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Original

Serum 25-hydroxy vitamin D level in diabetic patients versus normal individuals; a pilot study

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Abstract

Introduction: Vitamin D deficiency is a common health problem throughout the world. There is growing interest in vitamin D status as a potentially adjustable risk factor for diabetes mellitus.

Objectives: The main aim of this investigation is to assess, the possible differences of vitamin D serum value of diabetics versus normal persons.

Patients and Methods: This study was a cross-sectional investigation was conducted on 106 persons (females; 44, males; 62) consisting of 75 subjects, were free of any diseases who had normal fasting blood sugar (FBS) and 31 type 2 diabetic patients. Blood level of 25-hydroxy vitamin D [25(OH) D] was FBS, 2-hour postprandial blood sugar (2-h PPBS), calcium, creatinine, and uric acid were measured using standard kits. The independent *t* test was used to determine the significance of any baseline differences between groups and Pearson correlation test was used to assess correlations by STATA software version 12.

Results: The mean serum 25(OH) D concentration was 27.44± 3.66 and 27.64 ± 5.62 nmol/l in diabetics, and normal persons respectively. There was any significant difference in serum 25-hydroxy vitamin D level between diabetic and normal individuals. The prevalence of vitamin D deficiency (<50 nmol/l) was 88.87% in diabetic and 92% in normal subjects respectively.

Conclusion: The prevalence of vitamin D deficiency was high in two groups, however, there was not any significant difference in serum 25-hydroxy vitamin D level between diabetics and normal individuals.

Keywords: Vitamin D deficiency, Diabetes, Serum vitamin D

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Introduction

Vitamin D is a vital fat-soluble vitamin, which obtained via both food and cutaneous production. It is present in various forms. Vitamin D2 (ergocalciferol) is acquired of non-animal products, and vitamin D3 (cholecalciferol) is created in the human skin and is distributed in animal tissues. Diet may supply either vitamin D2 (ergocalciferol) or vitamin D3. Vitamin D plays an important role in calcium and phosphate homeostasis, bone mineralization and body growth (1,2).

Vitamin D deficiency is a common health problem throughout the world. High prevalence of vitamin D deficiency has shown in studies carried out in Middle East countries (3). The first National Investigation for Micronutrient Status (NIMS) and newer studies has revealed the high prevalence of vitamin D deficiency in various subgroups in Iran (4).Vitamin D deficiency causes musculoskeletal and extra skeletal defects. Musculoskeletal defects including failure to thrive, rickets, and skeletal abnormalities in children, and osteopenia, osteoporosis, osteomalacia, and increased risk of fractures in adult. In addition to musculoskeletal defects, low 25-hydroxyvitamin D (25(OH)D) is related to some extra-skeletal disorders such as cancer, autoimmune diseases, hypertension, endothelial dysfunction, dyslipidemia, infections, cardiovascular disease (CVD), impaired glucose tolerance, diabetes and obesity. Although several epidemiologic and cross-sectional studies have revealed that low circulating 25(OH)D concentrations are related to increased fasting blood glucose, insulin and higher prevalence of diabetes, the recent findings are controversy (5,6). As a result, there is growing interest in vitamin D status as a potentially adjustable risk factor for diabetes mellitus (7,8).

Objectives

The main question is whether diabetes state had an impact on vitamin D and is there any differences of serum vitamin D existed between normal individuals versus diabetic patients. Therefore, the main aim of this preliminary investigation is to assess, the possible differences of vitamin D serum value of diabetics versus normal persons and secondly we sought to assess the correlation of serum vitamin

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Implication for health policy/practice/research/medical education

In a cross-sectional investigation on 106 persons consisting of 75 normal subjects, 31 type 2 diabetic patients, we found the prevalence of vitamin D deficiency was high in two groups but there was not any significant difference in serum 25-hydroxy vitamin D level between diabetic and normal individuals. However, this finding requires further investigation.

D with some biochemical parameters in two groups.

