonymously with "triglyceride"

E-Glycerophospholipids, usually mentioned as phospholipids (though sphingomyelins also are classified as phospholipids), are ubiquitous in nature and are key components of the lipid bilayer of cells, also as being involved in metabolism and cell signaling[22]

F-Sterols, such as cholesterol and its derivatives, are an important component of membrane lipids, along with the glycerophospholipids and sphingomyelins. Other examples of sterols are the bile acids and their conjugates [23]

1.3.4 Diagnosis of lipids

To check cholesterol levels,shold be a blood test called a lipid profile, or lipid panel. This test measures your total cholesterol (both LDL and HDL) and triglycerides. Before this test, avoid eating and drinking liquids aside from water for a minimum of 8 to 12 hours.

The lipid profile measures cholesterol in milligrams of cholesterol per deciliter (mg/dL). Your total cholesterol level should be no above 200

1.4 studies conducted on lipids profile in patient with diabetes mellitus Type 2:

A study done at Bengaluru population, India at 2018. The authors find that when compare between males and females showed that LDLC was significantly higher in females with T2DM compared to males. Other lipid parameters TC, TG, and HDL-C showed no significance differences between females and males with T2DM [5]

In a Study done at , King Abdulaziz University , Jeddah, SA at 2018 . It found that The females had significantly higher values for, HbA1c, triglycerides (TGs), (HDL-C (LDL-C) compared to the males.

The study subjects were grouped according to their level of HbA1c good

glycemic index <7%, and poor glycemic index >7%). In both groups, no significant differences were found in any of the parameters other than TG.[8]

A study done at china at 2016, the diabetic patients presented serum lipid abnormality. Elevated triglyceride (TG) levels in 19.69% of males and 20.40% of females, and reduced high-density lipoprotein cholesterol (HDL-C) levels in 21.96% of males and 15.74% of females, no change was observed in the levels of low-density lipoprotein cholesterol and total cholesterol.[24]

A study done at Aurangabad (India) at 2020. It was observed a slight increase in FBG, HbA1C, TC within females compared with males. It was also found that the increase within males in TG and VLDL is less than females. The result showed a correlation between glycemic and other variables. The HbA1c has a positive correlation with FBG, TC, TG, LDL. Also, it was found a positive correlation in the FBG HbA1c, TC, TG, LDL. On the other hand, it was found a negative correlation between each of (FBG and HbA1c) and the HDL[25]

Due to the variations on lipids results in male and female diabetics and also in controlled and uncontrolled diabetics, so the aim of this study is to evaluate the lipid profile in type 2 diabetic patients in respect to gender in Najran population.

Chapter tow

2. Rationale and objectives

2.1 Rationale :

There were many studies on diabetes and its complications, and the statistics of the International Diabetes Federation indicate that approximately 463million people around the world have diabetes, and by 2030 there will be about 578 million people afflicted with this disease, equivalent to one patient for every 10 people, and in a survey conducted by WHO Diabetes It was revealed that the Kingdom of Saudi Arabia recorded 3 million cases of diabetes in the world in 2017. Studies of the World Health Organization indicate that diabetes is one of the main causes of premature death, vision loss, kidney failure, heart attacks, stroke and lower limb amputations, and by 2030 diabetes will be the seventh cause of death in the world.(3)

There are studies conducted around the world which state that there is a relationship between levels of lipids profile and diabetes in men and women. But the result were very conflicting.

2.2.1 General Objective:

To compare the levels of lipid profile between Type 2 Diabetics Males with Females.

2.2.2 Specific objectives:

1. To measure HbA1c and the plasma levels of FBG,cholesterol, triglyceride, Low density lipoprotein and High density lipoprotein in type 2 diabetic males group and females group.
2. To compare the men levels of FBG,HbA1c and lipid profile level between diabetic male group and diabetic female group.
3. To find out if there are a correlation between age and lipid profile in male and female with T2DM

3. Materials and Methods:

3.1 Study design:

Descriptive, analytic, case- control and hospital- based study.

