

Article

Effect of Myonectin, Glycated Hemoglobin, and Lipid Cluster Indicators in Patients with Type 2 Diabetes Mellitus

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Abstract

Measurement of myonectin and some biochemical variables in patients, with type, 2 diabetes. 90 samples were collected, including 60 people with type, 2 diabetes and 30 healthy people who did not have any chronic disease, and their ages, ranged between (20-79) years.

The, study included measuring ,the level of myonectin, glucose level, HbA1C, cholesterol (Ch), triglycerides, (Tg), high-density- lipoproteins, (HDL), low-density lipoproteins- (LDL), and very low-density lipoproteins- (VLDL).

The results, showed a significant decrease. ($P < 0.005$) in the level of myonectin and no significant difference between genders, age groups and body mass when compared with healthy controls. There was a significant increase ($P \leq 0.01$) in the level, of glucose, cumulative sugar, low-density proteins, very low-density proteins and cholesterol. Comparing diabetes with healthy controls: It was found, that there was no significant, difference in the, levels of(triglycerides) and high-density lipoproteins when comparing diabetic patients with healthy controls.

Keywords: T2DM, HbA1C, EDTA

Introduction

Diabetes mellitus is a chronic metabolic disease, characterized by an increase, in the level of sugar, in the blood. Hyperglycemia. This disease, appears when the, pancreas, does not, secrete a sufficient amount of insulin, the hormone, that controls the level of glucose, in the blood, or when it is, unable to stop the body from using the insulin it secretes, which means Decreased tissue sensitivity to insulin [1] Glucose is the primary energy source for cells in the body and is the primary factor in performing all physiological functions in the body and a major source of most biological and structural reactions in the body. After eating food rich in carbohydrates, the level of glucose in the blood rises, and then beta cells Located in the pancreatic islets of Langerhans, it transport the hormone Insulin to the blood [2] Diabetes is classified into two types: Type 1: It results from the body not producing a sufficient amount of insulin, which is the hormone responsible for regulating the level of sugar in the blood. This type requires regular injections of insulin[3]. Type, 2: It results, from the body's resistance, to the effects of insulin. or not producing it efficiently enough. This type can be controlled through healthy nutrition, physical activity, and medication when necessary [4]. Myonectin is a nutrient-sensing cytokine that may have an important role in diabetes and related disorders [5] In addition, myonectin could be a potential biomarker in predicting the development of diabetes and identifying the levels of myonectin[6] HbA1c and blood glucose, level in patients, with type, 2 diabetes (T2DM).[7]They are natural compounds. It does not dissolve in water, but it does dissolve in organic solvents, and it is of great importance, as it is involved in the composition of cell walls. It is also one of the most important means of obtaining and storing energy, in addition to its participation in the synthesis of hormones. Among its advantages, it is distinguished by its insoluble in water or polar solvents, but it dissolves in non-polar solvents and is formed. Fats are composed of carbon, hydrogen, and oxygen, and some contain phosphorus and nitrogen [8] Cholesterol is found in the body, either in the form, of free cholesterol, or in the form of an ester. Cholesterol is the intermediate compound in the formation of all steroid hormones, bile salts, and vitamin D [9]. Triglycerides consist of esters of fatty acids with a tertiaryalcohol, which is glycerol, to produce the so-called glycerides, which contain a mixture of Fatty Acids: Triglycerides are characterized by the fact that they do not carry charges on their chemical group and are therefore called neutral fats. They do not form hydrogen bonds with water molecules and therefore do not dissolve in them [10] Very Low- Density Lipoproteins (VLDL) are medium-sized particles (lipoproteins) of which triacylglycerol is one of its main components. It is the main carrier of endogenous

triglycerides (manufactured in the liver). This type of protein is denser and smaller in size than emulsifying molecules, and its high concentrations lead to a high concentration of triglycerides in the plasma [11]. cholesterol, as cholesterol constitutes about 50% of the fats that make up it, and it also contains small percentages of proteins, about 20%, and thus it constitutes two-thirds of the cholesterol present in the blood [12] High- Density Lipoproteins_Cholesterol (HDL_Ch) are the smallest and densest lipoprotein particles and contain equal amounts of fat and cholesterol, but their triacylglycerol content is very small. It has been observed in previous studies that there is a change in the, levels of lipoproteins in patients, with both types of, diabetes. It, was found that there was an increase in LDL-C and ,a decrease in HDL-C in patients, with type 1 diabetes, as well as in patients, with type, 2 diabetes [13]

Materials and Methods

Study design

The- case-controlled study included 90 male metabolic syndrome patients (60 patients and 30 control) who were 20-79 years old the samples were collected.) from October 2023 to the end of November 2023 from Tikrit Teaching Hospital in Tikrit City.

