



SERUM VITAMIN D LEVEL IN TYPE 2 DIABETIC PATIENTS

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Article received on:
25/06/2014
Accepted for publication:
09/09/2014
Received after proof reading:
16/10/2014

INTRODUCTION

Type 2 diabetes mellitus is a polygenic and multi-factorial disease. The robust literature have shown that Vitamin D deficiency may cause glucose intolerance, decreased insulin secretion and may result type 2 diabetes, that suggests in the role for vitamin D in the pathogenesis of type 2 diabetes¹. In one study 40-100% of the elderly population is Vitamin D insufficient or deficient and more in Asia and Africa².

A most beneficial serum concentration of 25-OHD appears to be 30–40 ng/ml³.

Recently it has been shown that serum vitamin D levels increased after the correction of acute hyperglycemia⁴ which suggests an inverse correlation to between vitamin D and glucose levels.

The decreased vitamin D has recently emerged as one of the factors contributing to the development of both type 1 and type 2 diabetes mellitus⁵.

ABSTRACT... Objective: To find out serum vitamin D levels in type 2 DM patients in Hyderabad. **Design:** Cross sectional study. **Setting:** Private clinics, OPDs of government hospitals like Qasimabad, Latifabad and Pretabad. Duration: January to July 2013. **Patients and Methods:** Total 550 patients were selected, 450 patients (250 males and 200 females) taken from different OPDs of Hyderabad and towns or Tehsils with diagnosis of type 2 Diabetes mellitus and another 100 patients were taken as control (60 males and 40 females). The mean age was 45.6 years. The written consent was obtained and demographic features were noted, 3cc of blood was taken for estimation of vitamin D levels. The level of vitamin D was done on an Electrochemiluminescence Immuno Assay (ECLIA) at Diagnostic & Research laboratory Liaquat University of Medical & Health sciences (LUMHS) Jamshoro, Sind. **Results and Observations:** Out of 550, 450 diabetic subjects tested for vitamin D, females were 44.4% and 55.5% were males. The deficiency was seen in 33.7% patients ($p < 0.04$) and Vitamin D insufficiency was observed in 20% in both sex. In control group, the deficiency was observed in 23% in females and 20% in males while insufficiency noted in 5% in both sex. **Conclusions:** The study showed significant decreased levels of vitamin D in type 2 Diabetic subjects than normal individuals. The vitamin D deficiency increased considerably in females with diabetes type 2.

Key words: Serum Vitamin D level, Type 2 diabetes.

Article Citation: Shaikh IA, Masood N, Memon S. Serum vitamin D level in type 2 diabetic patients. Professional Med J 2014;21(5):992-997.

Vitamin D plays an important role in insulin secretion. Pancreatic tissues (exclusively the insulin-producing beta-cells) express vitamin D receptors which are involved in vitamin D metabolism, glucose metabolism and insulin actions⁶.

Interestingly, Type 2 diabetic patients also have a higher incidence of low serum vitamin D levels⁷.

Another report showed that increased risk of mortality in patients with Type 2 diabetes and lower serum vitamin D levels persisted even after adjustment for all major parameters of complications like the urine albumin to creatinine ratio, estimated glomerular filtration rate, hemoglobin A_{1c}⁸.

The prevalence of diabetic neuropathy went up to 67.5% in patients with vitamin D deficiency. The level of vitamin D was lower in patients with diabetic neuropathy as compared to those without neuropathy⁹.

The vitamin D deficiency is associated with increased insulin resistance, decreased insulin production and metabolic syndrome¹⁰.

In china researchers have found that among diabetic patients, vitamin D supplementation decreases the inflammatory biomarkers¹¹. In fact activation of inflammatory pathways may down regulate insulin signaling and vitamin D levels¹².

In randomized control trials, attempts to increase vitamin D have been shown to reduce blood pressure in population. The intake of vitamin D increases pancreatic insulin release and improves glucose tolerance in patients with Type 2 diabetes¹³.

Amini et al reported Vitamin D deficiency in Middle East¹⁴.

In fact serum calcium and phosphorus levels do not predict exactly its deficiency¹⁵ and deficiency is more prevalent in Asia.

The criteria for interpretation of vitamin D values are as below¹⁶.

Deficiency < 20 ng/ml
Insufficiency 21-29 ng/ml.
Sufficiency 30 ng/ml.
Intoxication more than 150 ng/ml.

