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BIOCHEMICAL COMPARATIVE STUDY FOR THE ROLE OF VITAMIN D IN TYPE 2 DIABETIC PATIENTS WITH DYSLIPIDEMIA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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IN
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BIOCHEMICAL COMPARATIVE STUDY FOR THE ROLE OF VITAMIN D IN TYPE2 DIABETIC PATIENTS WITH DYSLIPIDEMIA

By Adnan Abed Azeez AL-AZRAQI

January 2022

We certify that we have read this thesis and that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science

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ABSTRACT

BIOCHEMICAL COMPARATIVE STUDY FOR THE ROLE OF VITAMIN D IN TYPE2 DIABETIC PATIENTS WITH DYSLIPIDEMIA

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February 2022

In this work, we will try to find the possible relations between serum vit. D levels and each one of parameters relevant to control of hyperglycemia such as fasting blood glucose and glycosylated hemoglobin. Besides, to shed a light on the possible relations between serum Vit. D levels and lipid profile as well as atherogenic index to provide information about its role in diabetic dyslipidemia .The subjects of this study will be from (Diabetes and Endocrinology Center at Thi-Qar province/ Iraq. The study needs at least 75 patients with Type 2 diabetes and 25 healthy age 40 to 60 years. According to the results showed the BMI of patients was significantly ($P \leq 0.05$) greater than that of the controls, the 25(OH)d levels were significant increase levels in control, there was the serum glucose level and HbA1C was significantly higher in the patients, the cholesterol levels and triglyceride in cases significantly ($P \leq 0.05$) increase of the controls. HDL levels significant ($P \leq 0.05$) increase levels in control. The results of the study showed the correlation between serum vit. D level with parameters was found no statistically significant ($P \leq 0.05$) correlation with glycemia such as serum glucose, hemoglobin A1C, show none significant ($P \leq 0.05$) found between 25(OH) D with the body mass index, In this study show there was positive significantly correlation ($P \leq 0.05$) was found between (HDL) levels and vitamin D.

2022, 29 pages

Keywords: Diabetes, Lipid profile, Vitamin D, Atherogenic index

ÖZET

DİSLİPİDEMİA TİP2 DİYABETİK HASTALARDA D VİTAMİNİNİN ROLÜ ÜZERİNE KARŞILAŞTIRMALI BİYOKİMYASAL BİR ÇALIŞMA

Adnan Abed Azeez AL-AZRAQI
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Şubat 2022

Bu işte serum vit arasındaki olası ilişkileri bulmaya çalışacağız. D seviyeleri ve açlık kan glikozu ve glikozile hemoglobin gibi hiperglisemi kontrolüne ilişkin parametrelerden her biri. Ayrıca, serum vit arasındaki olası ilişkilere ışık tutmayı da sağlar. Diyabetik disslipidemi'deki rolü hakkında bilgi sağlamak amacıyla D seviyeleri ve lipid profilinin yanı sıra aterojen indeks. Bu çalışmanın konuları (THI-QAR eyaleti/Irak'taki Diyabet ve Endorinoloji Merkezi) olacaktır. Çalışma, Tip 2 diyabetli ve 25 sağlıklı yaşlı 40 ila 60 yaş arası en az 75 hastaya ihtiyaç duyar. Sonuçlara göre, hastaların BMI'sinin kontrollerin BMI'sinden önemli ölçüde ($P \leq 0,05$) daha büyük olduğunu, 25 (OH) d düzeylerinin kontrol açısından önemli bir artış gösterdiğini, serum glikoz seviyesi olduğunu ve HbA1c'nin hastalarda önemli ölçüde daha yüksek olduğunu göstermiştir. Kolesterol seviyeleri ve kontrollerin önemli ölçüde ($P \leq 0,05$) artması durumunda trigliserit. HDL seviyeleri ($P \leq 0,05$) kontrol seviyelerini önemli ölçüde artırdığı gözlenmiştir. Çalışmanın sonuçları serum vit arasındaki ilişkiyi göstermiştir. Parametrelerle D seviyesinin, serum glikozu, hemoglobin A1C gibi glisemi ile istatistiksel açıdan önemli ($P \leq 0,05$) bir ilişkisinin olmadığı tespit edilmiştir. 25(OH) D ile vücut kütle indeksi arasında hiçbir önemli ($P \leq 0,05$) ilişki bulunmamıştır. Bu çalışma ile (HDL) seviyeleri ile D vitamini arasında pozitif belirgin bir korelasyonun ($P \leq 0.05$) varlığı tespit edilmiştir.

2022, 29 sayfa

Anahtar Kelimeler: Diyabet, Lipid profili, D vitamini, Aterojenik indeks

PREFACE AND ACKNOWLEDGEMENTS

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Adnan Abed Azeez AL-AZRAQI
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CONTENTS

LIST OF SYMBOLS

%	Percent
±	Plus minus
DNA	Deoxyribonucleic acid
g	Gram
mg	Milligram
nm	Nanometer
O_2	Oxygen
µg	Microgram
µL	Microliter

LIST OF ABBREVIATIONS

CHO	Enzyme for the oxidation of cholesterol
CYP24	Gene cytochrome 24
CYP27	Gene cytochrome gene 27
FFAs	Free fatty acids
GK	Glycerol kinase
GLUT4	Glucose transporter type 4
HDL	High density lipoprotein
LDL	Low density lipoprotein
OGP	Oxidase of glycerol-3-phosphate
RPG	Randomized plasma glucose
TC	Total cholesterol
TG	Triglycerides
UVB	Ultraviolet B
VDR	Vitamin D receptor
VLDL	Very low density lipoprotein

