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Original research article

Correlation study of vitamin-d and diabetes mellitus

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Abstract

Background: The objective of this study was determine the correlation between vitamin D deficiency and diabetes. The experimental and epidemiologic studies suggest that vitamin D deficiency and diabetes are negatively correlated.

Objective: The study consist of total 60 patients including both male and females. They were selected from the patients of diabetics. At a tertiary Hospital. The aim of the study is to study the correlation between vitamin-D and diabetes in diabetic patients.

Results: The discovery of vitamin D is one of medicine's great achievements. Despite all the positive evidence emerging about the beneficial effect of vitamin D, we still find many are vitamin D deficient. The purposes of this study were to examine the association between serum vitamin D and glycosylated hemoglobin (HbA1c) levels, to test the hypothesis that lower vitamin D levels are associated with poorer glucose control in diabetes mellitus (DM) patients and to investigate the effect of vitamin D supplementation on HbA1c levels.

Conclusion: In this study, we established that vitamin D deficiency is found to be associated with diabetes, in a cohort of 60 subjects. The important result we find from this study is a significant reduction in HbA1c as vitamin D levels increased.

Keyword:

Introduction

Diabetes rates are increasing around the world, mainly driven by increasing levels of obesity. The dilemma for diabetes prevention is that the main risk factor-obesity-is a product of our modern lifestyle. Immediate prospects for changing the environment to reverse rising obesity levels are not promising, and there is a need to consider other options for preventing diabetes. The sun is the primary source of vitamin D, which is synthesized endogenously in skin to produce vitamin D_3, although a small proportion (<20%) of vitamin D comes through diet from a limited range of foods (in the form of ergocalciferol [vitamin D_2] and vitamin D_3). The main marker of vitamin D status is the metabolite 25-hydroxyvitamin D [25(OH) D], which is synthesized in the liver. The epidemiology of vitamin D status is inverse to that of diabetes, since blood levels of 25(OH) D decline with age and are lower in populations with increased skin pigmentation, such as African Americans and South Asians, and in people with obesity, while diabetes increases with age and obesity and is higher in these ethnic groups. Animal studies published nearly 30 years ago identified a pancreatic receptor to the active metabolite (1, 25-dihydroxyvitamin D) and showed that vitamin D deficiency decreased insulin secretion. Since then, numerous human studies of vitamin D and type 2 diabetes have been published, but the quality of these studies is mixed. Many are case-control studies flawed by the measurement of 25 (OH) D status on blood samples collected after diabetes diagnosis. Several population-based cross-sectional studies have been published showing inverse associations between 25(OH)D and undiagnosed diabetes risk, including two large national surveys, but this study design provides only moderate evidence regarding causation because of the simultaneous measurement of 25(OH)D and diabetes status. Stronger evidence comes from prospective studies, of which there have been two that show inverse associations between dietary vitamin D and diabetes risk; however, these studies are limited because they did not assess the major component of vitamin D from sun exposure.

Aim and Objectives

Aim

To find out the correlation between vitamin D deficiency and HbA1c.

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Objectives

To estimate:

- Vitamin D status
- HbA1c

Materials and Methods

HEMOGLOBIN A1c (HbA1c)

PRINCIPLE

The D-Hemoglobin A1c utilizes principles of ion-exchange high-performance liquid chromatography (HPLC).The samples as automatically diluted on the D-10 and injected in to the analytical cartridge, where the hemoglobin are separated based on their ionic interactions with the cartridge material. The separated haemoglobin then pass through the flow cell of the filter photometer, where changes in the absorbance at 415 nm are measured.