The Scientific committee of the faculty of medicine. at Tikrit University awarded the research protocol formal clearance which had previously ,accepted the methodology in Tikrit Teaching Hospital in Tikrit City provided clearance for collecting patient samples.

Research. Ethics:

This study is part of major research work and the Ministry of Iraqi Health approved it for using human serum samples.

Study groups were categorized as the following:

Group (1): include (60) male patients with T2DM.

Group (2): included(30) samples from a normal healthy control.

Each participant in this study should be fast at least 8 hours before that Blood

samples were collected from patients. All participants' samples were collected by using a disposable syringe to extract approximately five milliliters of blood from the antecubital vein. The obtained blood was divided into two portions; the first portion 3 ml, was put in a separation gel tube which facilitates serum separation by centrifugation at 3000 rpm for 10– 15 minutes. The clear serum was pipetted into clear, dry Eppendorf tubes and stored at deep freeze-20 °C for the subsequent measurement of myonectin, and blood glucose. The second part, consisting of 2 mL of blood, was put in a blood collection tube containing ethylene diamine tetra acetic acid (EDTA) as an anticoagulant for immediate measurement of glycated haemoglobin (HbA1c).

Results

Table1: Comparative mean of myonectine levels between cases and controls

Test	Groups	Mean±SD	SE	T-test	P-value	Sig.
Myonectine	Cases	292.78±110.32	14.24	2.96	0.005	H.S
	Control	379.72±140.64	25.67			

The results, of the current study observed the levels of Myonectine ($p < 0.05$) were lower among cases and higher among control groups with $P\text{-value} = 0.005$ as arranged in (Table 1: and Figure1).

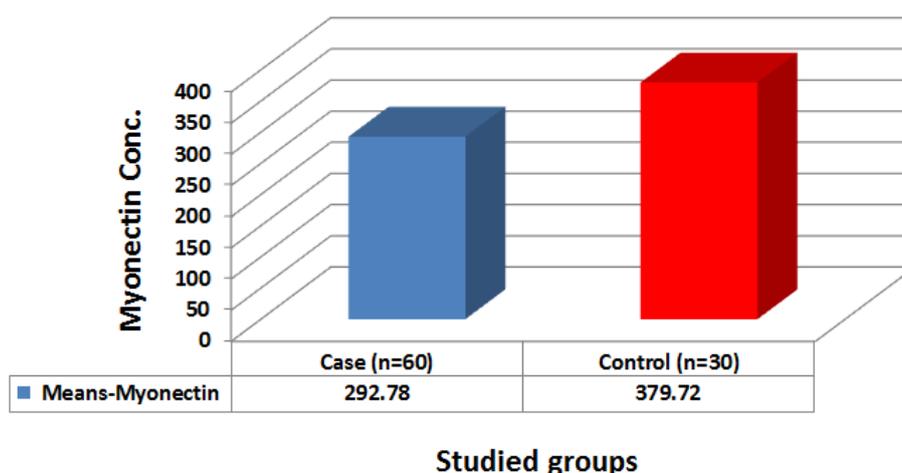


Figure1 : Comparative the mean levels of myonectine between cases and control

Table2: Comparative the mean levels of F.B.S (mg/dl),HbA1C (%) between cases and control

Diabetic test	Groups	Mean±SD	SE	T-test	P-value	Sig
F.B.S (mg/dl)	Cases	263.60±130.83	16.89	9.69	≤0.0001	H.S
	Control	97.56±15.54	2.83			
HbA1C (%)	Cases	8.10±1.67	0.21	14.11	≤0.0001	H.S
	Control	4.75±0.53	0.09			