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1. INTRODUCTION

High blood glucose levels are a characteristic of this condition abnormalities metabolic caused by Type 2 diabetes as well as abnormalities in carbohydrate, lipid, as dyslipidemia**,** Type 2 diabetes (as result of the loss sufficient insulin production as well as increased insulin resistance. Known as type 2 diabetes this heterogeneous illness Insulin resistance is a characteristic of this condition. In the context of an impairment of compensatory insulin production. Low levels of insulin or resistance to insulin can cause problems with several critical enzyme and pathway processes in lipid metabolism, and as a result, People are able to have abnormal lipid profile levels, lipid buildup in liver is intimately linked to this disease. Diabetic dyslipidemia, in type 2 diabetes, occurs because of insulin resistance that interferes with downstream processes, therefore leading to increased triglycerides and cholesterol in the circulation. Also, HDL's half-life decreased while LDL's half-life increased, and this has been found to be immunogenic in diabetics and lead to arterial endothelial damage. High triglycerides in the fasting, low HDL, high LDL, are all characteristics of patients with diabetes who have dyslipidemia. Diabetic individuals have an elevated cardiovascular risk because of the alterations in the fatty acid pattern that diabetes produces.

1.1 Objectives of study

(1) Determine the levels of Fasting blood glucose (FBS) and HBA1C in patients and control.

(2) Determine the lipid profile levels and level serum vitamin D in in patients and control and find the dyslipidemia in patient.

(3) Find a correlation of vitamin D level with (FBS), HBA1C and lipid profile in patients and control.

2. THE LITERATURE REVIEW

Cefalu *et al.* (2019) disturbed metabolic the results from an absence of insulin or an inability to produce enough insulin or both. Diabetes mellitus was estimated to affect most people, making the significant public health concern. Impaired glucose tolerance is caused by insufficient insulin activity and reduced tissue responses to insulin. Insulin secretion and insulin action disorders often coexist in the same patient; Long-term hyperglycemia is linked to diabetes retinopathy, diabetic nephropathy, diabetic neuropathy, and cardiac problems. Previously classified as non-insulin depending or individual diabetic, which funds for 90–95 percent of all diabetics.

Stepanova *et al.* (2019) developed type 2 diabetes significantly by a mix of environmental of the many variables with genetics variations. Several published research have found that hereditary characteristics can play an important role development diabetes type 2. This is corroborated by a large number of investigations. The complex and polygenetic character of type 2 diabetes makes it challenging to demonstrate relationships between particular genetic variations and specific metabolic alterations.

Czech. (2017) mentioned persons with monogenic mutations in insulin signaling components have elevated amounts of circulating insulin, and thereby predisposed them to type 2 diabetes. These findings suggest that the earliest stages of both inherited genetic and common obesity lead to insulin resistance, which further develops into hyperinsulinemia, which eventually raises triglyceride and fat liver levels.

Chang *et al.* (2015) Type 2 diabetes is caused both by insulin resistance & hyperinsulinemia; greater fats diet results in increased production (FFAs) than may be used by the human body, which are converted into glucose by the liver, because muscular resistance to insulin, it causes very high blood glucose levels.

Pandey *et al.* (2017) investigated insulin resistance develops because of the metabolic syndrome, which characterized by obesity as the most prominent characteristic. In order to compensate for this insulin shortage, the pancreatic beta cells secrete excessive quantities of insulin, which caused development for type 2 diabetes. There is a possibility of development for type 2 diabetes exists when the body's ability to manage glucose levels is impaired, resulting in the normal loss of glycemic control. Adipocytes, which are fat cells that produce cytokines and peptide hormones, are found in adipose tissue. Because caloric excess which leads to the development of adipocyte malfunction this results in an excess of triglycerides into the circulation

Antwi-Baffour *et al.* (2018) studied diabetes mellitus is an illness that is prevalent around the world. Several hematological parameters in diabetics have been found to be abnormally high or low. Since glucose metabolism affects lipid metabolism, several other factors influence lipid levels in people with diabetes. However, there was a negative relation hemoglobin and lipid variables.

Krauss. (2004) Because of the clustering of connected abnormalities in lipoproteins and cholesterol in the blood, insulin resistance and type 2 diabetes are also associated with a decrease in HDL cholesterol and a rise in triglyceride levels. Having any of these dyslipidemia characteristics increases the risk of heart disease. The etiology of this dyslipidemia appears to be centered with increased hepatic secretion of big triglyceride and decreased clearing of VLDL.

Rehan *et al.* (2018) studied that dyslipidemia is common in In addition to hyperglycemia, diabetes mellitus is characterized by abnormalities in carbohydrate, lipid and protein metabolism that affect nearly every organ in the human body. People with diabetes frequently have dyslipidemia, a collection of metabolic abnormalities. Diabetic dyslipidemia is a crucial factor in the development of atherosclerosis and other cardiovascular problems.

Boucher *et al.* (2014) mentioned while a fast is occurring, excess glucose, it funneled into the skeletal muscle tissue by means of glycogen synthesis and then used in glucose metabolism. This latter aspect occurs to a far lower amount with adipose tissue. Insulin, produced by B- cells of the pancreas in times food intake, blocks the liver's glucose absorption while simultaneously increasing absorption glucose in muscle and fat tissue. Form GLUT4 absorbs glucose in muscles and fat, but Liver GLUT2 is responsible for releasing glucose into bloodstream.