Patients and Methods

Patients

This study was a cross-sectional investigation was conducted on 106 persons (females; 44, males; 62), consisting of 75 subjects, were free of any diseases who had normal fasting blood sugar (FBS) base on, history examination and laboratory assessments and 31 type 2 diabetic patients. Diabetic patients were under treatment of oral hypoglycemic agents or insulin therapy, who referred to nephrology clinic of Isfahan University of Medical Sciences in 2015. The inclusion criteria were diagnosis of T2DM according to typical criteria, lack of acute or chronic infections, hepatic or renal disease or any other chronic disease founded on history and physical assessment. Other exclusion criteria were administration of vitamin D, calcium supplements or every drugs effecting vitamin D or calcium metabolism in the past 6 months.

Laboratory tests

Blood level of 25-Hydroxy vitamin D [25(OH) D] was assessed in all individuals. Additionally for all individuals, FBS, 2-hour postprandial blood sugar *(2*-h PPBS), calcium, creatinine, and uric acid were measured using standard kits. Serum 25(OH) D was measured with ELISA method by Stat fax 2100 produced by Awareness Company (USA). Vitamin D status grouping were identified as sufficient (>75 nmol/l), insufficient (50–75 nmol/l) or deficient (<50 nmol/l). FBS and 2-h PPBS were measured by using enzymatic methods (GOD-PAP, Pars Azmon, Iran). Serum level of calcium was measured with Pars Azmoon kit using auto analyzer (Arsenazo method). Serum uric acid was also measured by uric acid TOOS kit (Pars Azmoon Co, Iran). Serum creatinine was measured using the photometric Jaffe method (Pars Azmoon kit, Tehran, Iran).

Ethical issues

The research followed the tenets of the Declaration of Helsinki. Written informed consent was obtained from all patients. This study was approved by Ethical Committee of Nickan Research Institute.

Statistical analysis

The normality of continuous variables was evaluated by normal probability plots and by one sample Kolmogorov-Simonov test. The independent *t* test was used to determine the significance of any baseline differences between groups and Pearson correlation test was used to assess correlations. The data was analyzed with STATA software version 12 (Stata Corp, College Station, Tex). *P* values of less than 0.05 was assumed to be significant ($P<0.05$).

Results

In this study 106 persons was evaluated (females; 44, males; 62). Of 106 individuals, 31 were diabetic patients. The mean age of diabetic and non-diabetic individuals was 58.71 ± 1.82 and 47.43 ± 1.83 years respectively. Table 1 presents vitamin D status in diabetic and non-diabetic participants. There is a significant difference between serum uric acid, creatinine, and calcium between diabetics and non-diabetics groups (Table 2; $P<0.05$). However, the level of vitamin D was 8% lesser in diabetics in comparison to non-diabetics, mean serum level of vitamin D was not significantly differ between the two groups ($P=0.788$). Table 3 shows no significant correlation of vitamin D, with age, sex, and calcium in diabetic individuals ($P>0.05$). However, in non-diabetic group, a significant association of vitamin D level with age ($r=0.38$, $P=0.001$; Figure 1) and serum calcium was seen.

Discussion

This study set out with the aim of assessing the differences of serum 25-hydroxy vitamin D level between diabetic patients and normal individuals. The results of this study did not show any significant differences between diabetic and normal individuals. The findings of the current study are consistent with studies by Raab et al (9), Al-Shoumer et al (10) and Bierschenk, et al (7). Our results was different

Table 1. Vitamin D status in diabetic and non-diabetic participants

Vitamin D status	Diabetic n (%) n=31	Non- diabetic n(%) n=75
Sufficient	1 (3.23)	1 (1.33)
Insufficient	4 (12.9)	5 (6.67)
Deficient	26 (88.87)	69 (92)

Table 2. Distribution and statistical comparison of variables in the study population

Variable	Diabetic (Mean ± SE) n=31	Non- diabetic (Mean ± SE) n=75	*P* [a]
Uric acid (mg/dl)[b]	6.48 ± 0.41	4.94 ± 0.16	0.00
Creatinine (mg/dl)	1.52 ± 0.14	0.91 ± 0.04	0.00
Calcium (mg/dl)	9 ± 0.13	9.33 ± 0.18	0.283
Vitamin D (nmol/l)	27.44 ± 3.66	27.64 ± 5.62	0.788

[a] *P* value <0.05 was significant.