The results, of the current study showed the levels of F.B.S (mg/dl) were higher in cases than control groups with means value (263.60±130.83),(97.56±15.54) respectively, These differences had P-values ≤0. 01. The results of this study also documented there were high levels of HbA1C (%) among cases than control groups with means value (8.10±1.67) ,(4.75±0.53) respectively, These differences statistically were highly significant (P-value ≤0.01) as arranged in (Table2 and Figure2,3)

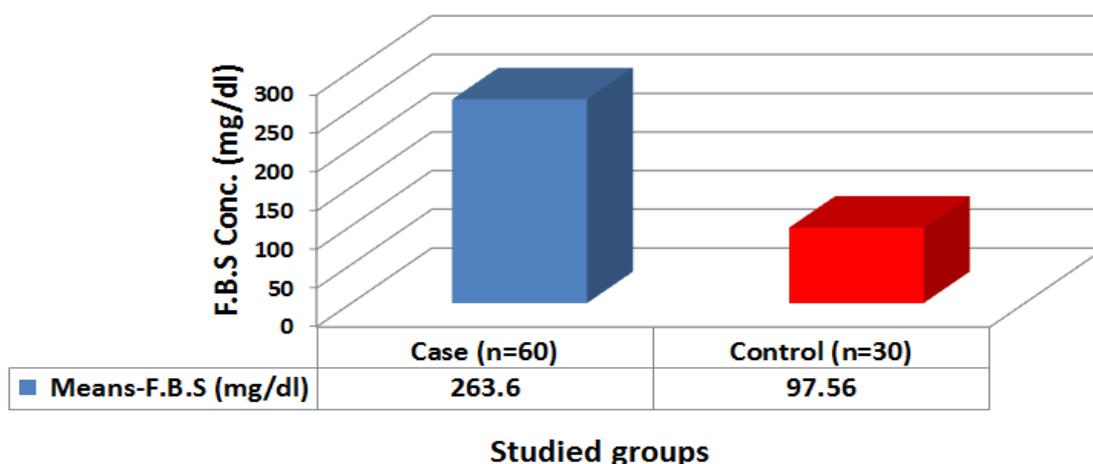


Figure2: Comparative the mean levels of F.B.S (mg/dl),HbA1C (%) between cases and control

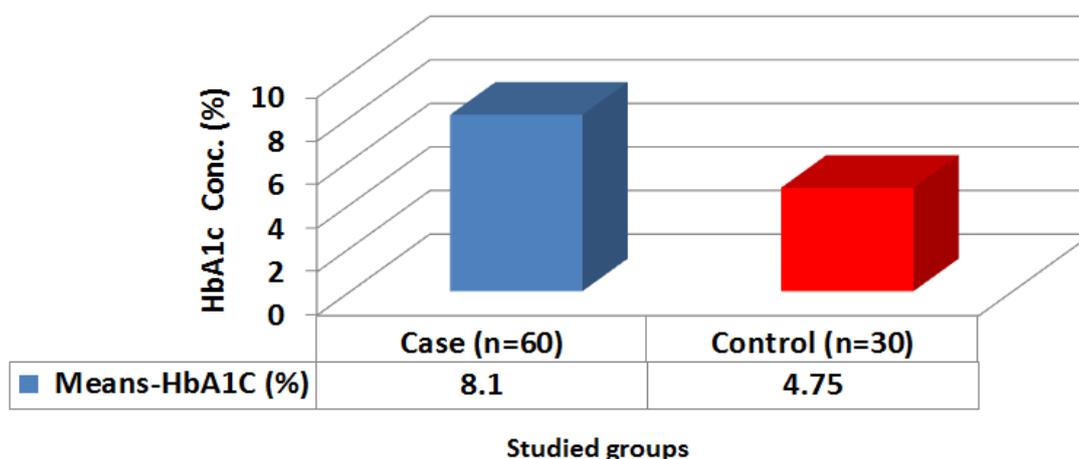


Figure3: Comparative the mean levels of HbA1C (%) between cases and control

Table 3: Comparative the mean levels of lipid profile test between cases and control