Jaworski *et al. (*2007) studied that increased amounts of free fatty acids will cause lipolysis in adipose, to convert fat into fatty acids and ketone bodies, the liver goes through the process of ketosis. The liver also converts excessive fat into phospholipids, while removing excess fatty acids from the blood. In liver, triglycerides, when present in excess, will also combine with these two molecules to create lipoproteins, which are released into the blood.

Maestro *et al.* (2000) studied that human insulin production and secretion have been found to be Vit D has an effect on deficiency. It insufficiency has link to resistance insulin, hyperglycemia abnormalities with diabetes type 2. Supplementation it decreases glucose level in individuals with diabetic type 2 who have low level vitamin D, implying that vitamin D plays a role in etiology for diabetic type 2. Pancreatic tissue contains (VDRs) and (DBPs), all of which have been linked to variations in glucose and insulin all backed up this theory.

Masoud *et al.* (2017) in the study Vitamin D showed significant decrease in cases when compared to controls (P-value < 0.05). When comparing cases to controls, HbA1c and serum glucose levels were significant increase in patients (P < 0.05). Triglyceride levels was increases significant in patient (P <0.05), while HDL-C levels decreases significantly in patients (P <0.05). The concluded Vitamin D levels in the blood showed significantly negative correlation with BMI and HbA1c, as well as significant positive correlations with (HDL).

Muñoz-Aguirre *et al.* (2015) this study show the A de lipid profile has been connected to serum 25(oh) d levels that are too decreases in the blood. In the research, the impact of vitamin d when taking a vitamin D tablet every day for six months supplement LDL, HDL, and total CHOL showed no significant; triglycerides, on the other hand, decreased significantly. According to the findings, vitamin D treatment lowers triglyceride levels without changing other lipid values.

Rashidbeygi *et al.* (2018) in the study is to shown metabolism dyslipidemia and vit D deficiency go together in hand it was classified as having increase a TG level and decrease HDL level. The findings of the current research show that vitamin D was associated lipid profile and BMI. Vitamin D concentrations that are too low were found to lower the chance of developing metabolism dyslipidemia by 77% as compared to insufficiency, however, when compared to a healthy state, the prevalence of TG is increased by a deficiency in vitamin D. There were strong correlations between the level of vitamin D in the blood and dyslipidemia. There's also correlation between vitamin D and lipid levels in the study.

Patel *et al.* (2017) Vitamin D levels and blood lipids were examined as a correlation in the study. Result Vitamin D deficiency (75.98%). High-density lipoprotein showed significant decrease in the population and there was a significant increase in Low - density lipoprotein, people with a lack of vitamin D. Cholesterol level and VLDL had a weak correlation with 25(OH) D, while LDL had a negative correlation. Vitamin D deficiency was found to be associated with significantly higher levels of LDL, lower levels of HDL and VLDL.

3. MATERIAL AND METHODS

3.1 Materials

3.1.1 Instruments and other chemical materials

Table 3.1 and Table 3.2 show all the materials, chemicals which Selected for the current studies.

Table 3.1 Chemical used in the study

	Kit	Company, Origin
1	Fasting blood glucose (FBS)	Bio Systems – Spain
2	Hemoglobin in whole blood (HBA1C)	Roche, German
3	Cholesterol	Randox kit, UK
4	Triglyceride	Randox kit - UK
5	HDL	Randox kit _ UK
6	Vitamin D	Roche- German

Table 3.2 Instruments used in the study

	Materials	Company and origin
1	Centrifuge	Suzhou Dukangning Medical. China
2	COBAS INTEGRA 400	German (Roche)
3	COBAS e411	German (Roche)
4	Incubator	Germany (memmert)
5	Macro centrifuge	Japan (kokusan)
6	Refrigerator	Turkey (beko)
7	Spectrophotometer	Japan (APEL)
8	Water bath	Germany (memmert)

3.1.2 Study design

The study is performed in the Diabetes and Endocrinology Center in Thi-Qar province/ Iraq. Patients of type 2 diabetes patients with dyslipidemia between the ages of 40 and 60 and other samples was taken by healthy people as the control group.

3.1.3 Patients

The number of patients under study reached 75 Diabetic type 2 patients with dyslipidemia ranging (40 _60) years in the Diabetes and Endocrinology Center in Thi-Qar province/ Iraq. During the interview with the patients, information was taken on their demographic characteristics, age, gender, and health status.

A set of requirements for exclusion

1) Who are the patients & controls who are in the age range of 40 to 65 years?
2) Diabetes with type one diabetes.
3) Women who are expecting a child.
4) Patients with additional chronic conditions
5) Patients with dietary supplements.

3.1.4 Control group

The study included 25 healthy control group who haven't any disease ranging in age from 40 to 60 years, with the same demographic properties (healthy individuals).

3.2 Methods

3.2.1 Sampling

Total 75 diabetics and 25 healthy provided capillary samples of blood for this study, after they had fasted for 12 hours the night before. Drew From each control and diabetic patient, sampled form of blood 5 mL and placed in plastic tube. The HbA1c test for patients and controls performed with approximately 2 mL of sample is drawn and placed in EDTA tube. In order to allow the blood to clot, the remaining a little amount of blood (5 mL) is deposited in a plastic tube then kept for a period without using an anticoagulation. For the measurement of FBS, CHOL, TRI, HDL, LDL, and vitamin D, serum samples separated by centrifugation at room temperature for 10 minutes.

3.2.2 Determining of fasting blood glucose (FBS)

The glucose-oxidase technique is used to assess the amount of glucose in the blood (Bio Systems).

The basic principle

Glucose assaying measurement following enzymatic oxidation by glucose oxidase performed. The catalytic activity of peroxidase aided by the presence of peroxidase.

