International Journal of Clinical and Medical Cases

ISSN 2517-7346

Vitamin D Deficiency in Young Saudis with Type 1 Diabetes mellitus

Khalid S Aljabri [*]
Samia A Bokhari [1]
Emad I Alghannami [1]
Turky A Alharthy [2]

[1]Department of Endocrinology, King Fahad Armed Forces Hospital, Jeddah, Kingdom of Saudi Arabia
[2]College of Medicine, Jeddah, Kingdom of Saudi Arabia

Abstract

Background: Some studies reported the prevalence of vitamin D deficiency in non diabetic population. This study was investigated to find out the vitamin D status in Saudi patients with type 1 diabetes mellitus (T1DM).

Methods: A cross-sectional single centre study was conducted in 286 Saudi patients with T1DM between January to December 2018. The serum concentration of 25-hydroxyvitamin D (25-OHD) and glycosylated hemoglobin (HbA_{1c}) were measured.

Results: There were 286 patients with T1DM, 155 (54.2%) male and 131 ((45.8%) female. The mean age was 16.1 ± 2.1 years (12-19 years). The mean and median 25-OHD concentrations were 43.0 ± 22.4 and 37.7 nmol/l respectively. The prevalence of different vitamin D status were; 71.3% deficient, 19.9% insufficient and 8.7% sufficient. Moreover, vitamin D deficiency (VDD) was significantly more prevalent among males than females (54.2% *vs.* 45.8% respectively, p=0.01) with male to female ratio 1.2:1.0. In addition, there was no statistically significant different between HbA_{1c} and different vitamin D status groups. The mean 25-OHD was lowest in the age 18 years patients, whereas highest in the age 19 years (33.5 and 51.9 nmol/l respectively). Moreover, males had lower mean 25-OHD than females across most of the age groups with vitamin D deficient was more prevalent at the age 17 years. 25-OHD concentration was non-significantly negatively correlated with age (r=-0.049, p=0.4) and non-significantly positively correlated with HbA_{1c} (r=0.066, p=0.4).

Conclusions: The prevalence of vitamin D deficiency in young with Saudi patients with T1DM is high. We recommend larger scale studies for detecting VDD in our population with T1DM and suggest planning strategies to supplement our T1DM population with vitamin D.

Keywords

Vitamin D; Saudis; Type 1 diabetes

Introduction

Type 1 Diabetes mellitus (T1DM) is a consequence of an autoimmune destruction of the insulin producing beta cell [1]. The incidence rate of T1DM has grown in Saudi Arabia over the last 3 decades [2]. The increasing incidence of T1DM strongly suggests the importance of environmental factors including diet and viruses [3].

Serum 25-hydroxyvitamin D (25-OHD) concentrations are determined by environmental factors, through vitamin D intake and ultraviolet exposure. The main marker of vitamin D status is the metabolite 25-OHD, which is synthesized in the liver [4,5]. Vitamin D (VD) has anti-inflammatory and immune-modulatory effects that could influence the autoimmune pathology of T1DM [6,7]. There are significant higher insulin requirements in T1DM patients with vitamin D deficiency (VDD) together with low insulin sensitivity and higher levels of glycosylated hemoglobin (HbA_{1c}) [8,9]. Increasing VD levels from 25 to 75 nmol/L was shown to improve insulin sensitivity by 60% [10]. VDD has been involved in the development of diabetes complications as nephropathy and retinopathy [11-13].

VDD is considered a major health problem in many parts of the world [4]. The relationship between T1DM and VDD has been reported to be 15% to 90.6% [14-23]. In 2013, we reported VDD in T1DM was as high as 97% [23]. Studies from Saudi Arabia in cohort of subjects with and without history of diabetes mellitus showed high prevalence of VDD ranging from 21.9% to 81% [21,22,24]. Therefore, we conducted a cross-sectional study to define the prevalence of VDD in young Saudi patients with T1DM.