3.2 Study area and period:

This study was conducted in Njran state, with a surface area 360000 Km and population of about 505,652inhabitants. Patient enrolled in this study were from King Khalid hospital, The study was done during the period from September 2023 to December 2023.

3.3 Target population and sample size:

The study samples comprised 60 Saudi patients with type 2 diabetes mellitus (30 males, 30 female all patients) were age and sex matched.

3.4 Selection criteria:

(a) Inclusion criteria

Test group: Saudi's Patients with type 2 Diabetes Mellitus.

(b) Exclusion criteria

- Patients with other types of diabetes mellitus, renal failure, liver disease, hypertension, cardiovascular diseases and thyroid disease were excluded from this study.

3.5 Ethical consideration:

- Permission of this study was obtained from the medical director of the above-mentioned hospital.
- Health education was provided to all participants in this study.
- The objectives of the study were explained to each subject participated in this study.
- An informed consent was obtained from all participants in this study.

3.6 Data collection and analysis:

3.6.1 Interview with a questionnaire:

An interview with a questionnaire to obtain the clinical data was done for each participant in this study.

3.6.2 Clinical examination of patients:

Clinical history and examination of the test group and the controls were done by physicians working in King Khalid hospital.

3.7 Blood samples collection:

In sterile condition and using a local antiseptic for skin, 5mls of venous blood was collected from each participant and separated into 3mls as serum and 2mls as plasma in EDTA tubes .For serum preparation the blood samples were separated after complete clotting by centrifugation at 4000 rpm for 5 minutes and serum was obtained. The serum samples were stored at -20 degree centigrade in deep freezing until the whole collection of the samples.

3.8 Biochemical measurements:

3.8.1 Measurement of glucose.

Spectrophotometric Measurement of Glucose.

Principle of the method:

Reagent at room temperature (20-25 C), and the glucose concentration is read directly from the display or printed out. This makes it suitable technique for single assays.

Test Procedure:

1. Plug in the spectrophotometer and turn it on by turning the left dial clockwise. Allow the spectrophotometer to warm up at least 5 minutes before proceeding.
2. Set the wavelength dial to 600 nm. This is a wavelength of light that gets absorbed readily by the pigment in the Grape Kool-Aid.
3. With no vial in the spectrophotometer, the light path is closed. Therefore no light is transmitted, or in other words there is an infinite absorption. With the on/off dial (left dial) set the needle to read infinity (∞) on the absorbance scale.
4. Now fill a cuvette (a small test tube that is 12 mm in diameter and 100 mm in length) with Blank 1. This solution should contain all the constituents except the substance to be measured. Since we are measuring Grape Kool-Aid, Blank 1 contains the other constituents, sugar and water, in the same proportion as are found in the Grape Kool-Aid.
5. Insert the cuvette containing Blank 1 into the sample chamber. As you do the light path will be opened. This blank solution does not contain any Grape Kool-Aid, and so the absorbance should be set to zero. Use the right knob to set the absorbance to zero.

6. Next fill a cuvette with Grape Kool-Aid test solution. Insert it into the spectrophotometer and record its absorbance in question number one of your assignment.
7. Next, fill a cuvette with Blank 2 solution and repeat steps 5 and 6.

3.8.2 Determination of $HbA1_c$:

HbA1c percentage level was measured by a method based on boronate affinity chromatography by using rapid invitro test for the measurement of glycated hemoglobin (HbA1c) % in human whole blood.The machine (NYCOCARDREADER II) is traceable to the international federation of clinical chemistry (IFCC) reference method for measurement of glycated hemoglobin ($HbA1_c$) %, and it is measuring range 3-18 %.