Results

Statistical Analysis

Graphic characteristic of the study of correlation of vitamin d and diabetes

Correlation of VIT-D and Diabetes

Table 1: Correlation of vitamin -D and HbA1c

Vitamin d level (ng/ml)	Vitamin d (Mean and standard deviation)	HbA1c (Mean and standard deviation)	r value	P value
>20	12.99±3.96	9.22±2.008	-0.24	0.0001
20-30	24.09±2.61	8.99±1.56	-0.23	0.0001
30-70	37.42±5.07	6.43±0.41	-0.24	0.0001

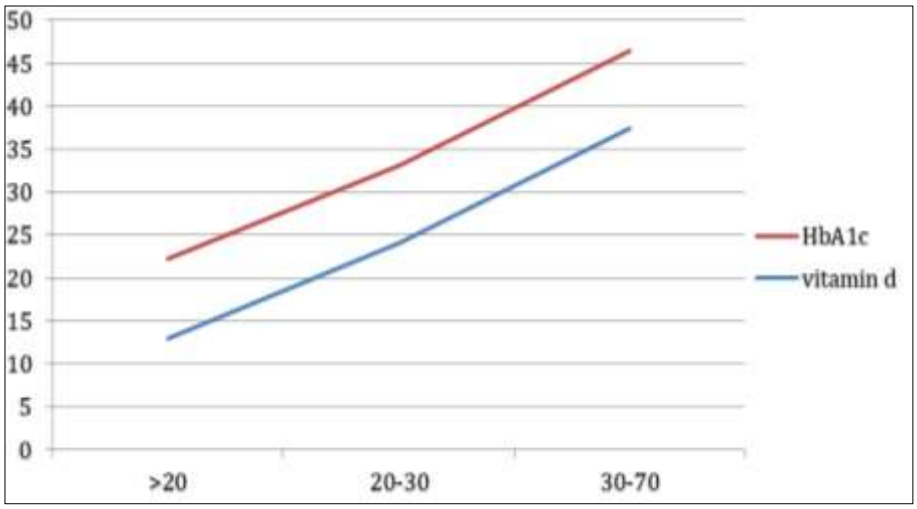

Fig 1: Correlation of vitamin d and diabetes. Statistical value p value <0.0001 shows significance.

Comparison between vitamin d and hba1c in different age group

Table 2 a: comparison between vitamin d in different age group.

Age		30-40	41-50	51-60	61-70	71-80
VIT-D (ng/ml)	Test	12.12	17.69	16.19	16.36	11.6
	Control	42.25	43.53	41.56	39.22	71.80

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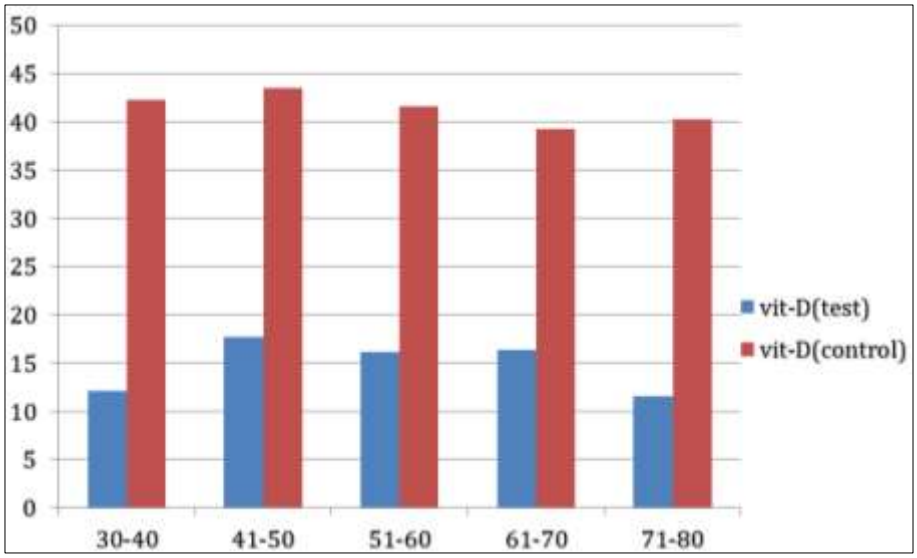

Fig 2: Comparison between vitmin d in testy and control of different age group. significant (p value <0.0001): statistical comparison of test and control.

b) Comparison of hba1c in test and control of different age group.

