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# Vitamin D deficiency in Saudi women of childbearing age with type 2 diabetes mellitus

## Abstract

**Introduction:** Vitamin D deficiency is a crucial health risk element especially throughout their childbearing period. The present study aimed to examine the prevalence of vitamin D deficiency among Saudi females of childbearing age with T2DM.

**Method:** A cross-sectional single centre study was conducted in 1237patients with T2DM between the age 20 years to 49 years attending the Diabetes Centre at King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia between January 2018 and December 2018.

**Results:** There were 1237 female patients between the ages 20 to 49years with T2DM with mean age was 36.6±7.8years. Vitamin D deficiency was found in 58.4%. Moreover, vitamin D deficient patients were statistically significant younger and have statistically significant higher HbA1c than non-vitamin D deficient. The mean of 25-hydroxvitamin D (25(OH)D) concentration was non-statistically significant different among and between age groups. Moreover, the frequency of vitamin D deficiency was non-statistically significant upward as age advanced with highest frequency of vitamin D deficiency was found in the fourth decade (41.5%). 25(OH) D concentration was significantly positively correlated with age (r=0.079, p=0.004) and significantly negatively correlated with HbA1c (r= -0.128, p=0.003). Regression analysis of OR of risk factors for patients with vitamin D deficiency showed that age was statistically significant associated with vitamin D deficiency, (OR=0.973; 95% CI=0.956-0.991), p=0.004).

**Conclusion:** The prevalence of vitamin D deficiency in Saudi women of childbearing age with T2DM is high. We recommend larger scale studies for detecting vitamin D deficiency in our population with T2DM.

**Keywords:** type 2 diabetes mellitus, vitamin D deficiency, childbearing age

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## Introduction

The emergence of high vitamin D deficiency prevalence in the last decade in particular in the Middle East justifies taking this problem seriously and planning to solve health problems associated with vitamin D deficiency.[1–5]

For young females, vitamin D deficiency is a crucial health risk element, especially throughout their childbearing period, when deficiency can affect the health status of both the mother and the fetus.[6–9] Adequacy of vitamin D concentrations while pregnant help to ensure appropriate calcium homeostasis and bone metabolism for the mother and the fetus.[8,9] In spite of the potentially dangerous consequences of vitamin D deficiency and even insufficiency, very few studies concerning vitamin D have been directed exclusively toward young women; the bulk of literature in having studied the problem of vitamin D deficiency in the general population.[10]

The prevalence of type 2 diabetes mellitus (T2DM) in Saudi Arabia was reported to be high, reaching up to 30%.[11] It was demonstrated that vitamin D deficiency is associated with T2DM.[12–16] In addition, it was shown that diabetes mellitus prognosis may be better when the status of vitamin D deficiency is corrected and that several mechanisms have been proposed to explain these findings such as enhancement of beta cell function and reducing insulin resistance.[17–21]

The prevalence of vitamin D deficiency was reported to be 18-84%.[22–25] In addition, vitamin D deficiency is high among the Saudi population, particularly in females with T2DM.[26–29] Thus, we aimed to examine the prevalence of vitamin D deficiency among Saudi females of childbearing age with T2DM.

## Methods

A cross-sectional single centre study was conducted in 1237patients with T2DM between the age 20years to 49years. Those patients attended the Diabetes Centre at King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia between January 2018 and December 2018. Exclusion criteria were known hepatic or renal disease, metabolic bone disease and pregnancy. The serum concentration of 25(OH) D was measured by competitive protein binding assay using kits (Immunodiagnostic, Bensheim, Germany). Vitamin D deficiency was defined as serum 25(OH)D concentration <50nmol/L.[30] Glycosylated hemoglobin (HbA1c) was measured by the high performance liquid chromatography method (Bio-Rad Laboratories, Waters, MA, USA). The total number of cohort was separated on basis of age values into three groups: 20-29years, 30-39years and 40-49years. 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. Differences in mean serum 25(OH) D levels were tested with ANOVA (using post-hoc Tukey's honestly significant difference (HSD) tests for differences among groups). 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 and HbA1c as risk factors and to estimate odds ratio (OR) and 95% confidence interval (CI). P value <0.05 indicates significance. The statistical analysis was conducted with SPSS version 23.0 for Windows.

