Risk Factors and Prevalence of Vitamin D Deficiency Among Iranian Women Attending Two University Hospitals

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Background: Several studies indicated that there is a high prevalence of vitamin D deficiency in Middle East countries.
Objectives: The aim of this study was to determine the prevalence and assess some risk factors of vitamin D deficiency among women attending our clinics in Tehran, the capital of Iran.
Patients and Methods: Five hundred and thirty-eight women aged 20-80 years were entered in this cross-sectional study from 2011 to 2012. Serum 25-hydroxy vitamin D levels were measured in all participants after recruiting their demographic and anthropometric data and past medical histories. Deficiency was defined as levels less than 35 nmol/L and classified as mild (≥ 25 nmol/L), moderate (12.5-25 nmol/L) and severe (≤12.5 nmol/L).
Results: The prevalence of vitamin D deficiency was 69%; mild, moderate and severe degrees were seen in %10.4, %38.3, and %20.3 respectively. Analysis of logistic regression shows that age (OR:0.96, CI: 0.93-0.97), menopause (OR: 0.44, CI: 0.21-0.99) and consumption of multivitamin supplements (OR: 2.67, CI: 1.4-5) were independent predictive factors for Vitamin D deficiency.
Conclusions: This study showed a high prevalence of vitamin D deficiency among Iranian women especially in reproductive ages.

Keywords: Vitamin D; Deficiency; Prevalence; Iran

1. Background

There is increasing evidence for the crucial role of vitamin D in maintaining human health (1). This vitamin is not only essential in processes such as bone development and muscle function, but also in modulation of the immune system and regulation of cellular differentiation and proliferation, leading to a probable etiologic role of deficiency states in serious conditions like diabetes and cancer (2). Several studies have shown a high prevalence of vitamin D deficiency in Middle East countries (3); the figures for suboptimal levels from several countries in this region were reported between 20% and 80% (4). In order to obtain a better estimation of the vitamin D status in Iran, studies encompassing different populations in various age and sex groups are required. Few studies have been performed on vitamin D status in this country, focused mainly on pregnant or elderly women (5, 6).

2. Objectives

The aim of this study was to determine the prevalence and assess some risk factors of vitamin D deficiency among women aged 20-80 attending our clinics.

3. Patients and Materials

This cross sectional study was conducted in Arash Women's Hospital and Cancer Institute of Tehran University of Medical Sciences in the capital of Iran between the years 2011 to 2012. The ethics institutional review board of Tehran University of Medical Sciences approved the study and informed consent was obtained from all participants. Among women admitted to our breast clinics for a breast symptom or breast cancer screening, 538 of those aged 20-80 years were consecutively entered in the study. Exclusion criteria included chronic illness, history of cancer, pregnancy or lactation, malabsorption syndrome or gastric disorders, metabolic bone disease, renal or hepatic failure, recent history of therapeutic vitamin D consumption or osteoporosis treatment. Those who consumed multivitamin supplements containing less than 100 units vitamin D per daily servings were not excluded. Participants completed a questionnaire including their anthropometric and demographic data, past medical history, parity and menopausal status, as well as their drug histories. Body Mass Index (BMI) was calculated from self-reported body height and weight. A 2 milliliters (mL) sample of blood was taken from all participants and

serum 25-hydroxy vitamin D (25-OHD) levels were determined by the electrochemiluminiscence method (Roche, Cobas e411, Ger many) by one specialist. Serum 25-OHD levels were defined as insufficient if less than 75 nanomoles per liter (nmol/L), deficient when 25- 50 nmol/L, and severely deficient in levels < 25 nmol/L (7). In order to have an adequate comparison with similar studies in Iran, we analyzed results a second time considering levels less than 35 nmol/L as deficient, and classified them as mildly deficient if between 25-35 nmol/L, moderately deficient when in ranges between 12.5-25 nmol/L, and severely deficient in levels less than 12.5 nmol (8, 9). Menopause was defined according to the subject's report if menstruation had stopped at least 12 months earlier. The sample size was calculated using Pass software. Considering a vitamin D deficiency prevalence of 75% according to previous studies and a power of 99%, the sample size was calculated as 517 participants

3.1. Statistics

Statistical analysis was performed using SPSS version 16.The Kolmogorov-Smirnov test (KS-test) was used to determine the normality of data distribution. Non parametric data are presented as median and data with normal distribution are presented as mean ± SD. Statistical significance of variables between groups were analyzed using Kruskal Wallis test, Mann-Whitney test and χ2 test. A multilinear regression analysis was performed to evaluate the association between serum 25-OHD (dependent variable) and age, BMI, parity, menopausal status, and consumption of multivitamin supplements (independent variable). P < 0.05 was considered statistically significant.

