Ministry of Higher Education
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Hilla University College
Department of Medical
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Correlation between Hyperglycemia and Vitamin D3 deficiency

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بسم الله الرحمن الرحيم

{ وَأَن لَّيْسَ لِلْإِنسَـٰنِ إِلَّا مَا سَعَىٰ(٣٩)وَأَنَّ سَعْيَهُۥ سَوْفَ يُرَىٰ(٤٠)ثُمَّ يُجْزَىٰهُ ٱلْجَزَآءَ ٱلْأَوْفَىٰ(٤١) وَأَنَّ إِلَىٰ رَبِّكَ ٱلْمُنتَهَى (٤٢)}

صدق الله العلي العظيم

سورة النجم

Dedication

I dedicate this modest researce:

To my impregnable refuge, where my small heart has always found shelter from the hustle and bustle of days, like a book whose poems never cease and whose stories never end, like a star that guides me whenever the darkest nights gather around me. To you, whose eyes expand the sky, erasing sorrow and planting hope,

My father.

To a woman of light, a woman whom the earth is proud to bear and the sky to cover and honor, as pure as dewdrops dancing among rose petals, to you, the pearl of the heavens,

My mother.

To everyone who has left a mark on us, whether through their effort, their heart, or their words sent to the Lord to steady our steps and light our path, to brothers and friends, and to all who loved us and added joy and warmth to every chapter of our journey.

And a special tribute to the souls burdened by illness, yet who did not hesitate for a moment to contribute support, both physically and morally, serving a noble goal and serving a generation they placed their trust in. They took our hands and accompanied us all along the way.

Acknowledgment

On that day, I read a sentence where the fox told the one willing to listen, "The time you've wasted on your rose makes your rose so important."

The more I ponder the meanings of life, the more I am convinced that the only thing that matters is being immersed in your journey towards something—being engrossed in science, in work, in art. That is what gives your fruits their value, a notion clarified and affirmed by the Lord Himself.

And because He commanded us to walk alongside life and strive, He surrounded us with His mercy all along the way, from dust to body to spirit, leading up to this research. Even though we are not in the perfect, complete image of a devout believer, the Lord loved us and chose us from everything His power and greatness could create. He chose us to be His craftsmanship, to produce with the grace He bestowed upon us. Thus, we thank our Lord first and foremost.

I also specifically mention Dean "Prof. Dr. Aqeel Majid Kadhim Al-Saadi" and the Head of the Department,"Assoc. Prof. Dr. Furqan Mohammed Hussein Al-Asadi", and all members of the Hilla College who have been a great support to us, standing by to provide everything a student needs within this academic institution.

I firmly believe in the idea that the Lord sends hundreds of messages to His servants every second, and I am certain that you, our dear supervisor, "Msc.Maysaa Zeki Yahya Alqizweeny", are one of the Lord's messages to us. We found in your voice the wisdom that guided us on our paths and reminded us that we are more than just small consumers. You gave our pens the courage to overflow with ideas, moving them from their limitations to boundless possibilities.

And I cannot forget to include my utmost thanks and gratitude for the valuable contribution of the patients in completing this research. Just as you were part of our educational journey today, we promise you that we will be part of the treatment tomorrow. And never forget that "He who has led you this far will lead you further." So be assured that healing is near, by the will of the Lord Almighty.

I conclude my words by saying that the Lord has seen all your efforts today, and I pray that He rewards you the best of rewards and increases you in His grace. Although my words may fall short of expressing my gratitude, I want to tell you that I am proud to be the fruit of your efforts invested in me. Thank you all.

Summary:

Summary Diabetes is a chronic (long-lasting) health condition that affects how your body turns food into energy. Particularly, diabetes including type 1, type 2, or gestational diabetes can negatively affect the health of women and men. It is now recognized that there are a variety of calcium metabolic disorders that are related to defects in the synthesis and metabolism of vitamin D. In current study, it has been found that Vitamin D3 levels measured in the same subjects were lower in diabetes compared to control. Further analysis showed that low levels of Vitamin D3 were detected in female and male with diabetes compare with healthy. This result may be explained by the fact that low level of D3 can increase blood sugar in female and male.