Methods

A cross-sectional single centre study was conducted in 286 patients with T1DM attended the Diabetes Centre at King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia between January 2018 and December 2018. Eligible patients were between the age of 12 years to 19 years old with T1DM [1]. Exclusion criteria were known hepatic or renal

Article Information

DOI: 10.31021/ijcmc.20192120
Article Type: Research Article
Journal Type: Open Access
Volume: 2 Issue: 2
Manuscript ID: IJCMC-2-120
Publisher: Boffin Access Limited

Received Date: 05 April 2019
Accepted Date: 10 May 2019
Published Date: 13 May 2019

*Corresponding author:

Khalid S Aljabri, MD, FRCPC, FRCPC(Endo), FACP, ABIM, ABEM
Department of Endocrinology
King Fahad Armed Forces Hospital
Jeddah, Kingdom of Saudi Arabia
PO Box 9862, Jeddah 21159
Kingdom of Saudi Arabia
Tel: +966590008035
E-mail: khalidsaljabri@yahoo.com

Citation: Aljabri KS, Bokhari SA, Alghannami EI, Alharthy TA. Vitamin D deficiency in young Saudis with type 1 diabetes mellitus. int J Clin Med Cases. 2019 May;2(2):120

disease, metabolic bone disease, malabsorption, hypercortisolism, malignancy, immobility for more than one-week, pregnancy, lactation, and medications influencing bone metabolism. The serum level of 25-OHD was measured by competitive protein binding assay using kits (Immunodiagnostic, Bensheim, Germany). Plasma levels from 75.1 to 250 nmol/l considered sufficient, from 50 to 75 nmol/l insufficient and <50 nmol/l as deficient [25]. HbA_{1c} was measured by the high performance liquid chromatography method (Bio-Rad Laboratories, Waters, MA, USA). The study was approved by the ethical 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 t-test. Differences in categorical variables were analyzed using the chi-square test. Differences in mean serum 25-OHD levels were tested with ANOVA. The relationship between continuous variables was assessed using coefficients of correlation. *p* value <0.05 indicates significance. The statistical analysis was conducted with SPSS version 23.0 for Windows.

Results

There were 286 patients with T1DM, 155 (54.2%) male and 131 (45.8%) female (Table 1). The mean age was 16.1 ± 2.1 years (12-19 years). The mean and median 25-OHD concentrations were 43.0 ± 22.4 and 37.7 nmol/l respectively. The prevalence of different vitamin D status were; 71.3% deficient, 19.9% insufficient and 8.7% sufficient (Table 1). Moreover, VDD was significantly more

Variable		Total	Vitamin D status			*p* value
			Deficient	Insufficient	Sufficient	
Number		286	204 (71.3)	57 (19.9)	25 (8.7)	
Age (years)		16.1 ± 2.1	16.1 ± 2.0	16.2 ± 2.5	16.1 ± 2.1	0.9
Gender	Male	155 (54.2)	121 (59.3)	26 (45.6)	8 (32.0)	0.01
	Female	131 (45.8)	83 (40.7)	31 (54.4)	17 (68.0)	
HbA1c (%)		9.3 ± 2.6	9.2 ± 2.5	9.6 ± 2.9	8.4 ± 2.7	0.5
25-hydroxyvitamin D (nmol/L)		43.0 ± 22.4	31.3 ± 9.1	61.5 ± 6.5	95.8 ± 16.8	<0.0001

Table 1: Characteristics of vitamin D status groups [mean ± standard deviation or number (%)]