3.2.3 Determining of hemoglobin in whole blood (HBA1C)

For the purpose of determining the quantitative measurement of hemoglobin A1C, an experiment was carried out on whole blood and the results were published (COBAS INTEGRA 400+ analyzer by Roche). With hemolyzing reagent gen (Roche clinical chemistry).

The principle of the test

It is hemolysis electronically on the COBAS INTEGRA 400 analyzer with reagents to minimize interference from leukocytes after the anticoagulated whole blood specimen has been hemolysis (TTAB does not lyse leukocytes). This test detects all hemoglobin varieties that are glycated at the N-terminus of the chain and that contain antibody-recognizable areas that are similar to the HbA1c measured by this assay.

3.2.4 Determining of serum cholesterol

Can be quantified using this method determination cholesterol found in the serum, an enzymatic colorimetric technique employed in conjunction with diagnostic systems. The Randox kit is a set of instructions.

The principle of the test

After enzyme hydrolyzed and oxidizing, cholesterol measurement. 4-Aminoantipyrine and phenol create hydrogen peroxide, which then used to form quinoneimine, a colorimetric indicator.

3.2.5 Determining of serum of triglyceride

The measured amount of triglycerides in serum was carried out using an enzyme colorimetric approach, which was carried out using diagnostic systems, Inc. Randox kit is a kit that may be used to measure triglycerides in serum quantitatively

Principle

Triglyceride measured after enzyme digestion accomplished using a colorimetric technique. Hydrogen – peroxide, 4- amino phenzone and 4-chlorophenol a combined to form an indicator, which activated by the action of peroxidase.

3.2.6 Determining of high density lipoprotein (HDL) levels

The HDL was measured by utilizing (utilizing diagnostic systems), and the Randox kit was used to do the measurement.

The principle of the test

Supernatant removes all but the HDL cholesterol from the supernatant, which is then measured enzymatically utilizing cholesterol reagents.

3.2.7 Determining of low density lipoprotein (LDL) levels

Use the Fried Ewald formula to measurement the amount of low-density lipoprotein (LDL) in the serum (Martin *et al.* 2013)

The principle of the test

According to Friedewald's underlying correlation, the measurement of LDL most typically obtained from statistical parameters of total and HDL-C, as well as serum triglycerides (TG).

3.2.8 Determining the very low density lipoprotein (VLDL)

Use the Fried Ewald formula to measurement the amount of VLDL in serum to determine serum very low-density lipoprotein (VLDL) (Martin et al. 2013)

The principle of the test

According to Friedewald's underlying correlation, the measurement of VLDL most typically obtained from statistical parameters of serum triglycerides (TG).

3.2.9 Determining of vitamin D serum

Principle

Measured an amounts of vitamin D in the blood serum. By electro hem Luminescence (Roche Cobas e411 analyzer Germany). With COBAS INTEGRA Hemolyzing, reagent Gen 2.

3.3 Statistical Analysis

Computerized statistically SPSS/PC was used for statistical analysis (Statistical Package version 18.0) package for analyzing data. The comparison was carried out using A t-test and chi-squared test (X2) in the determination of probability (P. value). Statistical significance was defined as a P-value ≥ 0.05, and statistically non-significant if the P. value exceeded 0.05. The correlation coefficient "r" was also calculated. It(-1.0 to +1.0)is the range. When "r" meaning the parameters are more strongly connected if the value is closer to (+1 or -1.) (either negative or positive correlation). When the value of "r" Is close to zero, it indicates that there is no correlation between the two variables.

4. RESULTS

4.1 General Characteristics of the Studied Groups

The general characteristics of the studied groups are shown in Table 4.1

Table 4.1 The general characteristics of the studied groups

	Groups	N	Mean	Std. Deviation	T-value	P-value
Glucose	Patient	76	221.60^{a}	77.92	10.83	0.01
	Control	26	107.76^{b}	10.06		
HbA1c	Patient	76	9.13^{a}	1.66	21.71	0.01
	Control	26	4.82^{b}	0.28		
Cholesterol	Patient	76	199.82^{a}	58.77	2.98	0.004
	Control	26	178.30^{b}	13.15		
TGs	Patient	76	244.42^{a}	54.11	9.26	0.02
	Control	26	131.53^{b}	12.40		
HDL	Patient	76	32.65^{b}	4.26	14.02	0.01
	Control	26	45.80^{a}	3.66		
VIT. D	Patient	76	8.47^{b}	1.85	21.44	0.002
	Control	26	25.44^{a}	3.88		
Age	Patient	76	47.80^{a}	5.93	3.36	0.001
	Control	26	42.23^{b}	10.30		
Wight	Patient	76	79.31^{b}	11.68	3.87	0.01
	Control	26	86.34^{a}	6.22		
Height	Patient	76	165.21^{a}	7.70	1.26	0.20
	Control	26	167.38^{a}	7.0		
BMI	Patient	76	28.96	3.34	2.98	0.004
	Control	26	26,75	1.75b		
*P-value ≤ 0.05 consider significant						

4.2 Levels of Glucose and Hba1c in Patients and Controls

There was significant increase in the glucose of the patients as compared to controls (221.60a ± 77.92 vs 107.76b ± 10.06 mg/dL, T-value = 10.83, P-value = 0.01). There was significant increase in the HbA1C of the patients as compared to controls patients (9.13a ± 1.66.vs 4.82b ± 0.28, T-value = 21.71, P-value = 0.01).