Lipid profile test	Groups	Mean±SD	SE	T-test	P-value	Sig.
TC (mg/dl)	Cases	238.16±79.32	10.24	4.93	≤0.0001	H.S
	Control	178.80±34.49	6.29			
TG (mg/dl)	Cases	178.12±80.43	10.38	1.83	0.07	N.S
	Control	204.44±54.04	9.86			
HDL (mg/dl)	Cases	50.03±12.63	1.63	1.06	0.29	N.S
	Control	47.26±11.08	2.02			
LDL (mg/dl)	Cases	165.85±83.38	10.76	5.81	≤0.0001	H.S
	Control	95±31.34	5.72			
VLDL (mg/dl)	Cases	35.31±15.16	1.95	2.04	0.04	S
	Control	40.88±10.79	1.97			

The results, of this study observed there were highly significant, differences in ,the levels, of TC (mg/dl) and LDL (mg/dl) between cases and control with (P-value=≤0.01) respectively, While the results, of this study there were non-significant differences in the levels of TG (mg/dl) and HDL (mg/dl) between cases and control

with (P-value=0.07,0.29) respectively. The results, of this also showed there were significant differences in the levels of VLDL (mg/dl) between cases and control with (P-value=0.04) as arrnaged in (Table3 and Figure4,5,6,7,8).