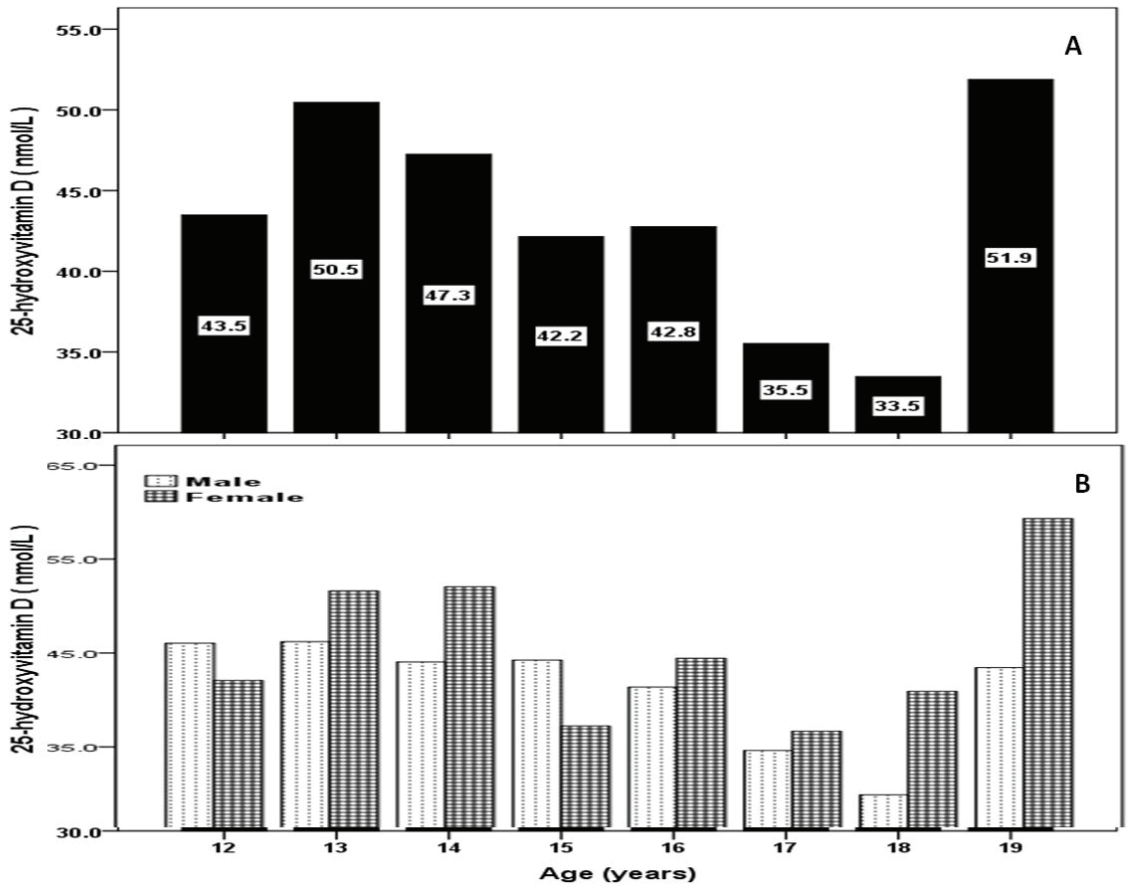

Figure 1: The mean of vitamin D concentration in correlation to age groups (A) and defined by gender (B)

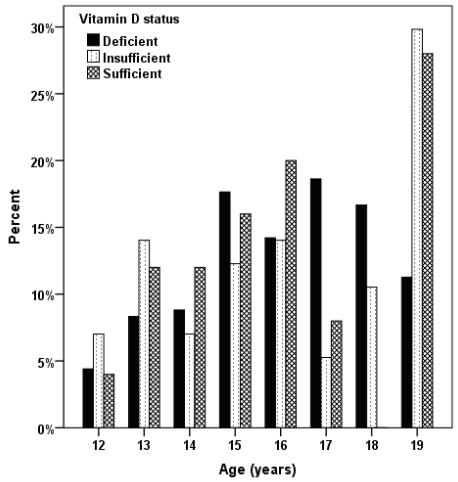

Figure 2: Vitamin D status in correlation to age groups

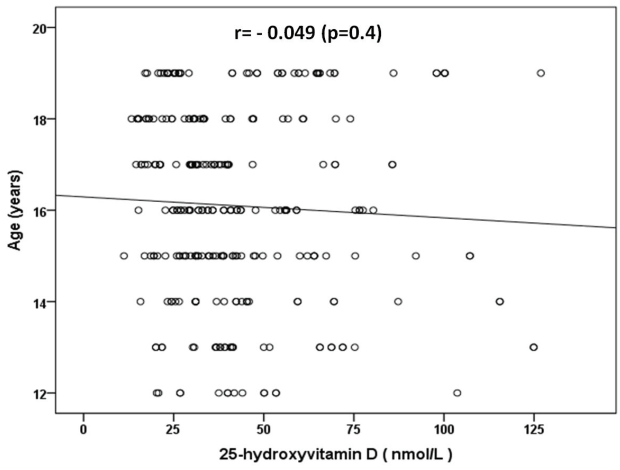

Figure 3: Correlation of 25-hydroxyvitamin D concentration and age

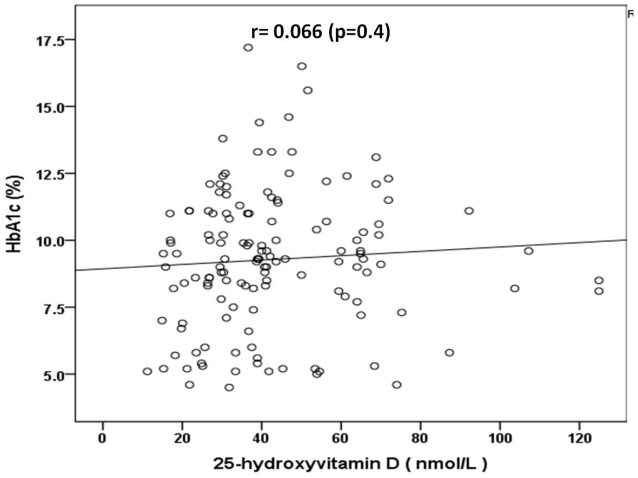

Figure 4: Correlation of 25-hydroxyvitamin D concentration and HbA1c

prevalent among males than females (54.2% *vs.* 45.8% respectively, p=0.01) with male to female ratio 1.2:1.0. In addition, there was no statistically significant different between HbA_{1c} and different vitamin D status groups.