As shown in Table 4.1, the glucose values levels and average HbA1c were significant increase in patients comparing levels controls. The same outcomes have obtained in another study (Wang *et al.* 2021). Throughout this research, the average HbA1c indicate the amounts of glucose in the blood exposed over a considerable length of time and it commonly used for the diagnostic of diabetes mellitus patients. In contrast to the fasting glucose level (FBS), which provides the glucose level in a short period and cannot be use to confirm the diagnosis of type 2 diabetes. Moreover, found the same outcomes have obtained in another study, the hemoglobin A1C level was employed as an objective measure of chronic glycemic control (Narayanan *et al.* 2020, Beck *et al.* 2019).

4.3 Levels of Vit. D in Patients and Control Groups

Vitamin. D levels in the controls were much higher than in the patients. (25.44a ± 3.88. vs 8.47b ± 1.85 ng/mL, T-value = 21.44, P-value = 0.02).

Because the definition of low amounts of 25(OH) D differs based on the level that is deemed Normal, low levels were defined as deficient, whereas low levels of 20 ng per milliliter were classified as insufficiency (Vicka Oktaria 2016). (30 to 76) ng/ mL is considered a normal serum concentration. Using that range, the predicted vitamin D insufficiency is common among the general public is a large increase (Holick *et al.* 2005). Current results show that the Patients with vitamin D deficiency are more common in greater reduction. Can be a conclusion that D blood levels are thought to be lower in those with diabetics. because of the long-term, aberrant glucose metabolism that occurs as a result of this condition; the same outcomes have been obtained in another study (Djalali *et al.* 2013).

From this study vitamin D significant decrease patients are much higher than the of controls, Vitamin D may play a role in the onset and progression of type 2 diabetes, according to a new study through impacts on numerous mechanisms correlated with the diabetic type 2 biology, such as reduced pancreatic-cell function and insulin resistance, among others. The same outcomes have obtained in another study (Angellotti and Pittas 2017). Vitamin D treatment, on the other hand, appears to be successful in recovering glucose-stimulated insulin levels in diabetic patients, this conclusion is consistent with has been established by (Liao 2018).

4.4 Body Mass Index (BMI)

Current results show there was a significant Patients' weights increased in comparison to controls (86.34a ± 6.22. VS. 79.31b ± 11.68 KG, T-value = 3.87, P-value = 0.01). Current results show that the BMI of patients is significant higher than the controls (28.96 ± 3.34a.VS. 26, 75 ± 1.75b) P = 0.004). The same outcomes have obtained in another study (Tripathy 2018).

BMI the average person's weight gain can be relied upon as a reliable indicator of future health problems related to diabetes, and this measurement is commonly used to make that determination. This conclusion is consistent with has been established by (Nuttall 2015). When comparing patients and controls, results showed that, their BMI was significantly greater. That is to say, people who overweight more likely to develop diabetes than others. the conclusion is consistent with has been established with, (Edqvist *et al.* 2019). Current results show can be conclusion a high BMI has linked to development of diabetics as a result of insulin resistance, according to some research (Li *et al.* 2018).

4.5 Levels of Lipid Profile in Patients and Controls

Current results show, Compared with control group, the cholesterol levels of the patients increased significant (199.82a ± 58.77 vs 178.30b ± 13.15 mg/dL, T-value = 2.98 mg/dL, (P = 0.004). There was Increases significant the TGs of the patients as compared to controls (244.42a ± 54.11.vs. 131.53b ± 12.40 mg/dL, T-value = 9.26, P-value = 0.02) and, there was Increases significant the HDL of the controls comparison to patients (32.65b ± 4.26 vs 45.80a ± 3.66 mg/dL, T-value = 14.02, P-value = 0.01).

When triglycerides and cholesterol levels compared between cases and controls, the current findings show significant increase in the patient. In diabetics, hypertriglyceridemia levels are connected to decreases the HDL; presence of the a hyperlipidemia, dyslipidemia in diabetics suggests a significant role in the disease's initiation, progression, the same outcomes have obtained in another study (Pandey *et al.* 2017). Current results show Diabetes mellitus usually accompanied with dyslipidemias, a metabolic disorder that is present in the blood. The significant of dyslipidemias is influenced by glycaemia, this conclusion is consistent with has been established by (Schofield *et al.* 2016).

When considering diabetics, the total increase in lipid levels can caused increase in fat deposits' fatty acid mobilization. This is because the hyperinsulinemia found in this study may have an effect on fatty acid metabolism. Extra fatty acids that were found in the serum were converted to cholesterol, phospholipids, and triglycerides by the liver, out of the serum's excess fatty acids. this conclusion is consistent with has been established by (Shankarprasad *et al.* 2015).

5. DISCSSION

5.1 The Correlation between, Serum Glucose, Whole Blood Hba1c, and Vitamin D Levels

The Correlation and Description between serum glucose levels, blood HbA1C levels and vitamin D levels are In Table 5.1 and Figure 5.1, this is demonstrated.