Principle of the method:

HbA1c is a boronate affinity assay when blood was added to glycinamide buffer containing dyeboundboronic acid and detergents the RBCs immediately lyses then boronic acid binds to glycated hemoglobin. **Reagents:**

- Test device (TD) plastic device containing membrane filter.
- Glycinamide buffer containing dye-bound boronic acid and detergants.
- Morphone buffered Nacl solution and detergents (washing solution).

Test Procedure:

1. Precipitate hemoglobin: 5µL of whole blood was added to the test tube with glycinated buffer containing dye-bound boronic acid and detergents .mix well. Incubate the tube for minimum 2 minutes, maximum 3 minutes. Use a timer.
2. Remix to obtain a homogenous suspension, 25µL of the reaction mixture was applied to a test device by holding the pipette approximately 0.5 cm above the test well. The pipette was embedded quickly in the middle of the test well. Allow the reaction mixture to soak completely into the membrane (approximately 10 second).
3. Washing solution (morphoine buffered Nacl solution and detergent), 25µL of washing solution was applied to the test device. Allowed the washing solution to soak completely into the membrane. Wait for minimum 10 seconds.
4. Test results were readied within 5 minutes using the NyoCard READER II. See appendix5.

Quality Control:

A quality control material with NYC0 CARD specific target value was used with every batch of sample to confirm the efficiency of the reagents and the correct performance of the NYCOCARDREADER II test system.

3.8.3Measurement of plasma cholesterol:

Test Principle:-

The cholesterol present in the sample originates a colored complex according to the following reaction:

Cholesterol ester +H2O2 $\xrightarrow{CHE}$ Cholestrole +Fatty Acids

Cholesterol+O2 $\xrightarrow{CHOD}$ 4-Cholestenone+H2O2

2H2O2+phenol+4-aminophenazone $\xrightarrow{POD}$ Quinoninine +4H2O

Procedure:

1-prepartion 3 test tube and libel sample ,stander,blank

2-add 1 ml of regent in 3 test tube

3-add 0.02ml sample in sample tube

4-add 0.02ml stander in STD tube

5-Mix incubates for S min. at 37 for 10 min. at room temperature. Read the absorbance of the samples and standard, against the blank. The color is stable for at least 60 min.

Calculate: Cholesterol mg/dl= AT/AS X 200g/dl

3.8.4Measurement of plasma tryglycerides:

Test Principle:

Sample triglycerides incubated with lipoproteinlipase (LPL), liberate glycerol and free fatty acids. Glycerol is converted to glycerol-3- phosphate (G3P) and adenosine-S-diphosphate (ADP) by glycerol kinase and ATP. Glycerol-3-phosphate (G3P) is then converted by glycerol phosphate dehydrogenase (GPO) to dihydroxyacetone phosphate (DAP) and hydrogen peroxide (H;O). In the last reaction, hydrogen peroxide (H,O) reacts with 4- aminophenazone (4-AP) and pchlorophenol in presence of peroxidase (POD) to give a red colored dye

Procedure :

1-prepartion 3 test tube and libel sample ,stander,blank

2-add 1 ml of regent in 3 test tube

3-add 0.02ml sample in sample tube

4-add 0.02ml stander in STD tube

5-Mix incubates for S min. at 37 for 5 min. at room temperature. Read the absorbance of the samples and standard, against the blank. The color is stable for at least 30 min.

Calculate: triglycerides mg/dl= AT/AS X 200g/dl

3.8.5Measurement of plasma HDL cholesterol:

Test **Principle :**

Low density fractions (LDL, VLDL) of lipoproteids of the serum are precipitated with a mixture of phosphotungstic acid and magnesiu chioride solutions and removed by centrifugation. Concentration of HDL in the clear supematant can be measured. The reagent used for the determination is identical with applied for assay of total cholesterol.

Procedure:

1. Separation of lipoprotein fractions. Serum 200 jul Precipitant reagent 500ul

2. Mix incubates the mixture for 10 minutes at temperature, then centrifuge at 4000 rpm for 10 minutes.

3. Determine the cholesterol concentration from supematant based upon instruction of cholesterol kit.

Calculate: NB: The concentration of LDL Cholesterol can be calculated according to Fredwalds formula: LDL mg/dl= total Cholesterol - (TG/5) - HDL Cholesterol.

