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Vitamin D Deficiency in Elderly Saudi Patients with Type 2 Diabetes Mellitus

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Research Article

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Abstract

Introduction: Vitamin D deficiency and type 2 diabetes mellitus (T2DM) remain major health problems. We conducted a cross sectional study to investigate the prevalence vitamin D deficiency in elderly patients with T2DM.

Method: A cross-sectional single center study was conducted in 1622 patients 60 years or more with T2DM attended the Diabetes Centre at King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia between January 2018 and December 2018. The serum concentration of 25-hydroxyvitamin D (25-OHD) and HbA1c were measured.

Results: There were 1622 patients with T2DM, 28.3% male and 71.7% female. Vitamin D deficiency was found in 37.6%. Moreover, vitamin D deficiency was significantly more prevalent among females than males (61.6% vs. 38.4% respectively, p<0.0001). In addition, Vitamin D deficient patients were statistically significant younger than non-vitamin D deficient (69.0±7.3 vs. 70.7±8.2 respectively, p<0.0001). Vitamin D deficient patients have statistically significant higher HbA1c than non-vitamin D deficient (8.3±1.9 vs. 7.4 ±1.6 respectively, p<0.0001). The mean 25-OHD was statistically significant lower in the age 60-69 years patients compared to ≥70 years patients (61.6 vs. 65.3 nmol/l respectively, p=0.02). There was higher frequency of vitamin D deficiency found in the age 60-69 years patients

compared to ≥70 years patients with males statistically significant most frequent than females in the 60-69 years compared to ≥70 years patients. 25-OHD concentration was significantly correlated with age and HbA1c. Regression analysis of odd ratio of risk factors for patients with vitamin D deficiency showed that female gender, age and HbA1c were statistically significant associated with vitamin D deficiency.

Conclusions: The prevalence of vitamin D deficiency in elderly patients with T2DM is high and that more females with T2DM are affected than males.

Keywords: Elderly Type 2 Diabetes Mellitus; Vitamin D Deficiency

Introduction

The global prevalence of vitamin D deficiency is estimated at 30-87% [1,2]. Moreover, in Saudi Arabia, these estimates range between15-30% in the general population [3,4]. In addition, the prevalence of type 2 diabetes mellitus (T2DM) in Saudi Arabia is one of the highest reported in the world, reaching up to 30% [3]. It has been demonstrated that vitamin D deficiency is associated with T2DM [4-6]. The prevalence of vitamin D deficiency in patients with T2DM varies from 70 to 90%, depending on the threshold used to define vitamin D deficiency [7-9]. Few published researches have been found that surveyed the prevalence of vitamin D deficiency in patients with T2DM in Saudi Arabia [10].

The elderly population is the more susceptible population to suffer vitamin D deficiency, especially the elderly who live in nursing homes and who are hospitalized [11-14]. Hollick found that 84% African males and females 65 years old in Boston experienced vitamin D deficiency [11,15]. Meanwhile, Setiati found 35.1% prevalence in the female population aged 60-90 years old who lived in the nursing home [16-23].

The proportion of people in Saudi Arabia aged 60 or more is predicted to be 25 percent of the total population of 40 million by the end of 2050. Moreover, the number of people aged 80 or more is expected to reach 4 percent of the country's total population in the same period [24]. We conducted a cross sectional study to investigate the prevalence vitamin D deficiency in elderly Saudi patients with T2DM.

Methods

A cross-sectional single centre study was conducted in 1622 patients with T2DM attended the Diabetes Centre at King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia between January 2018 and December 2018. Eligible patients were 60 years or older. Exclusion criteria were known hepatic or renal disease, metabolic bone disease, malabsorption, hypercortisolism, malignancy, immobility for more than one-week and medications influencing bone metabolism. The serum concentration of 25-OHD was measured by competitive protein binding assay using kits (Immunodiagnostic, Bensheim, Germany). Vitamin D deficiency was defined as serum 25-OHD concentration<50 nmol/L [1]. Glycosylated hemoglobin (HbA1c) was measured by the high performance liquid chromatography method (Bio-Rad Laboratories, Waters, MA, USA). The total numbers of cohort were separated on basis of age values into two groups: 60-69 years and ≥70 years. The study was approved by the ethical committee board of King Fahad Armed Forces Hospital.

Statistical Analysis

Data are presented as means ± standard deviation (SD) or numbers (%). Quantitative variables were compared between two groups by using the Student's test. Differences in categorical variables were analyzed using the chi-square test. The relationship between continuous variables was assessed using coefficients of correlation. Logistic regression analysis was carried out to identify the independent predictors of vitamin D deficiency considering age, gender and HbA1c as risk factors and to estimate odds ratio (OR) and 95% CI. P value <0.05 indicates significance. The statistical analysis was conducted with SPSS version 23.0 for Windows.

