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Association between type 2 diabetes mellitus and hypovitaminosis D

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Abstract

Introduction: Vitamin D is an important component in regulating the biological functions of the body in various ways. Many studies repeatedly explained the role of vitamin D in the pathogenesis and treatment of various diseases. Recent studies proved a correlation between vitamin D deficiency and prevalence of Type 2 Diabetes and its complications.

Objective: to find out the possible correlation between Vitamin D and T2DM. Mainly in this study we have tried to correlate serum 25(OH) D levels with HbA1c levels.

Materials and Method: The present study was carried out in the Department of Biochemistry on 120 subjects patient in the age group of 35-70 years, attended OP in Hind Institute of Medical Sciences. Among them 60 healthy subjects enrolled as control group remaining 60 T2DM patients were served as case group. Serum 25hydroxyvitamin D levels were estimated by chemiluminescence immunoassay (CLIA), glycosylated hemoglobin (HbA1c) was measured by IFCC method by using ALERA AFINION AS 100.

Results: The concentration of serum 25-OH vitamin D levels were significantly ($p<0.0001$) lower in cases (22.92±6.66) as compared to the controls (35.96± 8.46). There was negative correlation found between 25-OH vitamin D levels and glycosylated hemoglobin (HbA1c) in cases of type 2 DM.

Conclusions: Prevalence of hypovitaminosis D was appeared to be more common T2DM patients in compare to non diabetic healthy population. There is a negative correlation exists between serum 25 hydroxy vitamin D and HbA1C (glycemic Control).

Keywords: Type 2 Diabetes Mellitus, HbA1C, Hypovitaminosis D

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Introduction

Diabetes Mellitus is a metabolic disorder charctersied by hyperglycemia it not only effect carbohydrate metabolism but also disturbs the protein and lipid metabolism resulting from lack of insulin, or decrease in action of insulin or both.[1] Globally 400 million peoples are suffering withT2DM. In India alone more than 41 million peoples are suffering with this disease, and this is likely to increase up to 70 million by the year 2025.[2] In long term, chronic hyperglycemia of diabetes can lead to a multiple complications which includes of microvascular and macrovascular conditions such as retinopathy, nephropathy, neuropathy and cardiovascular diseases.[3] Even though earlier studies have been explained the etiology of diabetes but till today the pathogenesis of diabetes is unclear. Metabolically triggered inflammatory factors, auto immune reactions and reactive oxygen species all have been proposed as prime pathogenic factors for diabetes.[4]

Traditionally vitamin D has been associated with bone metabolism and Calcium phosphorus regulation. But, recent studies demonstrated nontraditional roles of vitamin D in human health and diseases including cancer, autoimmune, infectious, respiratory, and cardiovascular diseases.[5-6] Several Animal and In vivo studies have been proved the effects of vitamin D in pathogenesis and prevention of diabetes. In peripheral tissues, vitamin D can directly improve insulin exocytosis via activating calcium-dependent endopeptidases.[7] Additionally, the steroid hormone form of vitamin D promotes suppressor cell activity and inhibits the generation of cytotoxic (Tc), macrophages, delayed hypersensitivity type and natural killer (NK) cells.[7-8] Many studies have shown its role in increasing the insulin production and secretion in humans as well as decreasing insulin resistance.[9]

The goal of this study is to find out possible correlation between vitamin D and type 2 diabetes. Mainly in this study we have tried to correlate vitaminD with FBS and HbA1c levels in healthy and type2 diabetic patients.

Materials and Method

Present study was conducted on 120 subjects aged between 35-70 years attended OP in Hind Institute of MEDICAL Sciences & Hospital, MAU, Ataria Sitapur, U.P. These 120 subjects were divided into following groups.

Group-A contains 60 healthy individuals (without T2DM) serving as control group

Group-B includes 60 subjects suffering with T2DM (not more than 5 years).

All the subjects were informed and consent letter was taken.

Exclusion criteria: Lactating and pregnant women were excluded. Individuals suffering with T1DM, myocardial infarction, renal problems and patients on

calcium or vitamin D supplementation were also exempted.

Biochemical analysis: Using aseptic precautions 3 ml of venous blood was collected from antecubital vein in Fasting condition. Samples were centrifuged after 30 minutes; serum was isolated and used for the measurement of following parameters.