[b] The independent t-test was used to determine the significance of any differences between groups.

Table 3. Correlation of serum vitamin D level with age, sex, and serum calcium

	Variable	Sex	Age	Calcium
Diabetic	Vitamin D	0.529	0.19 P=0.291	-0.02 P=0.916
Non-diabetic	Vitamin D	0.289	0.38 *P* = 0.001[a]	0.68 *P* = 0.000[a]

[a] *P* value <0.05 was significant.

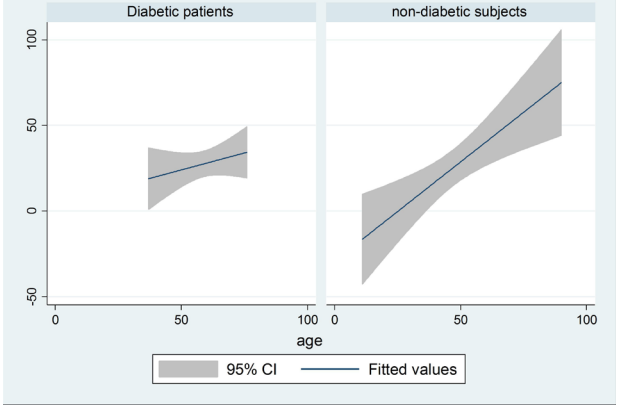

Figure 1. Correlation coefficient with 95% CI between vitamin d level and age.

from the studies by Tahrani et al (11) and Holick et al (12), which revealed type 2 diabetes mellitus patients as compared to non-diabetic individuals have lower serum vitamin D concentrations. Also our result is in contrast with the study done by Svoren et al (13), which showed patients with type 1 diabetic had lower serum concentration of vitamin D than healthy subjects. Payne et al suggested that diabetic patients had lower 25(OH)D levels than those without diabetes (14). Song in a meta-analysis showed an inverse association between circulating vitamin D levels and risk of diabetes (15). In our study the mean of vitamin D in individual with and without diabetes showed the presence of vitamin D deficiency in both groups. However, differences of our results as compared to other studies may be related partly to high prevalence of vitamin D deficiency in both groups. Several factors potentially influence on vitamin D status such as, adiposity, genetic factors, and issues have an effect on the cutaneous synthesis of vitamin D such as season, skin pigmentation, melanin concentration, age, clothes and consume sunscreens (16). It seems that these results are due to imperfect exposure to sun light and little sea food ingestion possibly influenced on vitamin D status in these groups.

Another important finding was the significant positive association of vitamin D level with age in normal subjects (r= 0.38, $P=0.001$), which was consistent with the study by Hagenau et al (17). They showed, serum 25(OH) D levels varied with age (17). We previously studied 259 ambulant medical staff adults and students to find the correlation of serum vitamin D level with body mass index of healthy Iranian individuals (18). The change in vitamin D status with age probably might be the result of lack of sunlight exposure related to social factors, supplementation intake, and physical inactivity.

Conclusion

The purpose of the current study was to determine the differences of serum 25-hydroxy vitamin D level between diabetic patients and normal individuals. The findings of this study suggest no significant differences between diabetic and normal individuals. The second major finding was the significant positive association of vitamin D level with age in normal subjects.

Limitations of the study

Finally, a number of important limitations need to be considered. The major limitation of this study is not assessing the dietary intake of vitamin D; the second limitation is not evaluation the use of the sun exposure in both groups. Additionally, major limitation of our study was the relatively small number of patients. As regard to these limitations it is suggested the association of these factors in future studies by multi-centric studies.

Authors' contribution

HN, MZ and SSM designed and conducted the research. AH, analyzed the data. MK prepared the primary draft. HN, edited the final manuscript. All authors read and signed the paper.

Conflicts of interest

The authors declared no competing interests.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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