Chapter Four:

4. Results

Sixty of type 2 DM patients were participated in this study. All participates were age and sex matched. In the present study, males constitute 50% (n=30) of the test group, while females constitute 50% (n=30) of the test group.

4.1 Comparison of mean of Age between male and female group:

Results shows insignificant difference (P.Value = **0.66**) between the mean of age of the male group compared with female group (42.34 ± 14.56 years) versus (45.46±16.02 years), respectively (Table1).

4.2 Comparison of results of FBG, HbA1c, TC, HDL-C, LDL-C and TG concentrations in type 2 diabetic males and females.

Results shows significant increase of means of HbA1c and LDL – C in female group compared with male group (7.52 ± 1.88) versus (6.94 ± 1.89) , (3.92 ± 1.46) versus (3.08 ± 1.16) respectively (P.Value less than 0.05) . Other parameters TC,FPG, TG and HDL-C did not show any significant differences between females and males with T2DM. (Table2).

4.3 Correlation between TG and LDL in Females with type 2 DM:

The results show a significant positive correlation between TG and LDL (r=0.578, P.Value = 0.001) (Table 3) (Fig. 1)

4.4 Correlation between Age/Year and LDL in Males with type 2 DM :

The results show a significant positive correlation between Age/Year and LDL (r=0.447, P.Value=0.013) (Table 4)(Fig.2)

Table (1): Gender distribution and age of patients with type 2 diabetes (n=60).

Gender	No of Patients (Frequency %)	Gender	Age / years (mean± SD)
Male	30 (50%)	Male	42.34±14.56
Female	30 (50%)	Female	45.46±16.02
Total	60 (100%)	P. value	0.66

• T. test was used to calculate P Value. P value Less than 0.05 considered significant.

Table (2): Comparison of results of FPG, HbA1c, TC, TG, HDL-C and LDL-C concentrations in type 2 diabetic males and females.

Parameters	Male (mean± SD)	Female (mean± SD)	P. value
FPG (mmol/l)	6.75 ± 4.08	6.73 ± 3.02	0.98
HbA1c %	6.94 ± 1.89	7.52 ± 1.88	0.02
TC (mmol\l)	4.63 ± 1.29	5.14 ± 2.01	0.24
TG (mmol\l)	1.44± 1.12	1.35 ± 0.96	0.76
HDL - C (mmol\l)	1.02 ± 0.41	1.16 ± 0.25	0.12
LDL - C (mmol\l)	3.08 ± 1.16	3.92 ± 1.46	0.03

• T. test was used to calculate P Value. P value Less than 0.05 considered significant.

Table 3: Correlation between LDL and TG in Females with DM

TG mmol/l	Diabetic patients	
	r. value	p. value
LDL mmol/l	0.578	0.001

- P value Less than 0.05 considered significant.

Table 4: Correlation between LDL and Age/Year in Males with DM

Age/Year	Diabetic patients	
	r. value	p. value
LDL mmol/l	0.447	0.013

- P value Less than 0.05 considered significant.