ABBREVIATION	MEANING
D	CHOLECALCIFEROL
D3	25-HYDROXYCHOLECALCIFEROL
RBS	RANDOM BLOOD SUGAR
HIV	HUMAN IMMUNODEFICIENCY VIRUS
AIDS	ACQUIRED IMMUNODEFICIENCY SYNDROME
ELFA	ENZYME-LINKED FLUORESCENT ASSAY
UV	ULTRAVIOLET LIGHT
FBS	FASTING BLOOD SUGAR
T2Dm	TYPE 2 DIABETES MELLITUS
Dm	DIABETES MELLITUS
B cell	BETA CELL
A	RETINOL
E	TOCOPHEROL
K	MENADIONE
Wnt	WINGLESS-RELATED INTEGRATION
ROS	REACTIVE OXYGEN SPECIES
IF	INFRARED
nm	NANOMETER
Cal	CALIBRATION
µL	MICROLITER

Chapter one
Introduction

1.1 Introduction

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. (Word Health Organization.,2021) There are three main types of diabetes - type 1, type 2, and gestational.

Type 1 diabetes can affect people of any age, but it usually occurs in children or young adults. People with type 1 diabetes need daily insulin injections to control blood sugar levels (International Diabetes federation Covid-19 and diabetes., 2020)

Type 2 diabetes is the most common type of diabetes, accounting for about 90% of all cases of diabetes. It is generally characterized by insulin resistance, in which the body does not fully respond to insulin. Because insulin doesn't work properly, blood glucose levels keep rising, releasing more insulin. (International Diabetes federation Coved-19 and diabetes., 2020).

Gestational diabetes is associated with multiple negative pregnancy outcomes. Women with gestational diabetes later run the risk of developing type 2 diabetes, especially three to six years after giving birth. Exposure to hyperglycaemia in utero also puts children at a high risk of developing overweight or obesity associated with the development of type 2 diabetes (International Diabetes federation.,2020).

Vitamin D is one of the four fat-soluble vitamins (vitamin A, E, and K). It is stored and dissolved in your fatty tissues instead of water, and the benefit of this is that it can be stored in your body for long periods of time. (Worldwide shipping from the USA and UK TESToFUEL., 2017).

Vitamin D3 is necessary for the normal functioning of many body systems. Vitamin D3 deficiency has been associated with many symptoms and conditions: fibromyalgia, chronic fatigue disease, osteoporosis, kidney disease. Cardiovascular disease, asthma, cancer. (Pittas *et.al*., 2007).

Research shows that more than a billion people worldwide are deficient in vitamin D. Symptoms include: muscle weakness and pain, weak bones, fatigue, inflammation,

and deficiency may lead to many health conditions, such as: depression, hypertension (high blood pressure), arthritis, and eczema. Therefore, a simple blood test can check vitamin D levels (Yvelette *et.al*., 2021).

Low levels of vitamin D are a prevalent issue in people with and without diabetes across the globe. Research has repeatedly found a clear association between low vitamin D levels in patients with insulin resistance and a high risk of developing type 2 diabetes as shown in 2011 study from Canada. (Health News., 2019) ― This newest study appears to show that with supplementation prior to diagnosis, or soon after, the body retains the ability to respond better on the cell level to insulin, which counters the hallmark of type 2 diabetes — insulin resistance, ‖ Jennifer Smith, CDE, RD, told Healthline. (Jennifer Smith *et.al*., 2019).

The other thing it appears to help with is allowing the beta cells in the pancreas that make insulin to stay healthy and functional, ‖ added Smith, who treats patients with all types of diabetes across the globe at Integrated Diabetes Services. (Health News., 2019). Beta cells play a central role in insulin secretion. Gradual beta cell dysfunction is the biggest culprit of type 2 diabetes for approximately 60 percent of people diagnosed, according to a 2016 study published in Diabetes Care. (Health News., 2019). The remaining 40 percent, then, is potentially able to reverse the condition through significant changes in nutrition, exercise, and body weight. (Health News., 2019).

1.2Aim and Objectives of the study:

The project aimed to study the level of vitamin D3 in diabetes patients. Followed by objectives:

1. To learn how to collect blood samples from diabetes patients.
2. To estimate level of vitamin D3 and blood sugar.
3. To analyses result data.

Chapter two
Literature review

2.1. Diabetes mellitus

chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Diabetes mellitus is a group of metabolic diseases characterized by Metabolic abnormalities in carbohydrates, lipids, and proteins result from the importance of insulin as an anabolic hormone. Low levels of insulin to achieve adequate response and/or insulin resistance of target tissues, mainly skeletal muscles, adipose tissue, and to a lesser extent, liver, at the level of insulin receptors, signal transduction system, and/or effector enzymes or genes are responsible for these metabolic abnormalities. The severity of symptoms is due to the type and duration of diabetes.

