RESEARCH ARTICLE

Detection of the Effect of Adiponectin, Vitamin D on Few Biochemical Parameters in Type 2 Diabetes Mellitus

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ABSTRACT

Diabetes is characterized by elevated blood glucose in the absence of treatment, resulting from defects in either insulin action, secretion or both, disturbances in the metabolism of fat, protein, carbohydrates and vitamin D3. The body gets vitamin D when exposed to UV radiation or food. Adiponectin is a protein hormone secreted by fat cells (adipose tissue) and is involved in regulating glucose and lipid metabolism. The aims of this study are : to evaluate the effect of vitamin D and adiponectin at patients with Type 2 diabetes mellitus (T2DM) as a G1 (120 patients 60 male and 60 female) and its relation with G2 healthy 60 subjects as a control (30 male, 30 female) and other related biochemical markers such as (lipid profile, and (BMI). The age of G1 and G2 is 35–65 years. Vitamin D and adiponectin value were measured by enzyme linked immunosorbent assay (ELISA) technique. A spectrophotometer measured FBG. The lipid profile was tested by lipid care analyzer. The results showed that the mean values of vitamin and adiponectin in G1 were lower than in G2 with highly significant differences between them ($p < 0.01$). The mean values of BMI and lipid profile in G1 were higher than that in G2, with a highly significant difference between them ($p < 0.01$), except the value of HDL it was lower in G2 than G1 with no significant difference between them ($p > 0.05$).

Keywords: VD, Adiponectin, BMI, Lipid profile

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INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by reduced secretion and/or insulin action. Hyperglycemia is a sign of diabetes mellitus. T2DM is a group of disorders caused by a mix of genetic, behavioral, nutritional, and environmental risk factors. It is a highly prevalent endocrine condition that affects most of the world's population and has reached epidemic proportions in some places. Diabetes mellitus (DM) is a kind of diabetes that affects people of all ages As a result of numerous anomalies in carbohydrate, fat, or protein metabolism regulation, or all of the aforementioned, Hyperglycemia, hyperlipidemia, and a negative nitrogen balance define this condition.. Metabolic dysregulation can affect a variety organize systems, including nerves, eyes, blood vessels, and kidneys are all affected. In type 2 diabetes patients, vitamin D reduces insulin sensitivity and systolic blood pressure by increasing glucose concentration and insulin resistance. Many studies have linked low blood 25-hydroxyvitamin D3 (25(OH) D3) levels to an increased risk of metabolic syndrome and type 2 diabetes complications (insulin resistance, insulin secretion, glucose intolerance). In rats and humans, insulin secretion is reduced by vitamin D insufficiency, and replacing it enhances B -cell function and glucose tolerance. In addition, several allelic variations in the vitamin D receptor (VDR) and vitamin D–binding protein (DBP) may affect glucose tolerance and insulin secretion, increasing the genetic risk of type 2 diabetes (T2D). vitamin D is an intriguing environmental possibility for T2DM pathogenesis and development since it regulates insulin receptor gene expression and secretion. Adiponectin, also known as adipocytes complement-related protein of 30 kDa), is a hormone origin involved in the homeostatic control of circulating glucose and lipid levels. Reduced adiponectin levels are documented in obese, insulin-resistant, and type 2 diabetes-affected patients, adiponectin and 25 hydroxyl vitamin D levels regulating food intake, energy metabolism, glucose and lipid metabolism and body weight have been reported in the pathogenesis of prediabetes and T2DM. Diabetic patients may have induced dyslipidemia. Dyslipidemia is a condition that can affect diabetic individuals. Total cholesterol, triglycerides, and (LDL) cholesterol levels are all increased in dyslipidemia. Reduced levels of LDL and increased levels of high-density lipoprotein (HDL)., In T2DM patients, underlying biochemical

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and hematological abnormalities can lead to long-term problems, poor quality of life, and even death. As a result, it is important to closely monitor and follow up on diabetes patients' biochemical and hematological markers. The purpose of this study is to to evaluate the effect of vitamin D and adiponectin in patients with T2DM and study its relationship with various biochemical changes like [lipid profile, Total cholesterol, (triglycerides (TG)), HDL, LDL, very-low-density lipoprotein (VLDL)), and body mass index (BMI) then compare the results with non-diabetic subjects (control) in both sexes.