## Results

There were 1237 female patients between the ages 20 to 49years with T2DM. The mean age was 36.6±7.8years (Table 1). The mean and median HbA1c levels were 7.2±2.1 and 6.6 respectively. The mean and median 25(OH)D concentrations were 51.3±29.2 and 44.7nmol/l respectively. Vitamin D deficiency was found in 723 (58.4%) (Table 2). Moreover, vitamin D deficient patients were statistically significant younger than non-vitamin D deficient patients (36.1±7.8 vs. 37.4±7.7 respectively, p=0.003). Vitamin D deficient patients have statistically significant higher HbA1c than non-vitamin D deficient patients (7.4±2.2 vs. 6.9±2.0 respectively, p=0.02). As expected, the mean 25(OH)D concentration was statistically significant lower in the vitamin D deficient patients compared to non-vitamin D deficient patients (32.8±10.3 vs. 78.2±26.3nmol/l respectively, p<0.0001).

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

| Variable | Values |
|---|---|
| Total | 1237 |
| Age (years) | 36.6±7.8 |
| HbA1c (%) | 7.2±2.1 |
| 25-hydroxyvitamin D (nmol/L) | 51.7±29.2 |

**Table 2** Vitamin D deficiency among child bearing women with Type 2 diabetes mellitus patients [mean±standard deviation or number (%)]

| Variable | Vitamin D deficiency | | P values |
|---|---|---|---|
| | Present | Absent | |
| Numbers | 723 (58.4) | 514 (41.6) | |
| Age (years) | 36.1±7.8 | 37.4±7.7 | 0.003 |
| HbA1c (%) | 7.4±2.2 | 6.9±2.0 | 0.02 |
| 25-hydroxyvitamin D (nmol/L) | 32.8±10.3 | 78.2±26.3 | <0.0001 |

The mean of 25(OH)D concentration was non-statistically significant different among and between age groups (Figure 1). Moreover, the frequency of vitamin D deficiency was non-statistically significant upward as age advanced with highest frequency of vitamin D deficiency was found in the fourth decade (41.5%) (Figure 2). 25(OH)D concentration was significantly positively correlated with age (r=0.079, p=0.004) (Figure 3A) and significantly negatively correlated with HbA1c (r=-0.128, p=0.003) (Figure 3B). Regression analysis of OR of risk factors for patients with vitamin D deficiency showed that age was statistically significant associated with vitamin D deficiency, (OR=0.973; 95% CI=0.956-0.991), p=0.004) (Table 3).

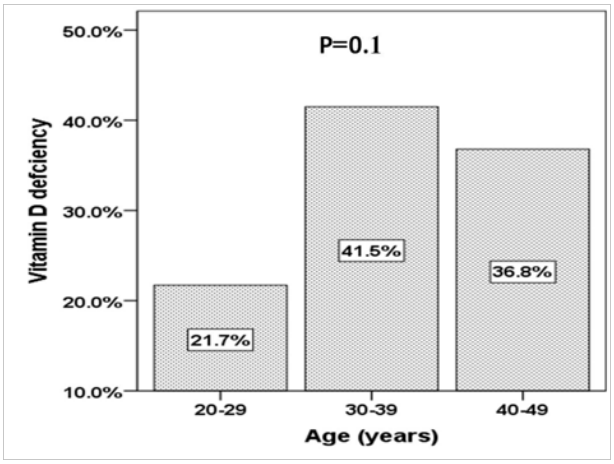


**Figure 1** The percentage of vitamin D deficiency among child bearing women with Type 2 diabetes mellitus patients in correlation to age groups.