Some of the diabetes patients are asymptomatic especially those with type 2 diabetes during the early years of the disease, others with marked hyperglycemia and especially in children with absolute insulin deficiency may suffer from polyuria, polydipsia, polyphagia, weight loss, and blurred vision. Uncontrolled diabetes may lead to stupor, coma and if not treated death, due to ketoacidosis or rare from non-ketotic hyperosmolar syndrome. (American Diabetes Association., 2014)

2.1.1. Diabetic complications

Diabetes can affect many different organ systems in the body and, over time, can lead to serious complications. Complications from diabetes can be classified as microvascular or macrovascular. Microvascular complications include nervous system damage (neuropathy), renal system damage (nephropathy) and eye damage (retinopathy) Macrovascular complications include cardiovascular disease, stroke, and peripheral vascular disease. Peripheral vascular disease may lead to bruises or injuries that do not heal, gangrene, and, ultimately, amputation. (Fox *et al*., 2004)

2.1.2. Insulin hormone

Insulin is a polypeptide hormone mainly secreted by β cells in the islets of Langerhans of the pancreas. The hormone potentially coordinates with glucagon to modulate blood glucose levels; insulin acts via an anabolic pathway, while glucagon performs catabolic functions. Insulin regulates glucose levels in the bloodstream and induces glucose storage in the liver, muscles, and adipose tissue, resulting in overall weight gain. The modulation of a wide range of physiological processes by insulin makes its synthesis and levels critical in the onset and progression of several chronic diseases. Although clinical and basic research has made significant progress in understanding the role of insulin in several pathophysiological processes, many aspects of these functions have yet to be elucidated. (Cefalu, 2001)

2.1.3. Classification

Diabetes can be classified into the following general categories: (American Diabetes Association., 2014)

1. Type 1 diabetes (due to autoimmune β-cell destruction, usually leading to absolute insulin deficiency, including latent autoimmune diabetes of adulthood)

2. Type 2 diabetes (due to a progressive loss of adequate β-cell insulin secretion frequently on the background of insulin resistance)

3. Specific types of diabetes due to other causes, e.g., monogenic diabetes syndromes (such as neonatal diabetes and maturity-onset diabetes of the young), diseases of the exocrine pancreas (such as cystic fibrosis and pancreatitis), and drug- or chemical-induced diabetes (such as with glucocorticoid use, in the treatment of HIV/AIDS, or after organ transplantation).

4. Gestational diabetes mellitus is associated with multiple negative pregnancy outcomes. Women with gestational diabetes later run the risk of developing type 2 diabetes, especially three to six years after giving birth. Exposure to hyperglycemia in utero also puts children at a high risk of developing overweight or obesity associated with the development of type 2 diabetes. (International Diabetes federation Covid-19 and diabetes., 2020)

2.1.4. Treatment of diabetes

Dietary intake and physical exercise are the two main determinants of the energy balance and they are considered as a basic base in the treatment of patients with diabetes. Adequate rest is also very important for maintaining energy levels and well-being, and all patients should be advised to sleep approximately 7 h per night Evidence supports an association of 6 to 9 h of sleep per night with a reduction in cardiometabolic risk factors whereas sleep deprivation aggravates insulin resistance, hypertension, hyperglycaemia, and dyslipidaemia On the other hand, a screening of patients with suspected obstructive sleep apnoea should be performed, and refer them to a sleep specialist for evaluation and treatment.

Although the pharmacological options are each time more extensive and they offer more therapeutics possibilities, especially in the T2DM, the interventions in the life style are essentials in the approach of these patients and they are needed to get the therapeutics goals. (Garber *et al*., 2009)

2.1.5. Diet

When nutritional intervention is contemplated, the co-morbidities that can coexist in a diabetic patient also have to be considered. The recommendations on dietary aspects can contribute to achieve the desired blood glucose, blood pressure, lipid profile and weight as well as improve sleep apnoea, depression and quality of life related to health; in addition, it has been observed that the incidence of urinary incontinence in women is reduced. (Williamson *et al*., 2009)

2.2. Vitamin D

Is one of the four fat-soluble vitamins (vitamin A, E, and K). It is stored and dissolved in your fatty tissues instead of water, and the benefit of this is that it can be stored in your body for long periods of time. (Worldwide shipping from the USA and UK Tasteful, November 16, 2017.)

Vitamin D3 is necessary for the normal functioning of many body systems. Vitamin D3 deficiency has been associated with many symptoms and conditions: fibromyalgia, chronic fatigue disease, osteoporosis, kidney disease. Cardiovascular disease, asthma, cancer (Pittas *et al*.,2007).