Table 3: Comparison between hba1c of different age group.

Age		**30-40**	**41-50**	**51-60**	**61-70**	**71-80**
	Test	6.74	8.56	9.25	9.41	8.5
HbA1c	Control	5.67	5.17	5.39	5.37	5.05

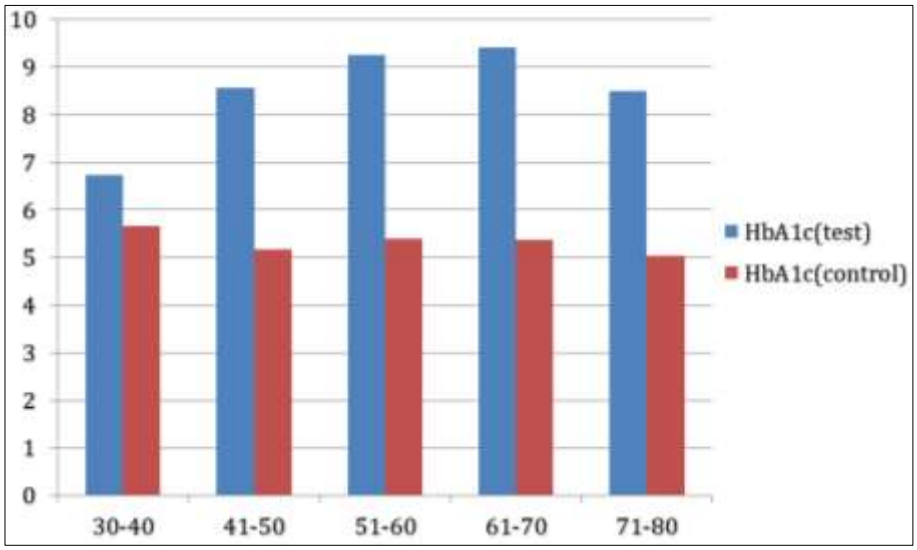

Fig 3: Comparison between HbA1c in test and control of different age group. significant (p value <0.0001):statistical comparison of test and control.

Discussion

The discovery of vitamin D is one of medicine's great achievements. Vitamin D is classed as a vitamin even though recent findings showed that vitamin D is truly a prohormone (109). If we step away from the fact that vitamin D is a vitamin and look at the bigger picture, it has huge potential in many areas.

Despite all the positive evidence emerging about the beneficial effect of vitamin D on various diseases and its need for optimal health, we still find that many people are vitamin D deficient. Vitamin D deficiency can aggravate many diseases, is linked to predisposition of diabetes and may play a role in the development of diabetes (110,111). Studies show that vitamin D affects insulin sensitivity and insulin secretion, and vitamin D deficiency may also contribute to impaired glucose tolerance.

In our study, we have taken vitamin-d deficient individuals as cases to find out the correlation of vitamin d with diabetes.

A total of 60 serum samples of vitamin d deficient individual were taken and glycosilated hemoglobin level estimated. In the present study, female sex is higher than male sex.

The present study includes 44 female (74%)and 16 male(26%) subjects, who are aged between 30-80

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years and gender distribution showed female preponderance of hypovitaminosis D. Some previous studies showed equal incidence in both genders. (A sheikh, Z. Saeed et in 2012).

The present study whether there is an association between vitamin d and HbA1c was investigated in the present study. The results showed that there was an inverse correlation between serum vitamin D and HbA1c (r (relationship coefficient) = -0.34, P < 0.0001).

There was an inverse correlation between vitamin D and HbA1c levels for each vitamin D group (< 20 group, r = -0.24, P = 0.0001; 20- 30 group, r = -0.23, P = 0.0001;30-70 group, r = -0.24, P = 0.008; however, it was not significant for all groups. All these results show that there is some significant inverse correlation between vitamin D and HbA1c, as vitamin D goes up HbA1c comes down.