Vitamin D deficiency may increase the risk of developing autoimmune diseases including type 1 diabetes through loss of vitamin D modulation of the immune and inflammatory reaction in diabetes¹⁷.

Vitamin D deficiency 92% and 81% has been seen from Karachi and Lahore recently¹⁸. Multiple reports previously have also demonstrated Vitamin D deficiency from various regions of Pakistan^{19,20}.

Suzuki et al showed in a cohort of 581 Japanese diabetic subjects that serum 25-OHD levels were significantly lower in subjects with diabetic retinopathy compared to those without diabetic

retinopathy and in those with microvascular complications compared to those without microvascular complications²¹.

Scragg R et al reported that lower vitamin D levels in new type 2 diabetics than normal subjects²².

Vitamin D replacement in Bangladeshi population in short and long term shown increased insulin secretion and improved glucose levels²³.

PATIENTS AND METHODS

Total 550 patients (310 males and 240 females) were included in study, taken from different OPDs of Hyderabad and towns/ Tehsils of Hyderabad, 450 patients were diagnosed cases of type 2 diabetes mellitus and 100 were normal subjects. Out of 450 type 2 DM patients, 150 were selected from private clinics of sadder, 100 from Pret abad, 75 patients from Qasimabad and 125 patients from Latifabad respectively.

The mean age and standard deviation (SD) was shown in Table-I.

The inclusion criteria were;

1. Patients diagnosed cases of Type 2 diabetes.
2. Age range was 35-70 years of either sex.

The exclusion criteria were;

1. Patients with osteomalacia, hyperparathyroidism or renal failure
2. Patients who were already on Vitamin D replacement
3. Patients already diagnosed as cases of Vitamin D Deficiency or insufficiency.

The patients were selected by convenience sampling technique. The sample size was calculated by FDI software with incidence of diabetes 4 %, CI 95% and margin of error was 5%.

The written consent was obtained and demographic features were noted.

3 ml of blood was taken for estimation of vitamin D levels.

The vitamin D level was done on an Electro chemiluminescence Immuno Assay (ECLIA) and done at Diagnostic & Research laboratory Liaquat University of medical & Health sciences Jamshoro Sindh.

The funding authorities were Pharmaevo pharmaceutical (30%) and two research authors (70%).

All patients were married. The male to female ratio was 1:1.25. The mean duration of diabetes was 7 years (SD 3.5). All patients were on oral hypoglycemic drugs.

The mean BMI was 27 (SD 4.5) in males and 25 (SD 3.5) in females. (Table-I).

The criteria for interpretation of vitamin D values were below;

1. Deficiency less than 20 ng/ml
2. Vitamin D insufficiency 21-29 ng/ml.
3. Sufficiency Equal to or more than 30 ng/ml.

To analyze the data, SPSS version 16 was used. Descriptive statistics were applied in order to find out levels of vitamin D deficiency in different regions of Hyderabad. The association between vitamin D status and predictor variables, simple bivariate association, ANOVA and linear regression were applied. P value calculated in

qualitative and quantitative variables, value less than 0.05 was considered significant.

RESULTS

In this study, we included 550 patients, 100 normal and 450 of DM type 2 from different towns of Hyderabad to find out vitamin D levels in different regions of Hyderabad. The male to female ratio was 1: 1.25. The demographic and other descriptive variables were mentioned in Table (I). The mean age was 43.3 years (SD 7.2) and BMI was 25 (SD 8.2). The mean duration of diabetes was 7 years (SD 3.5).

On univariate regression analysis 33.7% were Vitamin D deficient; p value was <0.04 and 20% were Vitamin D insufficiency.

The females were more suffered than males (150 vs 92) in either deficiency or insufficiency (Table-II).

In control group, the deficiency observed in 23% in females and 20% in males while insufficiency noted in 5% in each male and females. (Table-III)

In Multivariate analysis, age, duration since diabetes, BMI and weight did not show any impact on Vitamin D deficiency or insufficiency, p value <0.005 (Table-I).

| Demographic features | Sadder | Latif Abad | PretAbad | QasimAbad | P value |
|--------------------------------|---------|------------|----------|-----------|---------|
| Male | 110 | 80 | 75 | 45 | |
| Female | 70 | 65 | 50 | 55 | |
| Age | 47(8.5) | 45(9.7) | 45(11.8) | 42(12.2) | 0.006 |
| Weight | 67(6.7) | 60(10.7) | 62(10.5) | 68(9.5) | 0.005 |
| BMI | 25(4.3) | 24(4.0) | 26(2.5) | 27(2.7) | 0.006 |
| Duration since diabetes(years) | 8(2.4) | 7(4.2) | 5(3.6) | 6(3.5) | 0.005 |
| Exercise /day(minutes) | 15(4.5) | 20(5.5) | 15(3.6) | 20(2.2) | 0.005 |
| Sun exposure(hour/day) | 3(2.3) | 3(2.3) | 4(1.5) | 2(2.5) | |