Research shows that more than a billion people worldwide are deficient in vitamin D. Symptoms include: muscle weakness and pain, weak bones, fatigue, inflammation, and hair loss.

A deficiency may lead to many health conditions, such as: depression, hypertension (high blood pressure), arthritis, and eczema. Therefore, a simple blood test can check vitamin D levels. (Yvelette.,2021).Low levels of vitamin D are a prevalent issue in people with and without diabetes across the globe. Research has repeatedly found a clear association between low vitamin D levels in patients with insulin resistance and a high risk of developing type 2 diabetes as shown in 2011 study from Canada (Smotkin *et al*., 2007). —This newest study

appears to show that with supplementation prior to diagnosis, or soon after, the body retains the ability to respond better on the cell level to insulin, which counters the hallmark of type 2 diabetes — insulin resistance, (Smith *et.al*., 2019).

The other thing it appears to help with is allowing the beta cells in the pancreas that make insulin to stay healthy and functional, ‖ added Smith, who treats patients with all types of diabetes across the globe at Integrated Diabetes Services. (Health News.,2019)

Beta cells play a central role in insulin secretion. Gradual beta cell dysfunction is the biggest culprit of type 2 diabetes for approximately 60 percent of people diagnosed, according to a 2016 study published in Diabetes Care. (Health New.,2019)

The remaining 40 percent, then, is potentially able to reverse the condition through significant changes in nutrition, exercise, and body weight. (Health News., 2019).

2.3. Diabetes

which is characterized by an elevation in blood glucose, is becoming increasingly common. One reason for this is the increasing prevalence of obesity. A likely link between obesity and diabetes is the deficiency of Vitamin D that occurs in obesity. The aim of this review is to explore why Vitamin D deficiency is such a strong risk factor for diabetes. This review will begin by describing how Vitamin D deficiency may be the link between obesity and diabetes. Vitamin D seems to act to maintain many of the sequential events that enable the beta cells (β-cells) located in the pancreatic islets of Langerhans to release the insulin necessary to control blood levels of glucose. The decline in insulin levels begins with the onset of insulin resistance.

The β-cells are capable of increasing the amount of insulin being released in order to counteract the reduced effectiveness of insulin action. However, as the elevation of glucose continues to rise, this glucotoxicity increases the hyperactivity further and this overwhelms the β-cells that begin to die. The resulting decline in the release of insulin results in the excessive elevation of blood glucose that characterizes diabetes. In this review, this sequence of events will be described in more detail so as to illustrate why Vitamin D deficiency is such a strong risk factor for diabetes

2.4. Vitamin D deficiency and diabetes

There is increasing evidence that Vitamin D deficiency may contribute to the onset of diabetes (Scragg *et al*.,2005). This is supported by the finding that polymorphisms of the Vitamin D receptor.

(VDR) have been linked to diabetes (Sentinelli *et al*., 2016). There are indications that Vitamin D supplementation may prevent the onset of type 2 diabetes (T2D) (Wimalawansa, 2016; Sergeev, 2016)

It will be argued later that Vitamin D acts to control many of the processes that initiate the onset of diabetes such as the formation of Ca2+ and reactive oxygen **species (ROS).**

In effect, Vitamin D controls the expression of those genes that function to ensure that the levels of Ca2+ and ROS are

• maintained at their normal low physiological levels (Berridge., 2015) Another important action of Vitamin D is to maintain the normal mitochondrial control of cellular bioenergetics (Calton, Keane & Soares, 2015). Vitamin D also plays a role by reducing inflammation that helps to control the insulin resistance that is a major contributor to diabetes (Wimalawansa., 2016). These multiple actions of Vitamin D will be discussed in more detail in the following sections. One of the major causes of diabetes is obesity.

2.5. Obesity, Vitamin D and diabetes

There is a close association between obesity and Vitamin D deficiency (Smotkin-Tangorra., 2016). ability to promote energy expenditure by increasing fatty acid (FA) oxidation and mitochondrial metabolism, Vitamin D can reduce the onset of weight gain in mice (Marcotorchino *et al*,. 2014). Many reasons have been put forward to explain the reduced levels of Vitamin D in obesity (De Souza Silva et al. 2016; Abbas 2017). Perhaps, the most significant is that Vitamin D in the

Serum is reduced because it enters into the large fat depots located in the adipose tissue. There may also be 'volumetric dilution' as a result of the large body size in obesity. To understand how Vitamin D may act to reduce diabetes, it is instructive to explore the link between obesity and diabetes.