MATERIALS AND METHODS

Blood samples were collected from 180 participants who visited the Specialized Center for Endocrinology and diabetes in Al-Kindi Hospital for the period from December 2019 to February 2020. The sample size was 180 subjects divided into two groups: the first group (120 patient with T2D) was divided into two groups (60 males and 60 females) with age ranging between 35 and 65 years. The second group (60 subjects as healthy control) was divided into two groups (30 males and 30 females) with age ranging between 35 and 65 years. In this study, a self-administered questionnaire was structured and filled by the participants themselves. The questionnaire included descriptive information for each patient (name, gender, age, weight, height and history duration of DM), and BMI. BMI was calculated based on the following formula [weight (kg)/height (m)²]. About 5 mL of venous blood was collected from each participant (patient with T2D and healthy control), kept in plain tube, and left to clot. Then serum was separated by centrifugation for 5 minutes. Study protocols involved enzyme–linked immune sorbent assay (ELISA) Technique for vitamin D and adiponectin. Fasting blood sugar was measured by a spectrophotometer. Lipid profile tests were included (total cholesterol. triglyceride, HDLch, LDLch, and VLDL) and an automated device Lipid care analyzer was used for their determination.

RESULTS

The study included 120 patients and 60 healthy controls. Patient's age ranges were (35–65) years.

The differences of means vitamin D and Adiponectin between patients and control groups were found to be highly significant ($p < 0.01$) (Table 1). Similarly, Table 2 shows that the difference of mean BMI between patients and control groups was highly significant ($p < 0.01$).

Moreover, Table 3 shows that there was a significant difference of mean cholesterol, TG, LDL and VLDL between patients and controls ($p < 0.01$). Nevertheless, the difference of mean HDL was not found to be significant between patients and controls ($p > 0.05$).

Table 1: The level of Vitamin D &Adiponectin for patients and control groups.

Group		*Mean ± Std.*	*p-value*	*(CS)*
Control (n = 60)	VIT.D3 ng/mL	(34.05 ± 2.51)	.000	p <0.01 (HS)
Patients (n = 120)		(14.50 ± 1.62)		
Control (n = 60)	Adiponectin ng/mL	(20.83 ± 2.71)	.004	p <0.01 (HS)
Patients (n = 120)		(12.24 ± 1.63)		

Table 2: Comparison between Groups study Patients and Control according to BMI.

Group	*Mean ± Std. kg/ m²*	*p-value*	*(CS)*
Control(n=60)	(23.43 ± 1.46)		
Patients(n=120)	(31.85 ± 3.74)	.000	p <0.01 (HS)

Table 3: Comparison between Groups study Patients and Control according to lipid profile.

Parameter	*Patients Mean ± Std.*	*Control Mean ± Std.*	*p-value*
Cholesterol mg/dl	(252.40 ± 48.07)	(194.90 ± 36.55)	.000 (H.S)*
TG mg/dl	180.38 ± 74.29))	(141.35 ± 42.83)	.000 (H.S)
HDL mg/dl	37.63 ± 11.62))	40.60 ± 17.60))	.239 (N.S)*
LDL mg/dl	(106.53 ± 52.84)	(87.77 ± 33.14)	.013 (H.S)
VLDL mg/dl	142.50 ± 34.73))	(130.32 ± 33.64)	.026 (S)*

(H.S)*: Highly significant; (N.S)*: non-significant; (S)*: significant

DISCUSSION

These research (present) results agree that a probable causal link between vitamin D insufficiency and T2D should be established by randomized clinical studies demonstrating that vitamin D supplementation can either prevent T2D or increase insulin release and sensitivity. The reason is that vitamin D treatment for 6 months improved peripheral insulin sensitivity and ß-cell activity, indicating that it may help this population avoid metabolic decline. Adiponectin decreases in diabetic patients because it is a fat-derived hormone that appears to be important in preventing insulin resistance, diabetes, and atherosclerosis. Because obesity and associated diseases limit endogenous adiponectin production, a feasible treatment strategy is to utilize pharmacological or nutritional therapies to restore adipose tissue's ability to secrete adiponectin. These results were consistent with.