Table-I. Demographic features of total patients(n=550)

| Category | Males | Female | Percentage | P value |
|--------------|-------|--------|------------|---------|
| Deficient | 62 | 90 | 33.7% | 0.04 |
| Insufficient | 30 | 60 | 20% | 0.05 |
| Normal | 158 | 50 | 46.2% | - |
| Total | 250 | 200 | - | - |

Table-II. Vitamin D levels in DM -2 patients (n =450)

| Category | Males(60) | Female(40) | Percentage | P value |
|--------------|-----------|------------|------------|---------|
| Deficient | 20 | 23 | 43 | 0.006 |
| Insufficient | 5 | 5 | 10 | 0.000 |
| Normal | 35 | 12 | 47 | - |
| Total | 60 | 40 | - | - |

Table-III. Vitamin D levels in control patients (n =100)

DISCUSSION

There are enormous evidences which support that vitamin D plays a pivotal role in the patho physiology of glucose metabolism, cardiovascular diseases, malignancy mostly intestine and prostate^{24,25}.

Mazhar Ali Mufi et al have shown in a large study conducted in Islamabad for two years, 89.3% had low Vitamin D levels and 16.1% insufficiency²⁶.

Our study was conducted throughout Hyderabad city, which is 2nd biggest city of Sind province; included 450 patients of DM type 2 from different towns to find out vitamin D levels in different regions of Hyderabad.

The mean age was 43.3 years (SD 7.2) and mean BMI was 25(SD8.2), Hulya Parildar et al²⁷ have shown the of pregnant Diabetics, mean age was 33.4±5.2 years, mean BMI was 30.6±5.9 kg/m² and 25.9±4.4 kg/m² in case and control groups, respectively which is comparable to our study but our none of patient was pregnant.

The mean duration of diabetes was 7 years (SD3.5) in our study. In the present study, we analyzed retrospectively collected data of Type 2 diabetic patients with a mean duration of diabetes of 12.7 years²⁷.

Pittas AG et al showed that majority of patients with Type 2 diabetes or glucose intolerance may have lower serum 25(OH) D levels when compared to

healthy control²⁸.

In our study 33.7% were Vitamin D deficient from all towns of Hyderabad and p value was <0.04. Daly RM, Gagnon C et al²⁹ conducted a study in Australia in which 11,247 adults from 42 randomly selected districts were studied and exhibited 31% deficiency which is match able to our study.

In our study, 20% of patients metabolic have Vitamin D insufficiency which is match able to the results generated by Hala Ahmadieh. Sami T. Azar³⁰ et al showed that low 25-OHD level below 20 ng/ml was highly prevalent in ambulatory patients with type 2 diabetes .

Jung Re Y, Sang Ah Lee, et al³¹ demonstrated patients with Type 2 diabetes had serum vitamin D less than 30 ng/ml up to 98% of the patients had Vitamin D insufficiency or deficiency but this study did not comparable to our study.

The females were more suffered than males in either deficiency or insufficiency in our study and this fact was supported by study conducted by Aslam M, Masood et al³² from Faisalabad, reported the highest prevalence of vitamin D deficiency in females.

Khan AH et al³³ found in Karachi, females were 90.1 % vitamin D deficient.

In our study, the factors like fasting sugar, BMI and duration were not the contributory factors

of vitamin D deficiency or insufficiency that is matchable to study conducted by Giacomo Zoppini, et al³⁴ showed that Hemoglobin A1c was a significant predictor of serum vitamin D levels independently of age, BMI, duration of diabetes and nephropathy.

Two reports on the serum vitamin D levels of patients with Type 2 diabetics in the United States revealed higher mean values, 22.9 ng/ml and 22.3 ng/ml each^{35,36} which have shown that deficiency is prevalent in all developing and developed societies.

CONCLUSIONS

The deficiency of vitamin D is increased considerably with diabetes and more in females. Therefore, the correction of coexistent low vitamin D levels may be an important step in the management of Diabetes and prevention of complications.

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