The initial phase of diabetes is driven by insulin resistance in those organs (adipose tissue, skeletal muscle and liver) that respond to insulin to control glucose and lipid metabolism (Kahn *et al*., 2016). Initially, the pancreatic islet β-cells can overcome this resistance by releasing more insulin, thus preventing hyperglycaemia (Leahy., 2005). With time, this hyperactivity causes β-cell dysfunction that results in cell death and the onset of T2D caused by a marked decline in insulin secretion (Butler *et al*., 2003). There is increasing evidence to support the fact that Vitamin D deficiency can contribute to both the initial insulin resistance and the subsequent onset of diabetes caused by β-cell death as described below.

2.6. Vitamin D and insulin resistance

The low levels of Vitamin D in obesity may contribute to the onset of diabetes, because it functions to regulate many of the processes that are altered during the onset of both insulin resistance and the subsequent decline in β-cells that results in diabetes (Chiu *et al*., 2013). Under normal conditions, Vitamin D has many actions to control both gene transcription and cell signalling pathways to alleviate the onset of insulin resistance especially in adipose tissue (Abbas, 2016).

It can act through a non-genomic pathway to control lipogenesis and lipolysis (Shi *et al*., 2001). However, most of its actions seem to be mediated through genomic mechanisms. One of these actions is to inhibit adipocyte differentiation during adipogenesis by maintaining the Wnt/β-catenin signalling pathway (Abbas *et al*., 2012) and the mitogen-activated protein kinase signalling pathway (Lee et al., 2012). Vitamin D also acts to inhibit apoptosis by reducing the expression of the mitochondrial uncoupling protein 2 (UCP2) (Shi *et al*., 2004).

The diabetes that develops during obesity is driven by the onset of insulin resistance which results in a decline in the ability of insulin to reduce the output of glucose from the liver and to increase the uptake of glucose into muscle and adipose cells (Saltiel & Kahn., 2001).

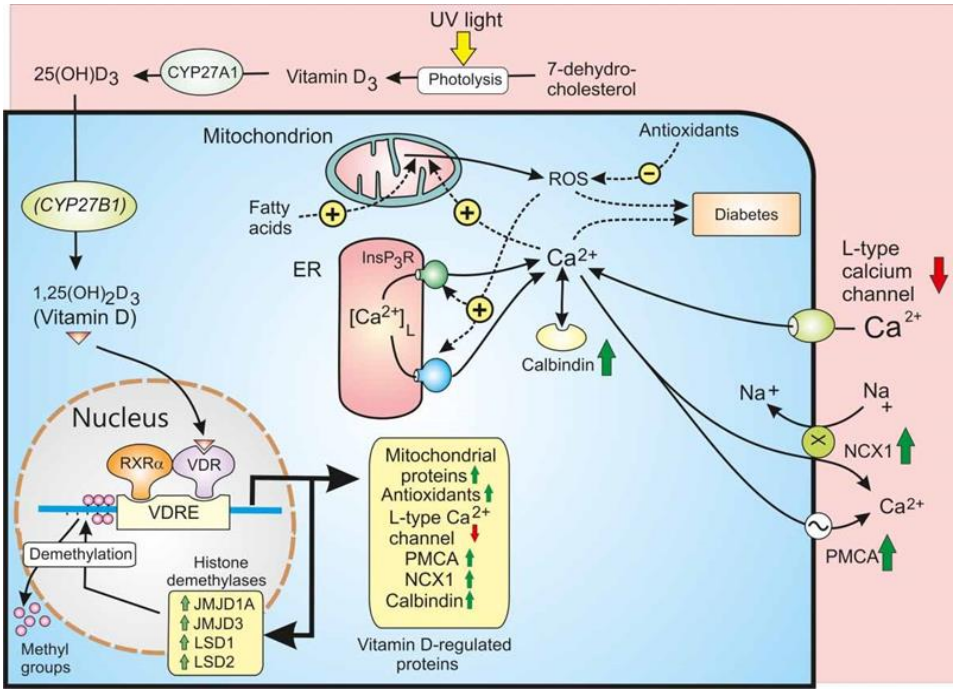

Figure 1. Vitamin D acts to prevent diabetes by maintaining low levels of Ca2+ and ROS.

ROS formation (Sun & Zemel, 2007). This action of Vitamin D in regulating ROS levels depends on its ability to control the expression of cellular antioxidants as part of its role to maintain.