BMI findings agreed with who found that individuals with moderate increases in BMI and those with BMI ≥ 30 kg/m^2 were more likely to have risk of diabetes. The reason may be attributed into a gradual decrease in insulin secretion accompanied by an increase in insulin resistance. Insulin resistance and faulty insulin secretion both occur relatively early in obese people and progress to diabetes in a similar way. Having a high weight leads muscles and tissues to more resistance to the insulin hormone.

This indicates that BMI and blood sugar should be monitored frequently to prevent diabetes. "It may also be feasible to control diabetes by decreasing weight before irreversible damage occurs if caught early enough. The results in table 3 showed that diabetes was linked to increased cholesterol production as well as slightly higher serum and

lipoprotein triglyceride levels. Insulin-resistant fat cells produce a lot of free fatty acids into the bloodstream, which the liver absorbs. Insulin resistance and/or relative insulin insufficiency, as well as adipocytokines, may all play a role in lipid metabolic alterations in T2D patients (e.g. adiponectin), and hyperglycemia The return of more fatty acids owing to enhanced hormone-sensitive lipase (HSL) activities in adipose tissue and insulin actions directly on apoB synthesis are two variables that may boost VLDL generation in the liver. low HDL cholesterol, a high frequency of small dense LDL particles, and high triglycerides are all associated to T2D and a plethora of interlinked lipid and lipoprotein abnormalities in the blood. Many individuals have elevated LDL cholesterol levels, which causes these problems. Increased fatty acid flow to the liver is caused by increased efflux of free fatty acids from adipose tissue and reduced insulin-mediated skeletal muscle absorption of free fatty acids, leading in insulin resistance and T2D. Adipocytokines, such as adiponectin, may also play a role in developing diabetic dyslipidemia.

CONCLUSIONS

In light of the results obtained, the study concluded the following:

- Vitamin D and adiponectin were low in DM patients.
- The BMI was increased in patients than in control.
- Lipid profile serum in patients increased than control, except HDL was in the patients' group less than the control group.