The result of present study shows that In different age group (30-40,41-50,51-60,61-70,71-80) vit-D and HbA1c were found to be significant, n 30-40 vit-D and HbA1c were found to be significant (p=0.0008),HbA1c is significant(p=0.1392),in 41-50 vit-D is significant (p<0.0001)and HbA1c is significant (p<0.0001),age group of 51-60 vit-D highly significant(p<0.0001),in 61-70 age groups vit-D significant (p<0.0001),HbA1c is groups found that vit-D and HbA1c significant level (p=0.0001andp=0.1188).

A systematic review and meta-analysis reported that vitamin D and calcium insufficiency may negatively influence glycemia and that a combined supplementation of vitamin D and calcium may optimize glucose metabolism (112). Another systematic review and meta-analysis reported a lower risk for developing type 1 diabetes with self-reported vitamin D supplementation in early childhood (odds ratio: 0.71, 95% confidence interval (CI): 0.60 - 0.84) (113). A meta-analysis of several prospective studies showed an inverse and significant association between circulating 25(OH)D levels and risk of type 2 diabetes across a broad range of blood 25(OH)D levels in diverse populations (114).A study from Italy showed HbA1c is inversely related to serum vitamin D levels in type 2 diabetes patients (r=-0.116, P=0.003) (115). Our study also found HbA1c to be inversely related to serum vitamin D levels (r = -0.14, P < 0.0000002 before supplementation and r = -0.16, P < 0.000001 after supplementation with vitamin D).

A study from Iran showed that HbA1c may be reduced by administration of vitamin D to children and adolescents with type 1 DM without changing the dose of insulin (116). A 3-year study done in the US found a significant reduction in HbA1c levels from year 1 to year 2 and between year 1 and year 3 after supplementation of vitamin D in type 2 African American diabetic patients (117). A study done in Saudi Arabia reported that there was an observed effect after 12 weeks of vitamin D supplementation on glycemic control in vitamin D - replete, type 1 DM patients (118). Our study concurs with all these studies and we observed lowering of HbA1c after supplementation of vitamin D.

Another systematic review done on 29 randomized control trials (3,324 participants) that assessed the relationship between vitamin D supplementation and change in HbA1c and fasting blood glucose (FBG) among adults with type 2 diabetes found there was a modest reduction in HbA1c (-0.32% (-0.53 to -0.10), I^2 = 91.9%) compared to placebo after vitamin D supplementation (119). In studies achieving repletion of vitamin D deficiency (n = 7), there were greater mean reductions in HbA1c (-0.45% (-1.09 to 0.20)) and FBG (-7.64 mg/dL (-16.25 to 0.97)) although not significant.

The need of accurate and precise measurement of blood glucose has made HbA1c become the gold standard for monitoring glycemic control in patients with DM from primarily fasting plasma. Endorsement of influential diabetes societies and the World Health Organization for using HbA1c as a diagnostic test for diabetes arose due to the clear advantages for HbA1c over glucose monitoring (and in particular oral glucose tolerance test (OGTT)). Vitamin D supplementation to help reduce HbA1c values will result in overall better health and improve glycemic outcomes in patients with diabetes. Our study also noted that the group with better vitamin D levels were older maybe due to better diet and lifestyle pattern (P = 0.0001). Poor diet, less time spent outdoors, and the consumption of more processed food by the younger generation can be a major contributor to their lower vitamin D levels.

Improvement in diet or vitamin D supplementation with added exposure to sunlight at the optimal sun exposure time may improve vitamin D levels with additional benefit to the patient's overall health.

Conclusion

In this study we established that vitamin D deficiency is found to be associated with diabetes, in a cohort of 60 subjects. The important result we find from this study is a significant reduction in HbA1c as vitamin D levels increased.

The percentage of vitamin D deficiency in the population and the growth of diabetes in the population suggest that repletion can improve overall health. There is so much benefit to be gotten from supplementation with vitamin D or by adding natural vitamin D rich food in the diet and including physical activities with possible sun light exposure.

Advising patients with higher HbA1c to get tested for lower vitamin D values and correct any deficiency if found may result in better blood glucose control and benefit the patient's overall health.

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Summary

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