Chapter three
Materials and methods

3.1. Patients

This study included 40 cases of diabetes, half of whom were healthy and the other half were found to suffer from diabetes, 20 of whom were females and 20 males who visited Zulkifli General Hospital.

3.2. Collecting of blood samples

Blood samples were taken in the morning between 9:00 and 12:00 . The doctor examines the injured person and sends him to the laboratory unit of the hospital. Using medical syringes, (2) ml of venous blood is drawn from the Antecubital vein and placed in a gel tube devoid of anticoagulants, because we need serum.

3.3. Principle of each device

1-Mini vidas

Mini VIDAS® is greatly appreciated worldwide for its simplicity, flexibility, reliability and 24/7 availability. It processes single sample and batch tests for all types of analysis: serology, immunochemistry, antigen detection. Ten different analytes can be used simultaneously. All enzyme immunoassay reaction stages are performed automatically in minimal space: pipetting, incubating, washing, reading, and results are sent immediately to the integrated printer. The mini VIDAS analyzer tests for vitamin D levels:

1. Assay Method:

- Utilizes ELFA (Enzyme-Linked Fluorescent Assay) technology

- Based on enzyme immunoassay sandwich method with final fluorescent detection

2. Reaction Steps:

- Patient serum sample is added to reagent pack container that has anti-vitamin D coated beads plus anti-vitamin D conjugated with alkaline phosphatase enzyme

- Any vitamin D in sample binds to antibodies, forming bead-vitamin D-antibody sandwiches
- Unbound material washed away, then substrate added cleaved by enzyme to generate fluorescent signal

3. Signal Detection:

- Laser in instrument excites fluorescent substrate product
- Converted to measurable emission indicating quantity of vitamin D present proportional to fluorescence

4. Result Output:

- Built-in calibration curves yield rapid, automated, quantitative analysis
- Provides vitamin D levels from serum in terms of 25-OH metabolite concentrations

So in essence, the competitive binding plus enzyme-mediated fluorescent tagging allows ultrafast, sensitive vitamin D determinations in small samples by VIDAS leveraging immunoassay technology engineered for speed and precision.

2- Spectrophotometer

A spectrophotometer is an instrument that measures the amount of photons (the intensity of light) absorbed after it passes through sample solution. With the spectrophotometer, the amount of a known chemical substance (concentrations) can also be determined by measuring the intensity of light detected. Depending on the range of wavelength of light source, it can be classified into two different types:

- UV-visible spectrophotometer: uses light over the ultraviolet range (185 - 400 nm) and visible range (400 - 700 nm) of electromagnetic radiation spectrum.
- IR spectrophotometer: uses light over the infrared range (700 - 15000 nm) of electromagnetic radiation spectrum.

Spectrophotometer consists of a light source, a collimator, a monochromator, a wavelength selector, a cuvette for sample solution, a photoelectric detector, and a digital display or a meter. Detailed mechanism is described below.

A spectrophotometer, in general, consists of two devices; a spectrometer and a photometer. A spectrometer is a device that produces, typically disperses and measures light. A photometer indicates the photoelectric detector that measures the intensity of light.

Spectrometer: It produces a desired range of wavelength of light. First a collimator (lens) transmits a straight beam of light (photons) that passes through a monochromator (prism) to split it into several component wavelengths (spectrum). Then a wavelength selector (slit) transmits only the desired wavelengths.

Photometer: After the desired range of wavelength of light passes through the solution of a sample in cuvette, the photometer detects the number of photons that is absorbed and then sends a signal to a galvanometer or a digital display.

After collecting the sample we measured

- Fasting blood sugar
- 2 - 25-hydroxycholecalciferol

3.4. Solutions

1 - R1 : monoreagent : phosphate buffer 200 mmol/L ph 7.5 glucose oxidase >10 kU/L peroxidase >2kU/L , amino antipyrine 0.5 mmol/L phenol 5mmol/L , sodium azide < 2.

2 - CAL glucose standard. Glucose 100 mg/dL (5.55 mmol/L) Organic matrix based on primary standard. Concentration value is traceable to Standard Reference Material G17b.