4. Results

Overall, 538 women were entered in the study. The mean age of the participants was 43.55 ± 1.1 years and their mean BMI was 26.7 ± 4.4 kg/m². Other demographic characteristics are shown in Table 1.

Table 1. Common Characteristics of the Participants [a]

	Mean	Min	Max	CI 95%
Age, y	43.5	16	83	42.5-44.5
BMI	26.6	16.03	43.34	26.37-26.97
Parity	2.4	0	14	2.30-2.60
Categorical Variable, No. (%)				
Menopausal status				
Menopause	140 (26)			
Premenopause	398 (74)			
Vitamin consumption				
Yes	108 (20.1)			
No	430 (79.9)			

[a] Abbreviation: BMI, body mass Index.

The median level of 25-OHD in all women was 19 nmol/L (IQR: 21.5l). Overall, 418 of the participants had vitamin D levels less than 50 nmol/L, the prevalence of vitamin D deficiency was therefore 78%; insufficiency was detected in 43 patients (8%), deficiency in 103 (19.1%) cases, and severe deficiency in 315 women (58.6.%). Following the classification used in Iranian studies as described in the method, the results would show mild, moderate and severe vitamin D deficiency in 10.4%, 38.3% and 20.3% (corresponding with 56,206 and 109 women in the three groups) respectively.

The prevalence of vitamin D deficiency in different age, menopausal and BMI groups is shown in Table 2. All variables were separately entered in the univariable model of logistic and were compared between vitamin D sufficiency and vitamin D deficiency group. The crude odds ratio of each was obtained (Table 3). The variables with P value less than 20% (5 variables), were included in the multivariate logistic model. A total of 5 variables with P value < 20% that were previously studied in univariate model were entered in the multivariate logistic model. These included: age, BMI, menopausal status, parity, consumption of multivitamin supplements.

Table 2. Prevalence of Vitamin D Deficiency in Different Age, Menopausal and Body Mass Index Groups[a,b]

	NL	Insuf	Def	Sev def
Age groups, y				
≤ 39	5 (2.9)	3 (1.7)	20 (11.4)	147 (84)
40-49	14 (6.8)	15 (7.3)	29 (14.1)	147 (71.7)
50-60	21 (17.8)	16 (13.6)	36 (30.5)	45 (38.1)
≥ 60	10 (25)	9 (22.5)	8 (20)	13 (32.5)
Menopause				
No	23 (5.8)	22 (5.5)	57 (14.3)	296 (74.4)
Yes	27 (19.3)	21 (15)	36 (25.7)	56 (40)
BMI group (kilograms/meters cube)				
<18.5	0	0	1 (11.1)	8 (88.9)
18.5-24.9	8 (6.8)	9 (7.6)	21 (17.8)	80 (67.8)
25-29.9	30 (9)	29 (8.7)	50 (15)	224 (67.3)
≥ 30	12 (15.4)	5 (6.4)	21 (26.9)	40 (51.3)

[a] Data are presented as No. (%).
[b] Abbreviations: NL, Normal (VitD > 35 ngr/mL); Insuf, Vitamin D insufficiency (35 < VitD < 25); Def, Vitamin D deficiency (VitD < 25 ngr/mL); Sev def, Severe vitamin D deficiency (VitD < 12.5 ngr/mL); BMI, body mass index.

In the univariable model, Vitamin D deficiency showed a significant inverse association with age, BMI, parity, menopause and consumption of multivitamin supplements (Table 3). A total of 538 samples were examined in this study and 5 variables were entered into logistic models. We used the Backward LR method for including variables and obtained adjusted odds ratio for significant

variables. All remaining variables in the final model were 4 variables include: 1-age (adjusted OR = 1.48) 2-consumption of vitamin supplement (adjusted OR = 72%) 3- BMI (adjusted OR = 87%) 4-menopausal status (adjusted OR = 25%).The results are given in Table 3. Among BMI, parity, age, menopausal status and consumption of multivitamin supplements, the 3 latter were independent predictive factors for vitamin deficiency.