Results

There were 1622 patients with T2DM, 472 (28.3%) male and 1150 (71.7%) female (Table 1). The mean age was 70.1.9 ±7.9 years (60-112 years). The mean and median 25-OHD concentrations were 63.3 ±31.9 and 59nmol/l respectively. Vitamin D deficiency (defined as 25-OHD<50 nmol/l) was found in 610 (37.6%) (Table 2). Moreover, vitamin D deficiency was significantly more

prevalent among females than males (61.6% vs. 38.4% respectively, p<0.0001) with female to male ratio 1.6:1.0. In addition, Vitamin D deficient patients were statistically significant younger than non-vitamin D deficient (69.0±7.3 vs. 70.7±8.2 respectively, p<0.0001). Vitamin D deficient patients have statistically significant higher HbA1c than non-vitamin D deficient (8.3 ±1.9 vs. 7.4 ±1.6 respectively, p<0.0001). As expected, the mean 25-OHD concentration was statistically significant lower in the vitamin D deficient patients compared to non-vitamin D deficient (35.4 ±9.4 vs. 80.1±28.8 respectively, p<0.0001).

Variables		Values
Total		1622
(Year)Age		70.1.9±7.9
Gender	Male	472 (29.1)
	Female	1150 (70.6)
(%)HbA1c		7.8±1.8
25-hydroxyvitamin D (nmol/L)		63.3±31.9

Table 1: Patient characteristics [mean±standard deviation or number (%)].

Variables		Vitamin D Deficiency		P values
		Present	Absent	
Numbers		610(37.6)	1012(62.4)	
(Year)Age		69.0±7.3	70.7±8.2	<0.0001
Gender	Male	234(38.4)	238(23.5)	<0.0001
	Female	376(61.6)	774(76.5)	
(%)HbA1c		8.3±1.9	7.4±1.6	<0.0001
25-hydroxyvitamin D (nmol/L)		35.4±9.4	80.1±28.8	<0.0001

Table 2: Vitamin D deficiency among elderly type 2 diabetes mellitus patients [mean±standard deviation or number (%)].

The mean 25-OHD was statistically significant lower in the age 60-69 years patients compared to ≥70 years patients (61.6 vs. 65.3 nmol/l respectively, p=0.02) (Figure 1A). There was higher frequency of vitamin D deficiency found in the age 60-69 years patients compared to ≥70 years patients (Figure 1B) with males statistically significant most frequent than females in the 60-69 years compared to ≥70 years patients (Figure 2). 25-OHD concentration was significantly positively correlated with age (r=0.059, p=0.02) and significantly negatively correlated with HbA1c (r= - 0.217, p<0.0001) (Figure 3A and 3B).

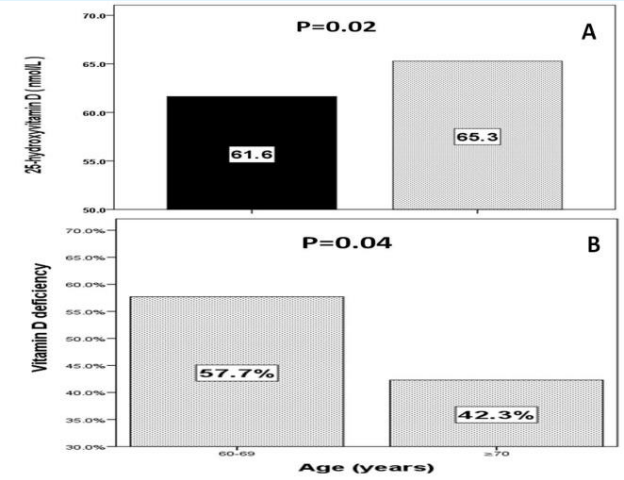

Figure 1: The mean of vitamin D concentration (nmol/l) (A) and the percentage of vitamin D deficiency (B) in correlation to age groups.

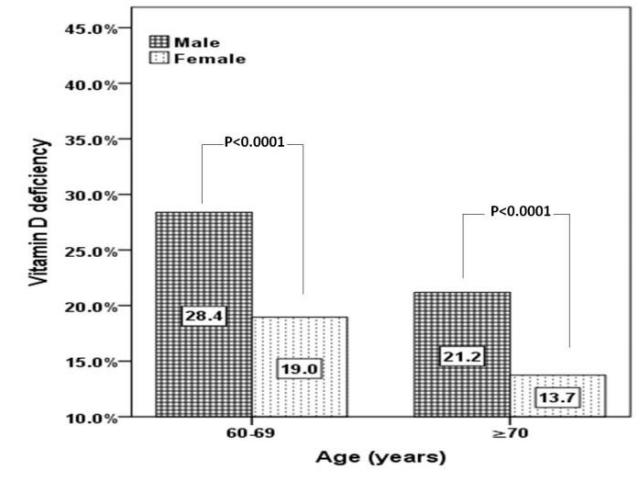

Figure 2: The percentage of vitamin D deficiency according to gender in correlation to age groups.