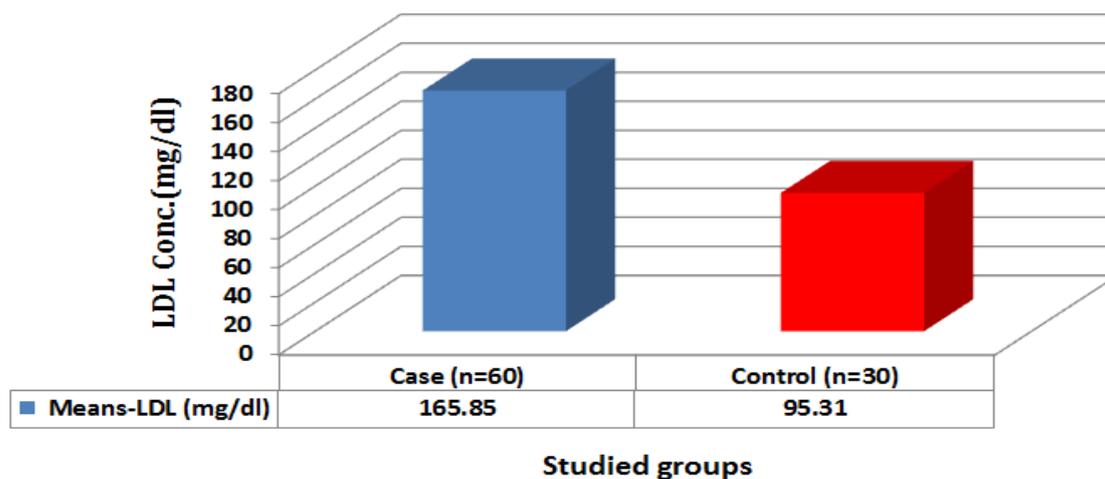


Figure4: Comparative the mean levels of LDL test between cases and control

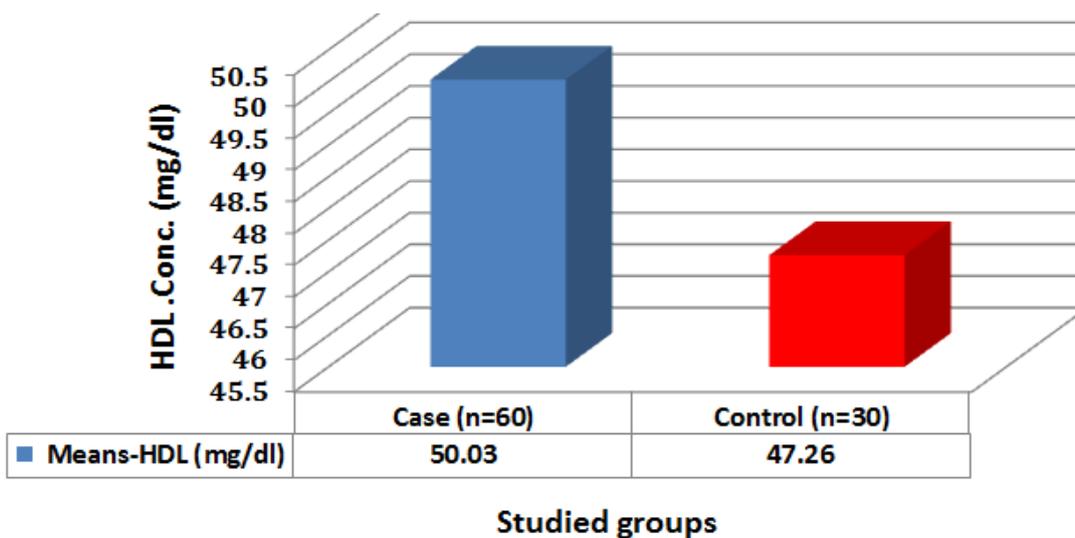


Figure 5: Comparative the mean levels of HDL test between cases and control

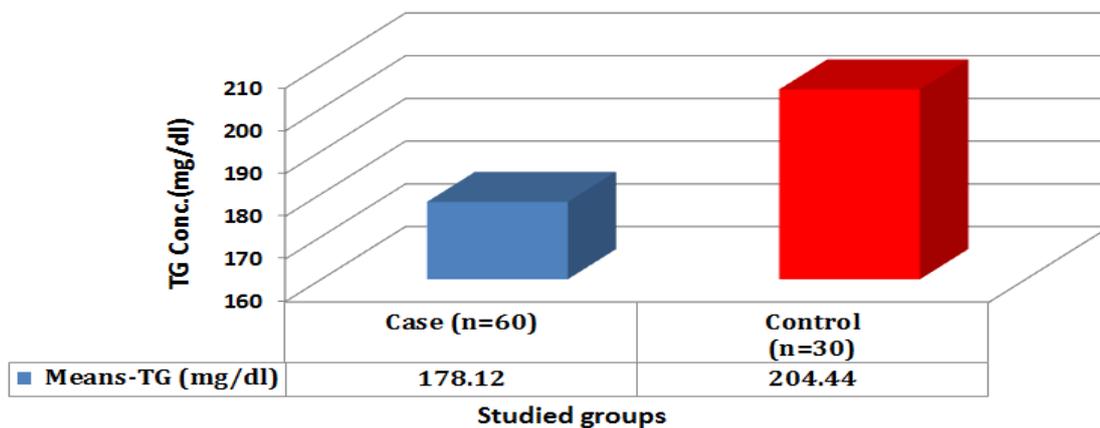


Figure 6: Comparative the mean levels of TG test between cases and control

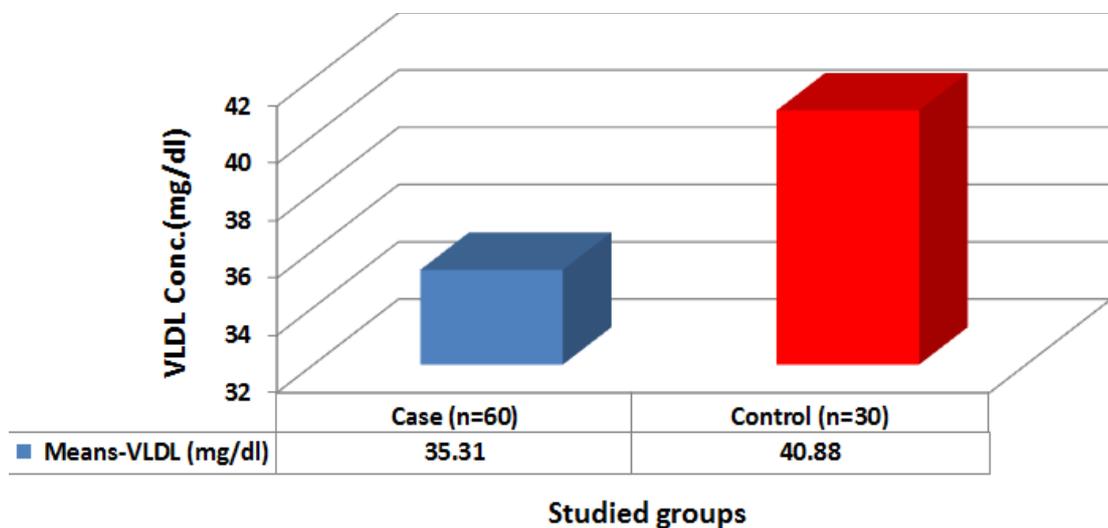


Figure 7: Comparative mean VLDL levels between cases and controls

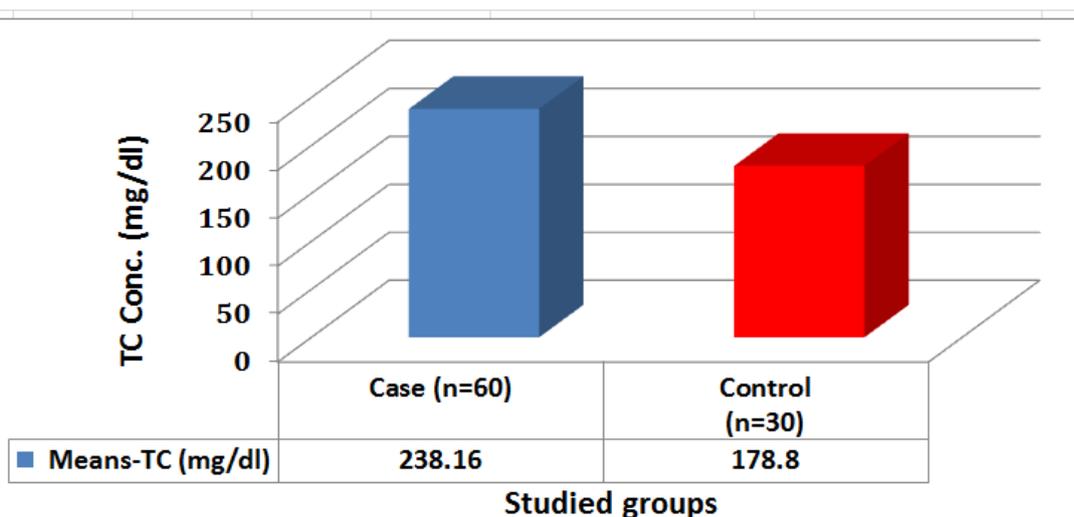


Figure 8: Comparative mean TC levels between cases and controls

The results, of this study observed ,there were ,a positive correlation between, the levels of myonectine () with Age (Years), BMI (Kg/m²) and Gender with (r=.044, .037,0.2) respectively,These correlations had P-value (.679, .730, .059) respectively. The results of this study also observed there were an inverse correlation between the levels of F.B.G (mg/dl) and HbA1C (%),statistically these correlation were significant with (P-value=.012, .016) respectively as arranged in (Table4)