The mean 25-OHD was lowest in the age 18 years patients whereas was highest at the age 19 years (33.5 and 51.9 nmol/l respectively) (Figure 1A). Moreover, males had lower mean 25-OHD than females across most of the age groups (Figure 1B) with vitamin D deficient was more prevalent at the age 17 years (Figure 2). 25-OHD concentration was non-significantly negatively correlated with age (r=- 0.049, p=0.4) (Figure 3) and non-significantly positively correlated with HbA_{1c} (r=0.066, p=0.4) (Figure 4).

Discussion

The prevalence of VDD in general population ranged from 44-95% [26-35]. We found the prevalence of VDD was high among T1DM subjects (71%) in Saudis residing in Jeddah. The result was lower than our previous report (97%) [23].

Number of studies have highlighted the high prevalence of VDD in patients with T1DM. A study in Australia by Greer et al. [16] found a three-times higher risk of having levels below 50 nmol/l in adolescents with newly diagnosed diabetes. Pozzilli et al. [19] from Italy examined 25-OHD levels in 88 children newly diagnosed with T1DM (mean age 14.6 years) and 57 healthy age and sex-matched controls. The concentration of 25-OHD was significantly lower in the diabetic adolescents. Another study measured 25-OHD levels in 128 children with established and newly diagnosed T1DM. A total of 24% had levels above 75 nmol/l, but 61% had levels between 52 to 72 nmol/l and 15% were deficient [17]. Bener et al. [18] compared 25-OHD levels in 170 age-, race- and sex-matched T1DM cases and healthy controls in Qatar. There was a high prevalence of deficiency/insufficiency in both the groups (90.6 *vs.* 85.3%), but it was significantly higher in the diabetic children. Janner et al. [36], of the 129 children and adolescents with T1DM, 78 (60.5%) were vitamin D deficient. A study in Saudi patients with T1DM showed that 71.1% were severely vitamin D deficient, 20.6% were moderately vitamin D deficient, 8.1% were mildly vitamin D deficient and 0.2% had normal 25-OHD levels [37]. Agha et al. [24] from Jeddah, Saudi Arabia showed that 48.2% of the diabetic patients were suffering from the condition of VDD. It was also evaluated that 28.8% of the diabetic participants were insufficient. However, 23% of the diabetic participants had normal levels of 25-OHD. In contrast, 25(OH)D levels were usually above 50 nmol/L in young adults at diagnosis of T1DM in Sweden [20]. These overall differences might be explained by the variability of the age of the subjects, duration of diabetes, glycaemic control and geographical environment [17].

In our study, we found statistical non-significant difference in age between vitamin D deficient diabetic patients and those with vitamin D insufficiency or sufficiency in concordance with other study [38]. It was also noted that the prevalence of VDD increased with age like other reports [38,39]. We found that VDD was statistically significant higher in males than in females in concordance with other study [38]. other study found that VDD was more prevalent in females [39]. Male patients may avoid sun exposure as misconception regarding harmful effects of sunlight.

Moreover, we found statistically non-significant difference in HbA_{1c} levels between vitamin D deficient patients and those with vitamin D insufficiency or sufficient subjects. We are not in line with Sgragg et al. [40] and Hypponen et al. [41] who found that serum 25-OHD levels were inversely correlated with HbA_{1c} in children with lower vitamin D concentrations.

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 sample confined to patients with T1DM but without comparable groups with small size sample.

Conclusion

In conclusion, the prevalence of vitamin D deficiency in Saudi young with T1DM is high. We recommend larger scale studies for detecting VDD in our population with T1DM and we suggest planning strategies to supplement our T1DM population with vitamin D.

Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2010 Jan;33 Suppl 1:S62-S69.
2. Cherian MP, Al-Kanani KA, Al Qahtani SS, Yesurathinam H, Mathew AA, et al. The rising incidence of type 1 diabetes mellitus and the role of environmental factors--three decade experience in a primary care health center in Saudi Arabia. J Pediatr Endocrinol Metab. 2010 Jul;23(7):685-695.
3. Eisenbarth GS. Update in type 1 diabetes. J Clin Endocrinol Metab. 2007 Jul;92(7):2403-2407.
4. Holick MF. High prevalence of vitamin D inadequacy and implications for health. Mayo Clin Proc. 2006 Mar;81(3):353-373.
5. M athieu C, Badenhoop K. Vitamin D and type 1 diabetes mellitus: state of the art. Trends Endocrinol Metab. 2005 Aug;16(6):261-266.
6. Hewison M. Vitamin D and the immune system: new perspectives on an old theme. Endocrinol Metab Clin North Am. 2010 Jun;39(2):365-379.
7. Baeke F, Takiishi T, Korf H, Gysemans C, Mathieu C. Vitamin D: modulator of the immune system. Curr Opin Pharmacol. 2010 Aug;10(4):482-496.
8. Thnc O, Cetinkaya S, Kizilgün M, Aycan Z. Vitamin D status and insulin requirements in children and adolescent with type 1 diabetes. J Pediatr Endocrinol Metab. 2011;24(11-12):1037-1041.
9. Kositsawat J, Freeman VL, Gerber BS, Geraci S. Association of A1C levels with vitamin D status in U.S. adults: data from the National Health and Nutrition Examination Survey. Diabetes Care. 2010 Jun;33(6):1236-1238.
10. Schwalfenberg G. Vitamin D and diabetes: improvement of glycemic control with vitamin D3 repletion. Can Fam Physician. 2008 Jun;54(6):864-866.
11. Kaur H, Donaghue KC, Chan AK, Benitez-Aguirre P, Hing S, et al. Vitamin D deficiency is associated with retinopathy in children and adolescents with type 1 diabetes. Diabetes Care. 2011 Jun;34(6):1400-1402.
12. Thrailkill KM, Jo CH, Cockrell GE, Moreau CS, Fowlkes JL. Enhanced excretion of vitamin D binding protein in type 1 diabetes: a role in vitamin D deficiency? J Clin Endocrinol Metab. 2011 Jan;96(1):142-149.
13. de Boer IH, Sachs MC, Cleary PA, Hoofnagle AN, Lachin JM, et al. Circulating vitamin D metabolites and kidney disease in type 1 diabetes. J Clin Endocrinol Metab. 2012 Dec;97(12):4780-4788.
14. Luong Kv, Nguyen LT, Nguyen DN. The role of vitamin D in protecting type 1 diabetes mellitus. Diabetes Metab Res Rev. 2005 Jul-Aug;21(4):338-346.
15. Mathieu C, Gysemans C, Giulietti A, Bouillon R. Vitamin D and diabetes. Diabetologia. 2005 Jul;48(7):1247-1257.
16. Greer RM, Rogers MA, Bowling FG, Buntain HM, Harris M, et al. Australian children and adolescents with type 1 diabetes have low vitamin D levels. Med J Aust. 2007 Jul;187(1):59-60.
17. Svoren BM, Volkening LK, Wood JR, Laffel LM. Significant vitamin D deficiency in youth with type 1 diabetes mellitus. J Pediatr. 2009 Jan;154(1):132-134.
18. Bener A, Alsaied A, Al-Ali M, Al-Kubaisi A, Basha B, et al. High prevalence of vitamin D deficiency in type 1 diabetes mellitus and healthy children. Acta Diabetol. 2009 Sep;46(3):183-189.
19. Pozzilli P, Manfrini S, Crinò A, Picardi A, Leomanni C, et al. Low levels of 25-hydroxyvitamin D3 and 1,25-dihydroxyvitamin D3 in patients with newly diagnosed type 1 diabetes. Horm Metab Res. 2005 Nov;37(11):680-683.
20. Littorin B, Blom P, Schölin A, Arnqvist HJ, Blohmé G, et al. Lower levels of plasma 25-hydroxyvitamin D among young adults at diagnosis of autoimmune type 1 diabetes compared with control subjects: results from the nationwide Diabetes Incidence Study in Sweden (DISS). Diabetologia. 2006 Dec;49(12):2847-2852.