3.5. Methods

1-Fasting blood sugar (FBS)

General laboratory

We used a gel tube in which the blood sample was placed, then we inserted it into the centrifuge to obtain the serum. After the additions, we stored it at a temperature of 37° C in the water bath for 5 minutes. Then we measured the sample in a spectrophotometer at 500 nm . We saved the readings and performed a calculation to obtain the final result as follows:

PROCEDURE

1. Bring reagents and samples to room temperature.

2. Pipette into labelled tubes: TUBES Blank Sample CAL Standard R1. Monoreagent Sample 1.0 mL 1.0 mL 10 µL 1.0 mL CAL Standard Air 10

AL. Standard	ample	lank	Tubes
1.0 ml 10 µL	1.0 ml 1 0 µL	1.0 ml	R 1. Mono-reagent Sample CAL. Standard

3. Mix and let the tubes stand 10 minutes at room temperature or 5 minutes at 37 ° C.

4. Read the absorbance (A) of the samples and the standard at 500 nm against the reagent blank. The color is stable for about 2 hours protected from light.

Calibration Calibration must be performed with two points (S1: distilled water and S2 Calibrator). Verify the working reagent blank every day before its use.

Calibration with aqueous standard may cause a matrix related bias in aut analyzers.

CALCULATIONS

A Sample x C Standard mg/dL glucose A Standard Samples with concentrations higher than 500 mg/dL should be diluted 1:4 with saline and assayed again. Multiply the results by 4. If results are to be expressed as SI units apply: mg/dL x 0.0555 mmol/L

2- Vitamin D3

We used a gel tube in which the blood sample was placed, then we inserted it into the centrifuge to obtain the serum. After obtaining the serum, an amount of it is withdrawn into the pipette 200µL and then placed in the designated hole in the mini vidas device, and within 45 minutes we get the result.

Chapter four
results and discussion

Table 1.1

Genetic disease	chronic disease	Tall	Wieght	age	RBS	D3	Name
N0	Pressure	1.68	77	39	97	13.8	شرمساء حميد نعمة
N0	No	1.44	48	17	88.4	29.7	زينب حاتم كريم
N0	No	1.53	55	19	93	26.2	اسماء راضي كريم
N0	No	1.69	58	23	104	9.1	زينب عبد الحسن كاظم
N0	No	1.71	67	25	97	8.2	بدرن ذرب هاتف
N0	No	1.65	68	38	104	28.3	غدير حاكم راقب
N0	No	1.57	64	25	83	25.6	زهراء ماجد امير
N0	No	1.74	102	28	96	31	اسراء هاشم سعد
N0	No	1.67	82	39	98	42.7	حوراء محمد علي
N0	No	1.55	77	24	97	16	افراح كاظم سعد
No	Pressure	1.76	81	47	104	58.1	راند عبد الامير نايف
No	No	1.85	79	37	87	21.8	حسين علي صالح
No	No	1.9	98	42	109	28.6	مهدي خالد جابر
No	No	1.86	95	27	88	28.6	سعد محمد حسن
No	No	1.8	69	24	82	22.6	محسن جاسم محسن
No	No	1.69	83	66	112	32.7	كريم هاتف حمادي
No	No	1.86	89	42	97.5	37.3	حمزة صالح مهدي
No	No	1.69	69	57	97.4	105.7	علاء حسين طاهر
No	No	1.74	79	41	88.4	17.7	حسن علي كاظم
No	No	1.66	59	46	93.5	16	جعفر هامل محسن
No	N0	1.66	85	46	217	22.3	عالية هادي حسن
No	N0	1.73	83	58	158	9.7	وهدان محمود شدان
No	N0	1.62	76	40	246	12.7	زينب غالب محمد
No	Pressure	1.61	59	77	318	9.8	ملوحة ابو الفود ابو حسله
No	N0	1.67	78	53	269	10.6	خميسة جاسم محمد
No	N0	1.64	71	37	256	8.8	زينب جاسم محمد
No	N0	1.72	97	34	289	17.6	ماليه حمزة محل
No	N0	1.61	76	54	236	11.8	رضية علي فاضل
No	N0	1.7	93	58	264.4	17.8	ابتسام مسلم سعيد
No	N0	1.82	84	47	148.8	9.7	هبة عبد الكاظم سعد
No	No	1.74	73	50	177	15.4	علي جاسم جواد
No	No	1.7	68	27	226	14.8	حسين علي جاسم
No	No	1.69	88	49	229	11.8	حيدر حمزة حسن
No	No	1.81	87	49	247	11.8	عقيل فاضل محمد
No	No	1.88	93	52	270	16.3	محمد عبد النبي راضي
No	Pressure	1.75	90	57	280	15.3	عابد ساير راغب
No	No	1.77	89	44	264	8.2	ضياء حمزة فاضل
No	Pressure	1.71	66	73	349	22.4	هادي فهد شرار
No	No	1.78	77	33	178	10.2	عقيل فاضل عبد علي
No	No	1.69	58	21	450	16.4	محمد ياسر عقيل

4.1. Results

The result of this study reveated that the patient (90 %) of diabetes mellitus (D.M) have low rates of vit.D3 (< 20 ng/dl) and remind patient have rates of vit.D3 (20 – 30) ng/dl . (Dutta *et al*., 2013). While in healthy women (without diabetes mellitus) the percentage of these result was as follows (20 %) of the patient more than 30 ng/ml , 40 % of them between (20 – 30 ng/ml) and 40% remaining less than (20 ng/ml) (Athanassiou *et al*., 2013).