1. **Fasting Blood Glucose:** was measured by GOD-POD METHOD. (End point colorimetric method. by using ERBA CHEM 5 semi auto analyzer).
2. **25-OH Vitamin D** was measured by CLIA method (by COBAS E411 analyser)
3. **HbA1c** was estimated by IFCC method by using ALERA AFINION AS 100.

Statistical Analyses: All the values were expressed as Mean ±SD. The statistical analysis was done using student 't' test and Pearson's correlations for comparison between two groups and a p-value of <0.05 was considered statistically significant.

Results

The present study conducted on 120 subjects among them 60 people suffering with type 2 DM were chosen as control (group-II) and 60 age and sex matched healthy subjects were served as case group (group-I). Mean age of the study population was 49.8± 8.6 and for control group it was 47.4±10.4. Serum 25-OH Vitamin D was estimated, and correlated with HbA1C and FBS. All the results were expressed in Mean ± standard deviation.

Table 1: Showing biochemical parameters with Mean value and S.D

Parameters	Group-II (n=60)	group-I (n=60)	P value	t-test
FBS	83.96 ± 5.90	134.7± 24.79	<0.0001*	15.42
Vitamin –D	35.96± 8.46	22.92±6.66	<0.0001*	9.38
HbA1C	5.21± 0.05	7.95±1.95	<0.0001*	10.88
Age	47.4±10.4	49.8±8.6	0.170	1.37

FBS-fasting blood sugar, HbA1c-glycosylated hemoglobin

* To calculate p value, t-test/Levene's test used for quantitative variables intergroup correlations.

Mean ±SD serum vitamin D values of the case groups was 22.92±6.66 where as controls were having a mean vitamin D values of 35.96±8.46. From Table 1 it was clear that mean vitamin D values were significantly lower in type 2 diabetic population compared to healthy individuals. (df=118; p <0.0001). Prevalence of hypovitaminosis D was found to be significantly higher in diabetics as compared to healthy subjects.

The HbA1c (%) values in group II, group and group I were measured as 5.21 ± 0.05 and 7.95 ± 1.95 respectively. HbA1C value were found to be significantly higher in control group (group-I) in comparison to Group-II (df; 118: p<0.0001) and an inversely correlated with the Mean serum vitamin D values

The mean age (in years) of cases was 47.4±10.4 years and that of controls was 49.8±8.6 years and was not significant. (p=0.17)

Table 2: Correlation between study variables

Correlation between	Correlation Coefficient(r)	Significance	P value
FBS and 25-OH Vitamin D	-0.25	negative correlation Highly significant	<0.0001*
HbA1c and 25-OH Vitamin D	-0.47	negative correlation Highly significant	<0.0001*

Serum 25-OH Vitamin D levels and HbA1c: There was significant negative correlation found between serum 25OH Vitamin D levels and HbA1c, r = -0.47, p < 0.0001 and was highly significant. (Table 2)

Discussion

Traditionally, vitamin D is linked mainly with bone mineral regulation, but from the past few decades extra skeletal activity of vitamin D has been a raised a global interest. Pietsmann-et al, demonstrated a link between hypovitaminosis and T2DM, which was published in 1988.[10] Since then numerous studies proved a correlation between vitamin D and human health.[11]

In the present study we found a correlation between Vitamin D levels and HbA1C levels. This study suggests that maintaining Vitamin D levels in normal range may help in regulating glucose homeostasis. This observation was supported by earlier studies.

Vitamin D mainly regulates glucose homeostasis mainly through its receptors (VDR), distributed on skeletal muscle, adipose tissue and β cells of pancreas. Calcitriol also trigger the transcription of human insulin receptor gene and activates PPAR (peroxisome proliferator activator receptor).[12-13]

Kostoglou et conducted a In a prospective study in high risk Asian subjects, where he observed 25(OH) vitamin D deficiency was a prime risk factor for the development of type 2 diabetes mellitus and vitamin D levels were negatively correlated with glycosylated hemoglobin levels in his study.[14]

The Earlier studies by Mezza et al and Lim et al.[15-16] On Vitamin D, has been shown that an association exists between prevalence of diabetes and lower circulating vitamin D levels. In our present study we also found that 25(OH) D levels were lower in type 2 patients compared to controls.