Table 5.1 The Correlation between serum glucose, blood HbA1C and vitamin D levels

Parameter	**Vit. D**	
	Person correlation (r)	**P-value**
Glucose	- 0.13	0.23
HbA1C	- 0.10	0. 38

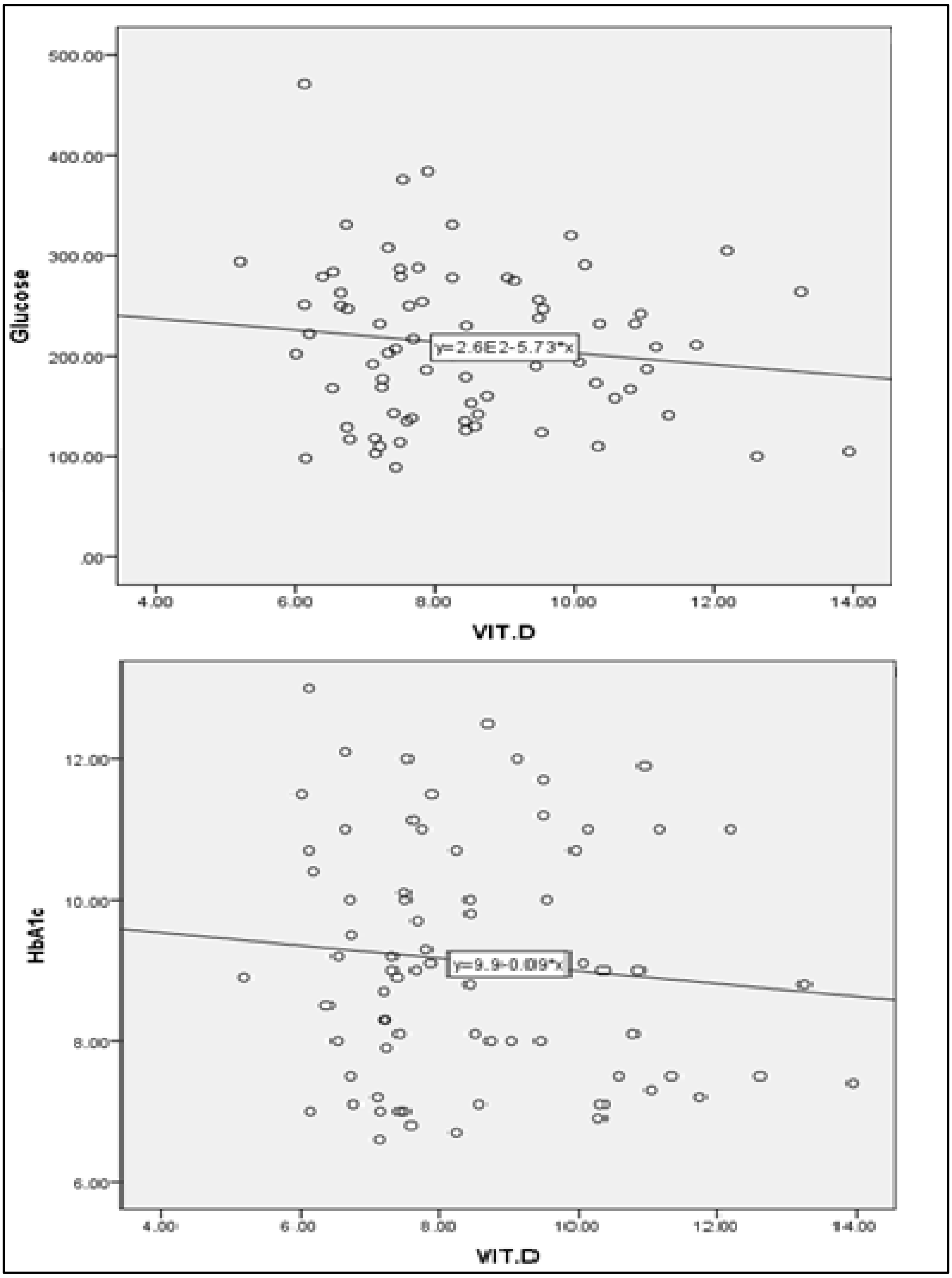

Figure 5.1 Correlation between serum glucose, whole blood HbA1C, and vitamin D

The level of vitamin D found in this study was found no have statistically significant correlation with glycaemia such as serum glucose, hemoglobin A1C (P = 0.23. R= -0.13), (P= 0.38. R= -0.10) the same outcomes have obtained in another study (Ismail *et al.* 2021). But there's another study that shows there is established inverted correlation HbA1c, FBS, and vitamin D status in people with patients type 2 diabetes, indicating that Glycemic control may be affected by vitamin D level management in these people, such (Olt 2015).

Show in another study the people fasting glucose levels and decreased vitamin D levels, not significant from supplementing with vitamin D of developing Diabetic type 2. This conclusion is consistent with has been established by (Avenell *et al.* 2009). Show another study have conclusion different is there found positively significant correlation between vitamin D and pancreatic b cell activity, sensitivity in addition to the control over the amount of insulin produced. Lowering vitamin D levels hinder pancreatic b cell insulin secretion. Is results are in agreement with (Rashidi *et al.* 2016).

5.2 The Correlation between BMI and Vita. D Levels

Table 5.2 and Figure 5.2 show there was A direct not statistically significant correlation between BMI and vitamin D (P = 0.72, R = 0.041).