Table4: Correlation between the levels of myonectine with levels of Age (Years),gender, BMI (Kg/m²), F.B.G (mg/dl) and HbA1C (%)

Test	R	P-value	Sig.
Age (Years)	.044	.679	Non- Significant
Gender	.200	.059	Significant
BMI (Kg/m ²),	.037	.730	Non- Significant
F.B.G (mg/dl)	-.264*	.012	Significant
HbA1C (%)	-.254*	.016	Significant

*. Correlation is significant at the 0.05 level (2-tailed).

The results of this study observed there were a positive correlation between the levels of myonectine with the levels of TC with (r=0.004) this correlation had P-value=0.97. The results, of the current study, also documented there was an inverse correlation between the levels of myonectine with the levels of TG ,HDL,VLDL and LDL with (r=-.280*,-.251, -.295*,-.029) , Statistically these differences had (P-value=.030, .053, .022, .827) as arranged in (Table5)

Table 5: Correlation between the levels of myonectine with levels of lipid profile test

Test	R	P-value	Sig.
TC ()	.004	.974	Non- Significant
TG ()	-.280*	.030	Significant
HDL ()	-.251	.053	Significant
LDL ()	-.029	.827	Non- Significant
VLDL ()	-.295*	.022	Significant

*. Correlation is significant at the 0.05 level (2-tailed).