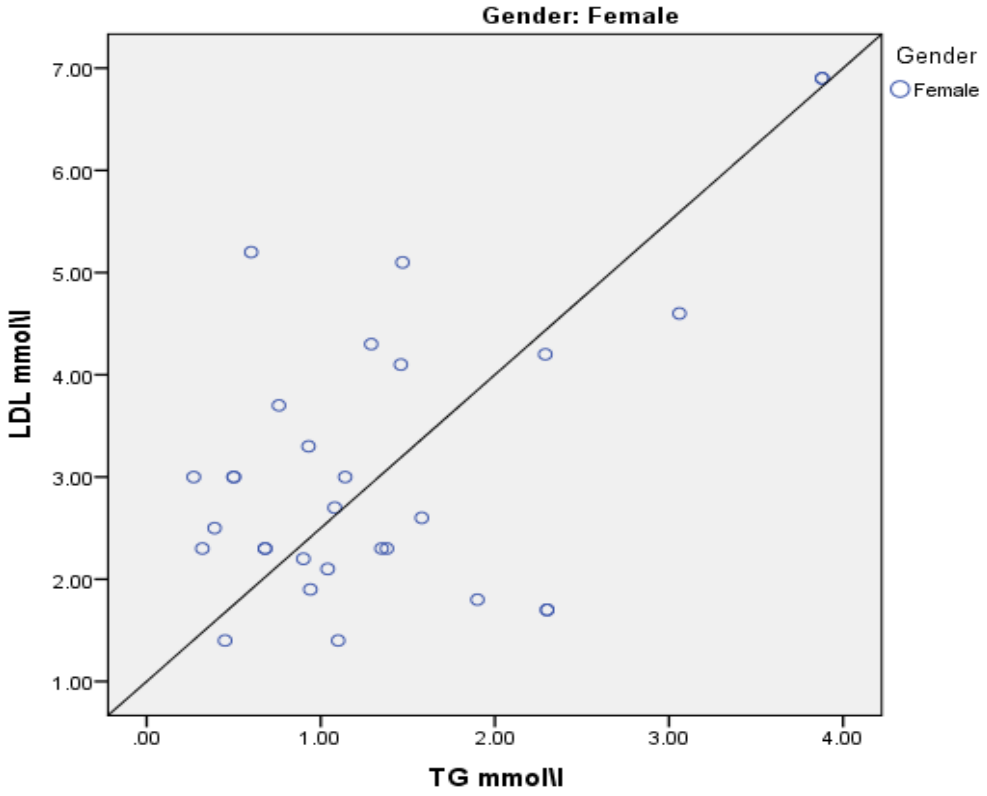

Fig. 1: Correlation of Triglyceride (TG) versus LDL in Females with type 2 diabetics.