REFERENCES

1. World Health Organization. Global diffusion of eHealth: making universal health coverage achievable: report of the third global survey on eHealth. World Health Organization; 2017 Mar 27.
2. Gil Á, Plaza-Diaz J, Mesa MD. Vitamin D: classic and novel actions. Annals of Nutrition and Metabolism. 2018;72(2):87-95.
3. Christakos S. In search of regulatory circuits that control the biological activity of vitamin D. Journal of Biological Chemistry. 2017 Oct 20;292(42):17559-60.
4. Gil Á, Plaza-Diaz J, Mesa MD. Vitamin D: classic and novel actions. Annals of Nutrition and Metabolism. 2018;72(2):87-95.
5. Christakos S. In search of regulatory circuits that control the biological activity of vitamin D. Journal of Biological Chemistry. 2017 Oct 20;292(42):17559-60.
6. Tao S, Yuan Q, Mao L, Chen FL, Ji F, Cui ZH. Vitamin D deficiency causes insulin resistance by provoking oxidative stress in hepatocytes. Oncotarget. 2017 Sep 9;8(40):67605.
7. Szymczak-Pajor I, Śliwińska A. Analysis of association between vitamin D deficiency and insulin resistance. Nutrients. 2019 Apr 6;11(4):794.
8. Wang Y, Meng RW, Kunutsor SK, Chowdhury R, Yuan JM, Koh WP, Pan A. Plasma adiponectin levels and type 2 diabetes risk: a nested case-control study in a Chinese population and an updated meta-analysis. Scientific reports. 2018 Jan 10;8(1):1-3.
9. Banerjee A, Khemka VK, Roy D, Poddar J, Roy TK, Karnam SA. Role of serum adiponectin and vitamin D in prediabetes and diabetes mellitus. Canadian journal of diabetes. 2017 Jun 1;41(3):259-65.
10. Al Shehri ZS. The relationship between some biochemical and hematological changes in type 2 diabetes mellitus. Biomedical Research and Therapy. 2017 Nov 29;4(11):1760-74.
11. Bhowmik B, Siddiquee T, Mujumder A, Afsana F, Ahmed T, Mdala IA, do V. Moreira NC, Khan AK, Hussain A, Holmboe-Ottesen G, Omsland TK. Serum lipid profile and its association with diabetes and prediabetes in a rural Bangladeshi population. International journal of environmental research and public health. 2018 Sep;15(9):1944.
12. Abbas MA. Physiological functions of Vitamin D in adipose tissue. The Journal of steroid biochemistry and molecular biology. 2017 Jan 1;165:369-81.
13. Kramer CK, Zinman B, Retnakaran R. Are metabolically healthy overweight and obesity benign conditions? A systematic review and meta-analysis. Annals of internal medicine. 2013 Dec 3;159(11):758-69.
14. Emerging Risk Factors Collaboration. Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. The Lancet. 2010 Jun 26;375(9733):2215-22.
15. Lips P, Eekhoff M, van Schoor N, Oosterwerff M, de Jongh R, Krul-Poel Y, Simsek S. Vitamin D and type 2 diabetes. The Journal of steroid biochemistry and molecular biology. 2017 Oct 1;173:280-5.
16. Zhao H, Tang Y, Zheng C, Ren L, Song G. Vitamin D status is independently associated with insulin resistance in patients with type 2 diabetes mellitus. Risk Management and Healthcare Policy. 2021;14:1393.
17. Swart KM, Lips P, Brouwer IA, Jorde R, Heymans MW, Grimnes G, Grübler MR, Gaksch M, Tomaschitz A, Pilz S, Eiriksdottir G. Effects of vitamin D supplementation on markers for cardiovascular disease and type 2 diabetes: an individual participant data meta-analysis of randomized controlled trials. The American journal of clinical nutrition. 2018 Jun 1;107(6):1043-53.
18. Ghoshal K, Bhattacharyya M. Adiponectin: Probe of the molecular paradigm associating diabetes and obesity. World journal of diabetes. 2015 Feb 2;6(1):151.
19. Achari AE, Jain SK. Adiponectin, a therapeutic target for obesity, diabetes, and endothelial dysfunction. International journal of molecular sciences. 2017 Jun 21;18(6):1321.
20. Gray N, Picone G, Sloan F, Yashkin A. The relationship between BMI and onset of diabetes mellitus and its complications. Southern medical journal. 2015 Jan;108(1):29.
21. Metzl J, Kirkland A, Kirkland AR, editors. Against health: How health became the new morality. NYU press; 2010 Nov 23.
22. Al-Goblan AS, Al-Alfi MA, Khan MZ. Mechanism linking diabetes mellitus and obesity. Diabetes, metabolic syndrome and obesity: targets and therapy. 2014;7:587.
23. Molla AM, Al Badawi M, Hammoud MS, Molla AM, Shukkur M, Thalib L, Eliwa MS. Vitamin D status of mothers and their neonates in Kuwait. Pediatrics international. 2005 Dec;47(6):649-52.
24. Berglund L, Brunzell JD, Goldberg AC, Goldberg IJ, Sacks F, Murad MH, Stalenhoef AF. Evaluation and treatment of hypertriglyceridemia: an Endocrine Society clinical practice guideline. The Journal of Clinical Endocrinology & Metabolism. 2012 Sep 1;97(9):2969-89.
25. Gordon L, Ragoobirsingh D, Morrison EY, Choo-Kang E, McGrowder D, Martorell E. Lipid profile of type 2 diabetic and hypertensive patients in the Jamaican population. Journal of laboratory physicians. 2010 Jan;2(01):025-30.
26. Ozder A. Lipid profile abnormalities seen in T2DM patients in primary healthcare in Turkey: a cross-sectional study. Lipids in health and disease. 2014 Dec;13(1):1-6.
27. Vergès B. Pathophysiology of diabetic dyslipidaemia: where are we?. Diabetologia. 2015 May;58(5):886-99.