Present the area under curve (AUC) for ROC curve analysis for the myonectine (.315) among cases and control groups. In the present study the sensitivity and specificity of myonectine (93%,10)respectively among cases and control groups as arranged in(Table6- and Figure-11).

Table6: ROC analysis for the myonectine between cases and control

Myonectine	
Sensitivity	93
Speceficity	10
Area under curve (AUC)	.315
Cutoff value	172
95% CI	.193-.437
SE	.062
P-value	.004

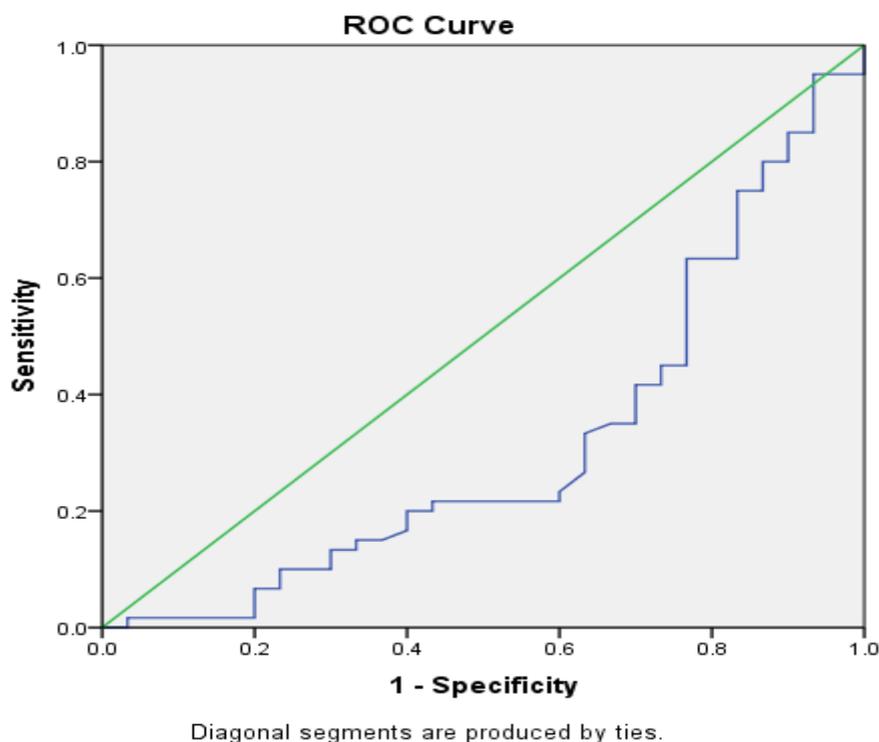


Figure 11: ROC analysis for the myonectine between cases and control

Discussion

Myonectine is one of the hormones secreted from skeletal muscle that belongs to the CTRP family. Serum myonectin was decrease in type 2 diabetic patients ,compared to healthy, controls, and this does not agree with the results of the researcher (Li, Kejia) [14] in their study that Higher levels of myonectine have been reported, in patients with, type- 2 diabetes, especially significantly higher in diabetic patients compared to people with pre-diabetes, indicating a course of progressive increase in the diabetic state. In this, study, plasma myonectine levels, were positively associated, with the proportion of Blood sugar such as fast blood sugar, but it has been negatively associated with insulin sensitivity and with low levels of myonectin in people who suffer from obesity and type- 2 diabetes [15] These, results indicate that myonectin signals have a role in regulating lipid levels and blood sugar, and their levels are affected at different pathological levels. Therefore, changes in myonectin levels have the potential to be a useful marker of the state of insulin resistance sensitivity in patients, with type- 2 diabetes [16]. The results of measuring The glucose level he found (King.M.W2014)[17] In his study on diabetic patients, he explained that a high glucose level in patients indicates that they have the disease. He found that the glucose level in patients is always more than 120mg/dl. The high glucose level in patients Type- 2 diabetes is due to a defect in the body's ability to use insulin properly and is consistent with many studies that confirm a high concentration of glucose in the serum of patients with diabetes[18] High blood glucose, in diabetic patients is due to a defect in insulin function, either its deficiency or lack of effectiveness, or the reason for this defect is genetic or acquired factors that are due to the deficiency or absence of insulin resulting in diabetes and high glucose levels [19]. The decrease in insulin secretion from beta cells leads to, an increase in the level of free fatty acids in the plasma, as a result, of the lack of control over the body's inability to control the decomposition of fats in adipose tissue [20] The HbA1C test ((glycated hemoglobin test)) or ((cumulative blood sugar)), which is related to hemoglobin, which is a protein found in red blood cells, lives for about four