Table 5.2 The Correlation between BMI and vitamin D levels

Parameter	Vit. D	
	Person correlation (r)	**P-value**
BMI	0.041	0.72

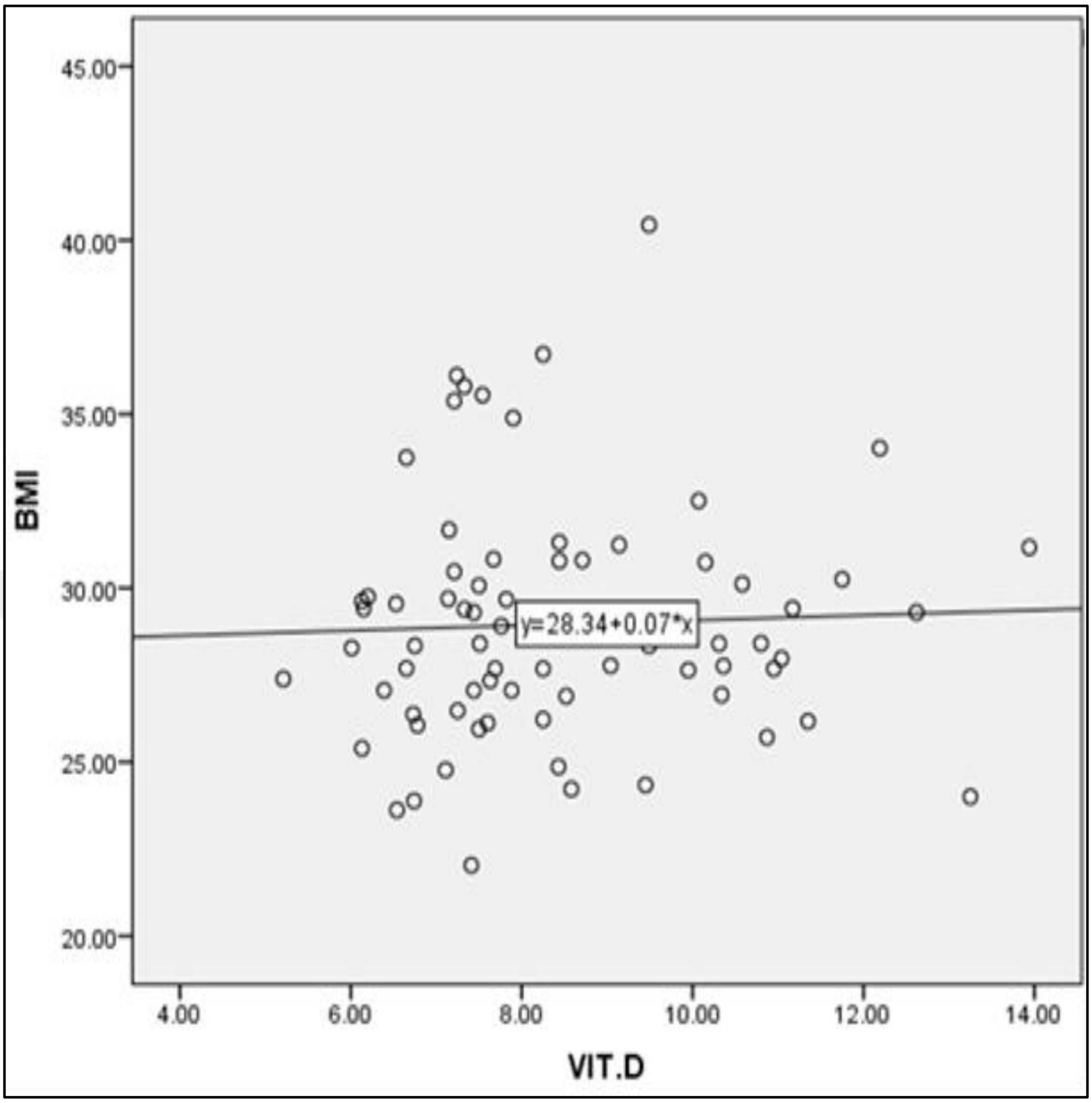

Figure 5.2 Correlation between BMI and vitamin D levels

The study Current results show, there was Levels 25 (OH) D finding is decreasing in cases when comparison to control. Current results show decrease level vitamin D in patients, which very large difference. The same outcomes have obtained in (Edqvist *et al.* 2019).

Show in another study the body mass index (BMI) is significantly to the vitamin D levels in the serum, with values ipatient ranging from 10 to 20 ng per milliliter. A number of factors contribute to the amount of vitamin D lower 10 ng, including inadequate vitamin D consumption combined with insufficient sun exposure. The same outcomes have obtained in (Rafiq and Jeppesen 2018). However, show none was statistically significant found between vit D with BMI in the study. This conclusion is consistent with has been established by (Al-Bayyari *et al.* 2018).

5.3 The Correlation between lipid profile and vitamin D levels

Table 5.3 and Figure 5.2 show that there was A direct positive significantly correlation between (HDL) and Vitamin D (R = 0.53, P= 0.001). show significantly negative none association was found between (TG, CHOL) levels and Vitamin D (R= -0.039, p = 0.73) and (R = -0.13, P=0.24).

Table 5.3 The Correlation between lipid profile and vitamin D levels

Parameter	**Vit. D**	
	Person correlation (r)	**P-value**
Cholesterol	- 0.039	0.73
TGs	- 0.13	0.24
HDL	0.53	0.001