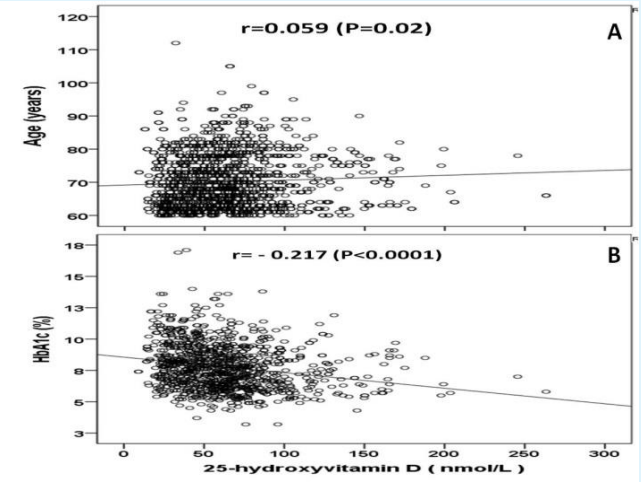

Figure 3: Correlation of 25-hydroxyvitamin D concentration and age (A) and HbA1c (B) in the study population.

Regression analysis of odd ratio of risk factors for patients with vitamin D deficiency showed that female gender, age and HbA1c were statistically significant associated with vitamin D deficiency, (OR=1.840; 95% confidence interval [CI]=1.422-2.380), p<0.0001), (OR=0.974; 95% CI=0.958-0.991), p=0.002) and (OR=1.312; 95% CI=1.221-1.410), p<0.0001) respectively (Table 3).

Parameter	Odd Ratio(95% CI)	P Value
Female Gender	1.840 (1.422-2.380)	<0.0001
(year)Age	0.974 (0.958-0.991)	0.002
HbA1c	1.312(1.221-1.410)	<0.0001

Table 3: Regression analysis for odd ratio of risk factors for patients with vitamin D deficiency.

Discussion

The high incidence of T2DM worldwide and in Saudi Arabia and the accumulated evidence on the status of vitamin D under different conditions make it extremely important to determine the relationship between vitamin D and diabetes mellitus [5,25]. In the present study, we used the cut-off level less than 50nmol/l in order to define vitamin D deficiency and we found 37.6% prevalence. To our knowledge, this is the first study conducted in Saudi Arabia, which establishes the prevalence of vitamin D deficiency in elderly patients with T2DM. When compared with previous studies in elderly populations (35.1-84%), our study was within the prevalence rate [11,15,26-28]. The lower vitamin deficiency in our study compared to others might be due to the different subject's characteristics, which were not limited only to the elderly group as the previous studies. Our study involved elderly, male and female subjects of general population and not only on limited population such as subjects who lived in nursing home. It is of importance to state that the sample size is representative for a number of subjects suffering from T2DM in the area and study population of one institution does not represent the entire city of Jeddah, in addition the study sample confined to patients with T2DM but without comparable groups.

Some factors estimated as affecting factors on the development of vitamin D deficiency were analyzed and we found evidence that gender, age and HbA1c were statistically significant. The female gender variable seemed to be the most affecting factor in the development of vitamin D deficiency, which was higher in female (61.6%) compared to male (38.4%) and whereas the risk was increased by 84%. Female subjects often used sun protectors, which consequently reduced the direct sun light exposure. Other possibilities include. Male subjects generally had more frequent and longer duration in doing outdoor activities; therefore most of them had more exposure to direct sun light.

We found serum 25-OHDconcentration was strongly correlated with age that is similar to the findings of Hashemipour, et al. [29] in a cohort of 1210 Iranians adult. The strong correlation of 25(OH)D to age is also in agreement with a study carried out in the US, where vitamin D deficiency was found to be more common among the young, and less common among the elderly [30].

We found vitamin D deficient patients aged 60-69 years have statistically significant higher HbA1c than the older group. Moreover, 25-OHD concentration was inversely correlated with HbA1c. These findings are supported by a number of international studies. In contrast some studies show no association of a low vitamin D with HbA1c levels [31]. But inverse correlation between the level of vitamin D and glucose level is well known [32-34]. In many studies vitamin D levels were low in subjects having higher HbA1c values in patients with T2DM indicating that they are inversely related [35]. Vitamin D has various effects on glucose homeostasis. Besides its role in insulin secretion, it also has an influence on insulin resistance directly or via Ca indirectly [36]. Changes in Ca in primary insulin target tissues may contribute to peripheral insulin resistance via impaired insulin signal transduction, leading to decreased glucose transporter-4 activity [37]. The results from the trials on the effect of vitamin D and/or Ca supplementation on insulin resistance have showed improvement on insulin action [38].

We had several limitations. Our study was a cross-sectional study; therefore, it could not evaluate the causal association directly among the studied variables as observed in longitudinal or interventional study. In addition, the study was done at one centre and was done at one point of time. The study sample confined to patients with T2DM but without comparable groups. Another limitation in our study includes the limited sample size. The high prevalence of vitamin D deficiency in our study consequently will call for greater sample size. Parathyroid level should also be studied as an indicator of vitamin D deficiency.

In conclusion, the prevalence of vitamin D deficiency in elderly patients with T2DM is high and that more females with T2DM are affected than males. We recommend larger scale studies for detecting vitamin D deficiency in our population with T2DM and suggest planning strategies to supplement our population with vitamin D.

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