months. It measures the level of glucose in the blood during the past three months. The relationship between the concentration of glucose in the blood and HbA1C. The concentration of glucose in the blood is closely related to the levels of red blood cells during the period of their presence in the bloodstream. The connection of glucose to hemoglobin. Therefore, measuring the level of (HbA1C) is the most effective evidence for measuring the level of glucose concentration in the blood during the previous three-month period[21]. The result is in, the research. It indicates, that there is a high significant difference between healthy people and patients, with type- 2 diabetes and agrees with the researcher (Khursheed.2018)[22] The study proved that there is a correlation between diabetic patients and a high cholesterol level $P \leq 0.01$ compared to healthy people. This increase is consistent with what previous studies have found and agrees with what the researcher (Yamada et Ai [23] mentioned) and that this increase is due to several factors, including lipoprotein decomposition and low density lipoprotein (LDL-Ch), which carries a large percentage of cholesterol, and the loss of low-density lipoprotein receptors (LDL-Receptor), which contributes to increasing the level of cholesterol in the blood [24 There is an association between differences in fat metabolism in the blood of patients and an increased risk of developing diabetes. This is due to several main factors, including the transfer of fats in the body through plasma and extracellular fluids by using means of special transport molecules called “lipoproteins.” Lipoproteins play an important role in transferring cholesterol from tissues to Target sites in the body: Any defect in the functions of lipoproteins leads to the accumulation of cholesterol in the blood [25] High levels, of cholesterol, in the blood, are linked to the quality of food consumed due to the consumption of large amounts of saturated fats leading to high cholesterol concentrations in the blood [26]. We also notice an increase, in the level of low-density lipoproteins, (LDL) $P \leq 0.01$ compared to healthy people, and this agrees with the researcher (Ray, Kausik K., et al) [27] The high level of low-density lipoprotein (LDL) in diabetic patients is the result of an increase in fat oxidation, which leads to its increase and an increase in the level of (LDL), and the effect of saturated fatty

acids resulting from increased fat intake impedes the filtering of these molecules from the blood, and the LDL molecules accumulate. (In high concentrations in the blood. We also note that there, is a significant, difference in the level of very low-density lipoprotein (VLDL) $P < 0.05$ in type- 2 diabetes, patients with control, and the reason for the increase is related to the high level Triglycerides (Tg) in the, liver, which inhibit the production of apoB protein, play an important role in the formation of lipoprotein, (VLDL) and increase, the level of glucose, and non-essential fatty acids that affect the regulation of VLDL exit from, the liver. [28]. This agrees with the researcher (Dobiasova M. , Stribrna (128) The decrease in the effectiveness of the lipoprotein enzyme, Lipase [29]. We also note that there, is no significant difference, in ,the percentage of triglycerides (Tg) $P > 0.05$ in type 2 diabetes patients with control, and there is no difference between the sexes, and this differs from what the researcher (Yathish TR) mentioned. et al)[30] We also note that there is no significance in the level of concentration of high-density lipoproteins (HDL-Ch) $P > 0.05$ in type- 2 diabetes patients with control, and this agrees with a researcher(willnow Thamas) [31]

Conclusion:

Myonectin levels decreased in patients, with type- 2 diabetes. Moreover, myonectin levels in the blood were associated, with metabolic markers in patients with type -2 diabetes. These data, indicate that myonectin, may be a useful marker in predicting, the development of type 2- diabetes.

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