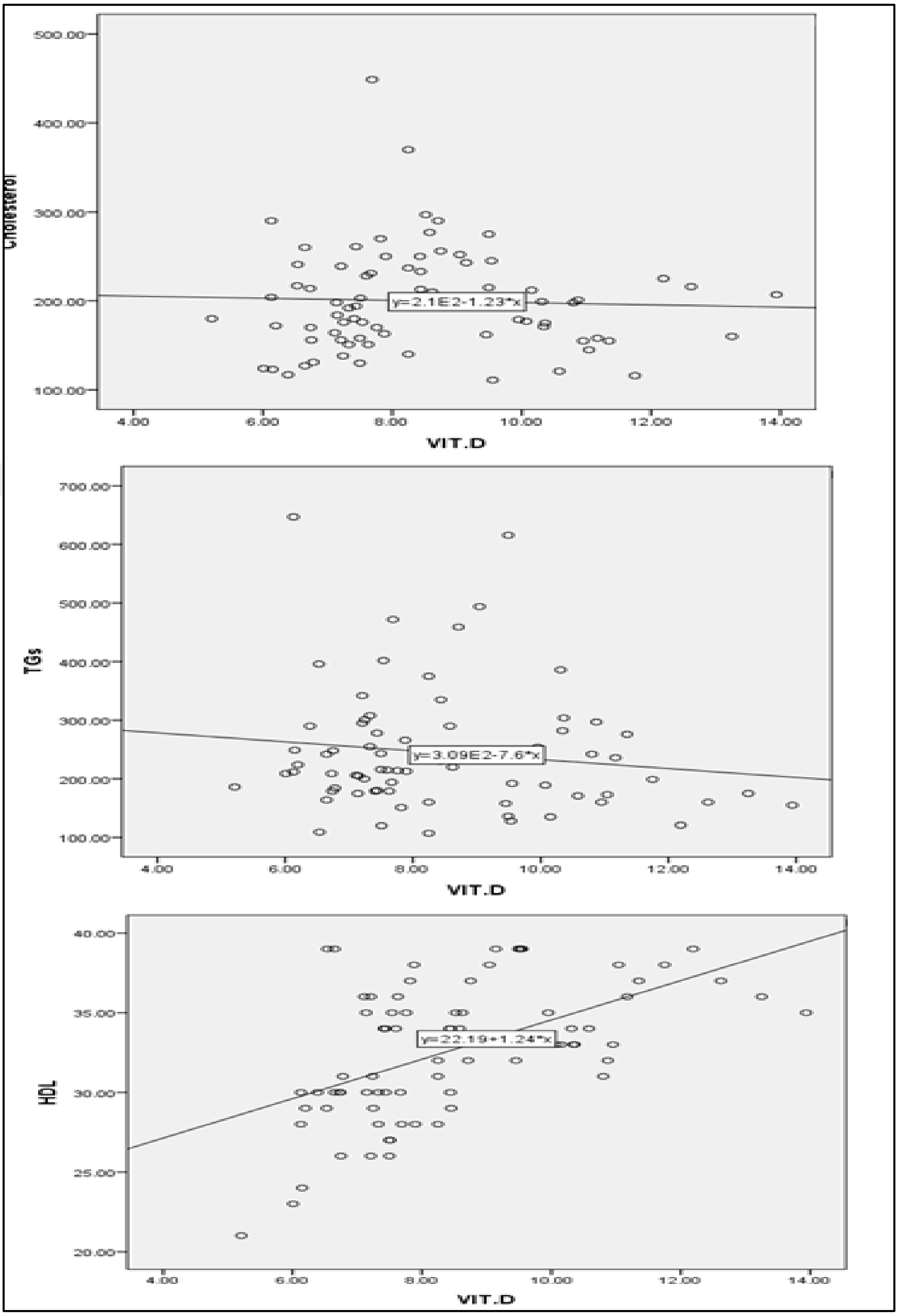

Figure 5.3 Correlation between lipid profile and vitamin D levels

In this study Current results show there was a considerable increase in the cholesterol of the patients as comparison to the controls, there was a considerable increasing the TGs of the patients as comparison to controls and there was a considerable increasing the HDL of the controls as compared to patients. The same outcomes have been obtained in (Raghavendra *et al.* 2018). In this study Current results show, there was Diabetic type 2 is characterized by increasing TC, and TG, levels, in addition to a decrease in HDL-c levels, without any problems. This conclusion is consistent with has been established by (Ejuoghanran *et al.* 2011). Because Diabetic type 2, the state of hyperinsulinemia interferes with every step of the downstream process, causing an excessive increase in lipids, (TG) and CHOL, in serum diabetes-induced dyslipidemia. This conclusion is consistent with has been established by (Lokhande Suryabhan *et al.* 2013). Specifically, increase value the triglycerides and decrease value the HDL were found in the study, indicating that dyslipidemia is a lipid profile abnormality that occurs in diabetes. The same outcomes have obtained in (Shahid and Sarwar 2020).

In this study, Current results show there was high cholesterol, hypertriglyceridemia, LDL levels have increased. And decreased HDL shown to be the most frequent people with type 2 diabetes have abnormalities in their lipids without problems. This conclusion is consistent with has been established by (Srinidhi *et al.* 2017), However In this study Current results show there was, Triacylglycerol levels and vitamin D levels had no statistically significant correlation. The conclusion was consistent with has been established by (Sadeghi *et al.* 2018). Results show there was HDL and Levels of 25(OH) D was found be positively significantly each other the study of dyslipidemia and hypo vitamin D discovered the dyslipidemia had found a significantly associated on vitamin D (P= 0.002). The same outcomes have obtained in (Yu *et al.* 2012).

The positively significantly in this study between HDL and vitamin D levels because to the role-played by vitamins D in providing sufficient value of Apo lipoprotein,(A-1) which is primary Components that make up HDL cholesterol. Adults with hypo vitamin D have been found to have lower levels of the protein Apo lipoprotein A-1 in their blood. The same outcomes have obtained in (Xu *et al.* 2013).

6. CONCLUSION

1. Cases had a much greater BMI than controls.
2. Mean serum vitamin D levels were significantly lower in cases as compared to control subjects. Vitamin-D inadequacy and insufficiency were found in significantly more instances than in controls.
3. In cases, amounts of HbA1c and values of glucose in the blood show much greater than in the control group.
4. Cases had significantly higher mean triglyceride and cholesterol levels than controls.
5. The HDL-C values was increased significant amount in controls compared to cases.
6. Vitamin D levels and HDL-C levels were shown was significant positively correlation.

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