In healthy men (without diabetes mellitus) the percentage of their results was as follows (40% of them are result of vitamin more than 30 ng/ml, 40% of them are the result of vitamine D3 between 20 - 30 ng/ml and remaining less than 20 ng/dl) (Bland *et al*., 2004).

4.2. Discussion

Vitamin D plays a critical role in regulating the body ‘s use of calcium. And calcium actually plays a small but critical role in the secretion of insulin. If too little vitamin D impairs the body ‘s ability to manage calcium levels, it inevitably impairs the body‘s ability to produce insulin. (Health News.,2019).

Vitamin D can positively impact insulin secretion in several ways; Vitamin D enters the beta cell and interacts with several types of receptors, which bind together and essentially activate the insulin gene, increasing the synthesis of insulin. (Health News.,2019). Through the same receptors associated with vitamin D‘s impact on insulin secretion, vitamin D stimulates receptors that affect insulin sensitivity.

Through a complicated physiological process, the interaction and binding with these receptors actually increase the number of total insulin receptors present in the body. (Health News.,2019).

In current study, Vitamin D3 levels measured in the same subjects were lower in diabetes compare to control, particularly in females, were unrelated to hypertension. (Health News.,2019).

4.3. Conclusion

Vitamin D status appears to play a role in the development and treatment of diabetes. It is possible that optimal levels of serum vitamin D may be different for people at risk for developing diabetes, those with diabetes, and those without diabetes.

Many people with diabetes are low in vitamin D This is an important finding because vitamin D is known to help regulate insulin levels. New studies have assessed if vitamin D supplementation helps in the management of type 2 diabetes

4.4. Recommended

1. Correlation between high blood pressure and Vitamin D3 deficiency
2. Correlation between Hyperglycemia and hypertension
3. Correlation between Hyperglycemia and Rheumatoid factor in type 2

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63 Yvelette Stines December 11, 2021 Medically reviwed by Meredith Bull, ND.

الملخص

مرض السكري هو حالة صحية مزمنة (طويلة الأمد) تؤثر على كيفية تحويل جسمك للطعام إلى طاقة. على وجه الخصوص، يمكن أن يؤثر مرض السكري بما في ذلك النوع ١ أو النوع ٢ أو سكري الحمل سلبًا على صحة النساء والرجال. ومن المسلم به الآن أن هناك مجموعة متنوعة من اضطرابات استقلاب الكالسيوم التي ترتبط بالعيوب في تخليق واستقلاب فيتامين D. وفي الدراسة الحالية، وجد أن مستويات فيتامين D3 التي تم قياسها في نفس الأشخاص كانت أقل في مرض السكري مقارنة مع من ليس لديهم سكري. وأظهر التحليل الإضافي أنه تم اكتشاف مستويات منخفضة من فيتامين D3 لدى الإناث والذكور المصابين بالسكري مقارنة بالأصحاء. ويمكن تفسير هذه النتيجة بحقيقة أن انخفاض مستوى D3 يمكن أن يزيد من نسبة السكر في الدم لدى الإناث والذكور.

وزارة التعليم العالي والبحث العلمي
كلية الحلة الجامعة
قسم الطبية
تقنيات المختبرات

العلاقة بين ارتفاع السكر في الدم ونقص فيتامين D3

البحث مقدم إلى

كلية الحلة الجامعة قسم تقنيات المختبرات الطبية

كجزء من متطلبات نيل درجة البكالوريوس في تقنيات المختبرات الطبية

مـــــن قـــــبـــل
فاتـــن عايـــد ســـاير
بـــراق رحـــمن حســـن
عمـــاد جـــاسم جـــواد
عـــلي محـــمد محـــسن
حســـين هـــادي داود
عبـــد الاميـــر كـــريم
مســـلم عـــلـــي عبـــاس
ســـجـــاد عبـــاس

بـإشراف
م. م ميساء زكي يحيى القزويني

١٤٤٥ هجري

٢٠٢٤ ميلادي