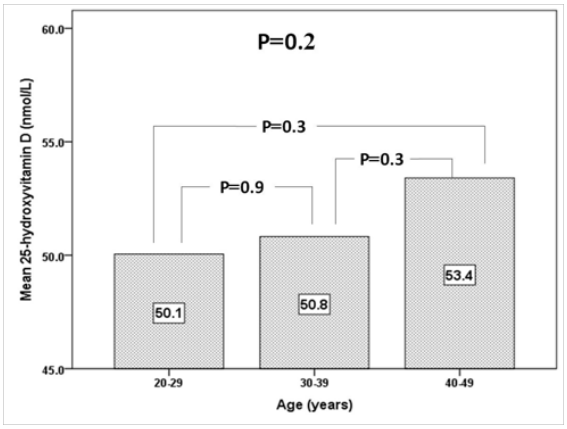


**Figure 2** The 25-hydroxyvitamin D concentration in correlation to age groups.

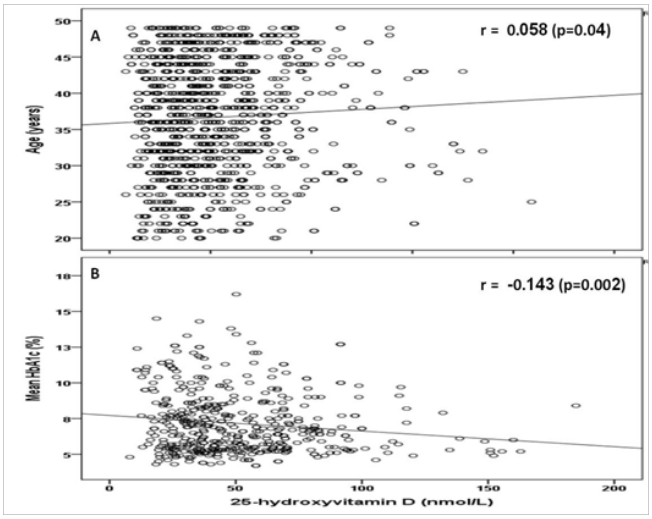


**Figure 3** Correlation of 25-hydroxyvitamin D concentration to age (A) and HbA1c (B).

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**Table 3** Regression analysis for odd ratio of risk factors for patients with vitamin D deficiency among child bearing women with Type 2 diabetes mellitus patients

| Parameters | Odd Ratio (95% CI) | P value |
|---|---|---|
| Age (years) | 0.966 (0.945-0.987) | 0.002 |
| HbA1c (%) | 1.106 (1.010-1.210) | 0.03 |

## Discussion

Vitamin D deficiency might be presented as a subclinical condition with hidden manifestations, in which the diagnosis would depend on the assessment of serum 25(OH)D levels. Serum 25(OH)D level is an indicator of vitamin D status in individuals.[31–33] The present study was aimed to examine the prevalence of vitamin D deficiency among Saudi females of childbearing age with T2DM reports the vitamin D status of Saudi women of childbearing age.

We included 1234 women in this study with a median serum 25(OH)D level of 44.7nmol/l. we found the prevalence of vitamin D deficiency was 58.4%. A meta-analysis found the mean 25(OH) D serum level was 32.75nmol/l (95% CI: 29.0-36.5 and the overall vitamin D deficiency prevalence among Saudi women of childbearing years was 77.4%.[34] Similarly, low 25(OH)D levels have also been found by researchers in the United states and Middle Eastern women.[5,26–29,35–42] The mean serum 25(OH)D reported among a sample of Emirati women was 21.0±15.0nmol/l; further, a level of 36.75±14.75nmol was found among Egyptian women and the highest level was found among a sample of Lebanese women with a mean of 39.5±20.5nmol.[40–42] The low vitamin D level may be due to several factors including avoidance of sunlight exposure. It is of importance to state that the sample size of our study is representative for patients with T2DM without comparable groups and the study population of one centre does not represent the entire city of Jeddah. We found that serum 25(OH)D was statistically significant correlated with age, that is similar to the findings of Hashemipour et al.[43] in a cohort of 1210 Iranians adult.[43] The correlation of 25(OH)D to age is also in agreement with a study carried out in the United states, where vitamin D deficiency was found to be more common among young subjects.[44] Our study showed that vitamin D deficient patients have statistically significant higher HbA1c than non-vitamin D deficient patients (Table 2). Moreover, 25-OHD concentration was inversely correlated with HbA1c (Figure 3B). These findings are supported by number of international studies. In contrast, some studies showed no association of low vitamin D in relation to HbA1c levels.[45] But an inverse correlation between the level of vitamin D and glucose level was well known.[46–48] In many studies, vitamin D levels were low in subjects having higher HbA1c values in patients with T2DM indicating that they were inversely related.[49]

This study has some limitations. We have based our serum 25(OH) D thresholds on prior outcome studies; no outcomes were assessed in this analysis. The data presented most likely represent the best case scenario; random sampling across all seasons should yield an even higher prevalence of vitamin D deficiency. We concluded that the prevalence of vitamin D deficiency in women of childbearing age with T2DM is high. We recommend larger scale studies for detecting vitamin D deficiency in our population with T2DM.

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## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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