21. Sedrani SH. Vitamin D status of Saudis III. Prevalence of Inadequate Plasma 25-Hydroxyvitamine D Concentrations. Saudi 0Med J. 1992;13:214-219.
22. Siddiqui AM, Kamfar HZ. Prevalence of vitamin D deficiency rickets in adolescent school girls in Western region, Saudi Arabia. Saudi Med J. 2007 Mar;28(3):441-444.
23. Aljabri KS, Bokhari SA, Alqurashi KA. Vitamin D Status in Saudi Patients with Type 1 Diabetes Mellitus. Open Journal of Endocrine and Metabolic Diseases. 2013;3:137-143.
24. Al-Agha AE, Ahmad IA. Association among Vitamin D Deficiency, Type 1 Diabetes Mellitus and Glycemic Control. J Diabetes Metab. 2015;6:594.
25. Hilger J, Friedel A, Herr R, Rausch T, Roos F, et al. A systematic review of vitamin D status in populations worldwide. Br J Nutr. 2014 Jan;111(1):23-45.
26. Hashemipour S, Larijani B, Adibi H, Javadi E, Sedaghat M, et al. Vitamin D deficiency and causative factors in the population of Tehran. BMC Public Health. 2004 Aug;4:38.
27. Du X, Greenfield H, Fraser DR, Ge K, Trube A, et al. Vitamin D deficiency and associated factors in adolescent girls in Beijing. Am J Clin Nutr. 2001 Oct;74(4):494-500.
28. Alagöl F, Shihadeh Y, Boztepe H, Tanakol R, Yarman S, et al. Sunlight exposure and vitamin D deficiency in Turkish women. J Endocrinol Invest. 2000 Mar;23(3):173-177.
29. Goswami R, Gupta N, Goswami D, Marwaha RK, Tandon N, et al. Prevalence and significance of low 25-hydroxyvitamin D concentrations in healthy subjects in Delhi. Am J Clin Nutr. 2000 Aug;72(2):472-475.
30. Sachan A, Gupta R, Das V, Agarwal A, Awasthi PK, et al. High prevalence of vitamin D deficiency among pregnant women and their newborns in northern India. Am J Clin Nutr. 2005 May;81(5):1060-1064.
31. Gannagé-Yared MH, Chemali R, Yaacoub N, Halaby G. Hypovitaminosis D in a sunny country: relation to lifestyle and bone markers. J Bone Miner Res. 2000 Sep;15(9):1856-1862.
32. Mishal AA. Effects of different dress styles on vitamin D levels in healthy young Jordanian women. Osteoporos Int. 2001;12(11):931-935.
33. Al Faraj S, Al Mutairi K. Vitamin D deficiency and chronic low back pain in Saudi Arabia. Spine (Phila Pa 1976). 2003 Jan;28(2):177-179.
34. Moussavi M, Heidarpour R, Aminorroaya A, Pournaghshband Z, Amini M. et al. Prevalence of vitamin D deficiency in Isfahani high school students in 2004. Horm Res. 2005;64(3):144-148.
35. Meddeb N, Sahli H, Chahed M, Abdelmoula J, Feki M, et al. Vitamin D deficiency in Tunisia. Osteoporos Int. 2005 Feb;16(2):180-183.
36. Janner M, Ballinari P, Mullis PE, Flück CE. High prevalence of vitamin D deficiency in children and adolescents with type 1 diabetes. Swiss Med Wkly. 2010 Sep;140:w13091.
37. Sambas OZ, Makeen AZ, Yamani AS, Alghamdi A, Makeen RZ. Prevalence of vitamin D deficiency in type 1 diabetes a control cross sectional study held in middle and western regions of Saudi Aarabia. Int J Adv Res. 2017;5(2):1321-1325.
38. Sonia HL, Ali M, Yousr D, Wiem B, Anies H, et al. Serum Vitamin D Level in Children with and without Type 1 Diabetes Mellitus. J Diabetes Metab. 2016;7:655.
39. Andadran N, Atelik N, Akaga H, Doayan G. Vitamin D deficiency in children and adolescents. J Clin Res Pediatr Endocrinol. 2012 Mar;4(1):25-29.
40. Scragg R, Holdaway I, Singh V, Metcalf P, Baker J, et al. Serum 25-hydroxyvitamin D3 levels decreased in impaired glucose tolerance and diabetes mellitus. Diabetes Res Clin Pract. 1995 Mar;27(3):181-188.
41. Hypponen E, Power C. Vitamin D status and glucose homeostasis in the 1958 British birth cohort: the role of obesity. Diabetes Care. 2006 Oct;29(10):2244-2246.