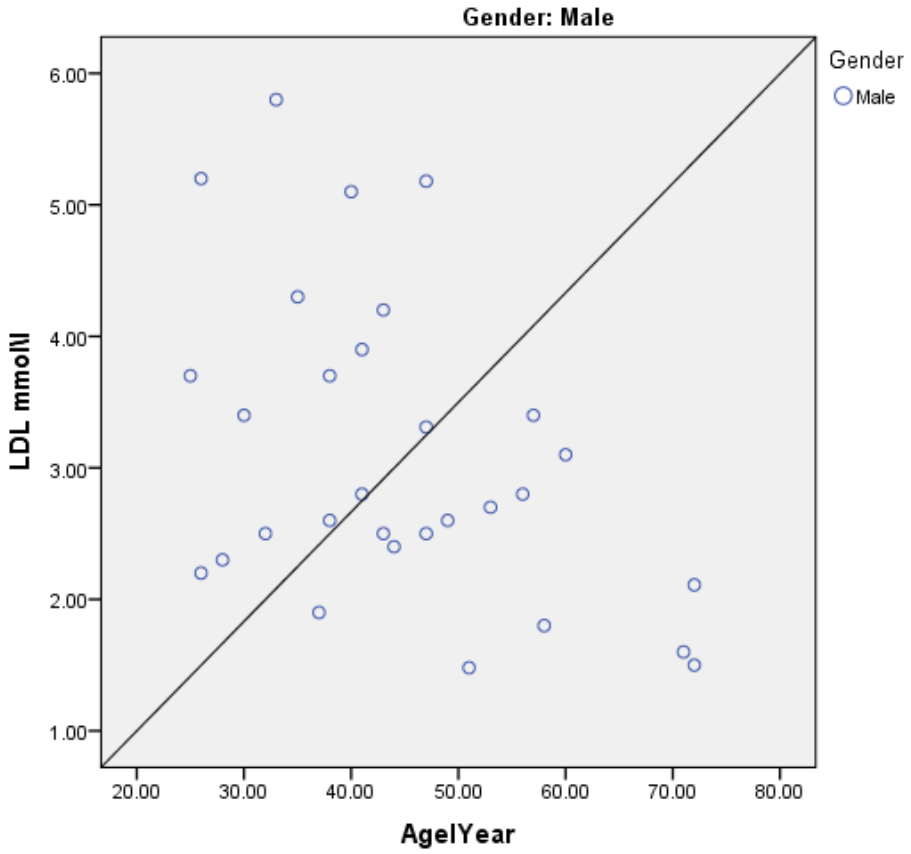

Fig. 2: Correlation of Age/year versus LDL in males with type 2 diabetics.

Chapter Five

5. Discussion:

This study comprise from 60 T2DM patients (30 male) and (30 female). We found that there is insignificant difference (P=0.66) between the mean of age of the male group and the female group that means the selection of sample population was correctly done and normally distributed. Our results reveal that HbA1c and LDL were significantly increased in females with T2DM compared with males with T2DM while other parameters TC,FPG, TG and HDL-C did not show any significant differences between females and males with T2DM. Results of this study clearly showed that the levels of FBG was not affected by patients' gender as neither of these parameters differed significantly between male and female diabetic patients .Our study is consistent with that of Sultan Alouffi et al[6] who found a significant increase of means of HbA1c in female grope compared with male group that means men are more committed to diabetes medication than women. HbA1c is associated with lipid abnormalities; such changes may play a role in CVD development. In our study, we found insignificant slight increase in TC in women and this may lead to a risk of developing atherogenicity problems. We also found a slight increase in TG in men than in women, and this contradicts the study by Venkatesh SK et al[5]. We found HDL to be slightly higher in women than in men, and this contrasts with the Achille ME et al[26] study and this reduces the risk of heart disease and stroke in women. Also in this study we found a significant increase in LDL levels in female, The primary cause for atherosclerosis is accumulation of LDL-C. Increased LDL-C concentration in T2DM patients or normal individual is likely to enhance atherogenicity and CVD. Insulin resistance in T2DM increases the free fatty acid flux to the liver which increases the TG synthesis in hepatic cells in turn causes the elevation of VLDL-C concentration. Increased VLDL-C results in change of lipoproteins and causes elevation of small dense LDL-C and decreases HDL-C and apolipoprotein A-I. Reduction in the concentration of HDL-C and apolipoprotein A-I results in the accumulation of the cholesterol in blood vessels which increases the risk of atherosclerosis. Increase in the small dense LDL-C further increases the apolipoprotein B and are more tending to transfer into the arterial wall in T2DM patients.

CHAPTER SIX

6. Conclusion and Recommendations

6.1 Conclusion

From the results of this study, it is concluded that, in patients with type 2 diabetes:

1- The serum levels of HbA1c and LDL-C are significantly increased in females with T2DM when compared to males with T2DM. Whereas TG, TC and HDL - C are not affected.

2- There is a positive correlation between the age and the LDL-C in females with T2DM.

3- There is a positive correlation between the TG and the LDL-C in females with T2DM.

4- Old females are more suspected to have a risk of CVD than males.

6.2 Recommendations

From the results of this study, it is recommended that:

1-Estimation of FBG, HbA1c and lipid profile should be done regularly for patients with type 2 diabetes mellitus for early diagnosis of cardiovascular diseases.

2- LDL- cholesterol can be useful in assessing the risk of CVD in females with T2DM therefore it would be benefited if it include in lipid profile for assessing the risk and guiding treatment.

4- There is a need for an educational program for diabetic patients regarding blood sugar control and the deleterious consequences of dyslipidemia. Awareness of this risk among family physicians and T2DM patients can play a pivotal role in controlling and avoiding the grave consequences of this complication for T2DM patients.

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