Other studies have shown that maintaining vitamin D levels above the sufficiency range will help to decrease the incidence of occurrence of diabetes and maintain the beta cell functioning.[17]

Conclusion

We conclude that hypovitaminosis D was more prevalent among type 2 Diabetic population and 25 OH vitamin D is correlated with glycemic status. Further early detection of hypovitaminosis D and supplementation may improve the of glycemic control and prevent complications of type 2 diabetes mellitus.

Reference

1. NCD Risk factor Collaboration (NCD-RisC).Worldwide trends in diabetes since 1980: a pooled analysis 751 population based studies with 4*4 million participants. Lancet 2016; published online 7.http://dx.doi.org/10.1016/s0140-6736 (16)00618-8.
2. V. Mohan, S. Sandeep, R. Deepa, B. Shah and C. Varghese. Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res.2007 March;125:217-230.
3. Moreira TS, Hamadeh MJ; The role of vitamin D deficiency in the pathogenesis of type 2 diabetes mellitus. Eur J Clin Nutr., 2010; 5(4):155-165.
4. M. Mata-Cases, C. DePrado-Lacueva, V. Salido-Valenciaetal., "Incidence of complications and mortality in a type2diabetes patient cohort study followed up from diagnosis in a primary health care centre," International Journal of Clinical Practice, vol. 65,pp.299–307,2011.
5. S.B. Mohr, "A brief history of vitamin D and cancer prevention," Annals of Epidemiology, vol.19, no.2, pp.79–83,2009.
6. W. Janssens, A. Lehouck, C. Carremans, R. Bouillon, C. Mathieu, and M. Decramer, "Vitamin d beyond bones in chronic obstructive pulmonary disease; time to act," American Journal of Respiratory and Critical Care Medicine, vol. 179, no. 8, pp.630– 636,2009.
7. J. Kendrick, G. Targher, G. Smits, and M. Chonchol, "25HydroxyvitaminD deficiency is independently associated with cardiovascular disease in the Third National Health and Nutrition Examination Survey," Atherosclerosis, vol. 205, no. 1, pp. 255–260, 2009.
8. Holick MF. Vitamin D deficiency. N Engl J Med. 2007 Jul 19; 357(3):266-81. DOI: 10.1056/NEJMra070553.
9. Jorde R, Sneve M, Emaus N, Figenschau Y, Grimnes G. Cross-sectional and longitudinal relation between serum 25-hydroxyvitamin D and body mass index: the Tromsø study. Eur J Nutr. 2010 Oct;49(7):401-7. doi: 10.1007/s00394-010-0098-7.
10. P. Pietschmann, G. Schernthaner, and W. Woloszczuk, "Serum osteocalcin levels in diabetes mellitus: analysis of the type of diabetes and microvascular complications," *Diabetologia*, vol. 31, no. 12, pp. 892–895, 1988.
11. Kayaniyil, S., Harris, S., Retnakaran, R., Vieth, R., Knight, J., Gerstein, H. et al. (2013) Prospective association of 25(OH)D with metabolic syndrome. Clin Endocrinol (Oxford).
12. Bourlon PM, Billaudel B. Dussert. Influence of Vitami D3 deficiency and 1, 25 dihydroxy D3 on denovo insulin biosynthesis in islets of the rat endocrine pancreas. J Endocrinol. 1999;160:87–95.
13. Danescu LG, Levy S, Levy J. Vitamin D and diabetes mellitus. Endocrine. 2009;35:11–7.
14. Kostoglou-Athanassiou I, Athanassiou P, Gkountouvas A, Kaldrymides P. Vitamin D and glycemic control in diabetes mellitus type 2. Ther Adv Endocrinol Metab, 2013; 4(4): 122-8.
15. Mezza, T., Muscogiuri, G., Sorice, G., Prioletta, A., Salomone, E., Pontecorvi, A. et al. (2012) Vitamin D deficiency: a new risk factor for type 2 diabetes? Ann Nutr Metab 61: 337–348.
16. Lim, S., Kim, M., Choi, S., Shin, C., Park, K., Jang, H. et al. (2013) Association of vitamin D deficiency with incidence of type 2 diabetes in high-risk Asian subjects. Am J Clin Nutr 97: 524–530.
17. Lau, S., Gunton, J., Athayde, N., Byth, K. and Cheung, N. (2011) Serum 25-hydroxyvitamin D and glycated haemoglobin levels in women with gestational diabetes mellitus. Med J Aust 194: 334–337.