Table 3. Association of Vitamin D Deficiency by Principal Characteristics: Adjusted and Unadjusted Results (Multivariable and Univariable Model) [a,b,c]

Variable	Crude OR	Adjusted OR
Age		
OR	0.93	0.96
95%CI	0.91-0.96	0.93-0.99
P Value	< 0.001	0.03
Consumption of multivitamin supplements		
OR	3	2.67
95%CI	1.6-5.5	1.40-5
P Value	< 0.001	0.003
Consumption of multivitamin supplements		
OR	1	1
Menopause		
OR	0.25	0.46
95%CI	0.14-0.46	0.21-0.99
P Value	< 0.001	0.04
Premenopause		
OR	1	1
BMI		
OR	0.9	0.93
95%CI	0.84-0.98	0.85-1.01
P Value	0.01	0.08
Parity		
OR	0.84	0.9
95%CI	0.73-0.91	0.7-0.1
P Value	0.02	0.5

[a] Abbreviation: OR, odd ratio; BMI, body mass index.
[b] Variables entered on step 1: age, menopaus al status, consumption of multivitamin supplements, parity, BMI.
[c] Variables entered on step 2: age, menopaus al status, consumption of multivitamin supplements, BMI.

5. Discussion

Hypovitaminosis D might present as a subclinical condition with hidden manifestations (4, 10), in which case the diagnosis would depend on the assessment of serum levels. Serum 25-OHD level is the best indicator of vitamin D status in individuals (7). Insufficient vitamin D may in-crease the risk of colon, prostate, breast and skin cancer as well as diabetes types I, multiple sclerosis and arterial diseases. The risk of rickets and other complications in infants increased with low vitamin D levels in the mother (4). Brandenbarg et al. demonstrated that low early-pregnancy vitamin D status was associated with more depressive symptoms in pregnancy (11). As well, the relationship between schizophrenia in adult men and vitamin D supply during the first year of life was shown in a study conducted by McGrath et al. (12).

In the present study, serum 25-OHD level of 538 women aged 20-80 years were measured and evaluated. The median level in all women (19 nmol/L) was in the severe range (< 25 nmol/L); the highest median belonged to women above 60 years of age.

Other studies in Iran also have shown vitamin D deficiency in their study groups. In a study performed among 1210 males and females in Tehran in 2004, the median level of vitamin D was 20.65 nmol/L and the prevalence of deficiency (vitamin D < 35 nmol/L) was 81.1%. Their results showed that 9.5% of the population had severe (< 12.5 nmol/L) and 57.6% moderate deficiencies (12.5-50 nmol/L) (8). High prevalence of hypovitaminosis D was detected as well in a research undertaken among 5232 men and women in five large cities of Iran with different weather conditions. Most of the cases were in moderate range, described as 12.5-25 nmol/L. The severe cases (< 12.5 nmol/L) comprised 15.4% of women under 50 years of age and the higher levels were seen in older cases (9). In another study including postmenopausal women in Tehran, the median level of serum vitamin D was 54.4 nmol/L, 37% had levels between 25-50 nmol/L and 5% below 25 nmol/L (13).

All these studies show low levels of vitamin D in their participants, but the levels are somewhat higher than ours and severe cases are less frequent. However, the first two studies involved both sexes and the latter involved older ages.

Hypovitaminosis D is becoming a problem in many developing countries (3). The mean vitamin D level among 321 premenopausal Saudi women was reduced at 27.5 nmol/L in one study (14), while a study in the Lebanese population demonstrated that 60% of 465 women aged 20-59 years had vitamin D levels below 25 nmol/L (15).

On the contrary to the study of Meddeb et al. (16), our results have demonstrated higher levels of vitamin D among menopausal women. Our finding of higher vitamin D levels in younger ages is in contrast with some existing facts in the literature (17). Although in our study the association between age and vitamin D deficiency is not substantially. We suppose that the differences seen in the diets of the old and young generation (healthier in the former) as well as the probably shorter duration of sun exposure in the latter because of their kind of indoor recreations in comparison with the older houses with yards are the probable causes; nonetheless more studies are required to investigate the contributory factors.

The main sources of 25-OHD are exposure to sunlight and dietary intake. Tehran is located in 36° 21"N with 3022 sunny hours per year, which seems good conditions for sun exposure (9). At first glance, it seems that the major cause for these very low levels of vitamin D in Iranian women is the highly covered type of dressing in Iran, but this would not rationalize the low vitamin status in Iranian men (8, 9). The study conducted in 5 large cities in Iran also showed better conditions in Booshehr despite the highly covered dresses and face-covering masks of women in that area (9). Other possible causes of reduced vitamin D synthesis in the skin in our area could be dark skin color, indoor lifestyle and air pollution (2); lack of dietary fortification with vitamin D multivitamin supplements might as well aggravate the situation in Iranian women (18).

This study was performed on vitamin D status specially on women .We did have some limitations in our work; detailed diet habits of the participants as well as rates of sun exposure were not considered in the method because of practical difficulties. On the other hand, blood samples were taken regardless of season or weather conditions whereas this could influence the serum vitamin D levels. As well, the weight and heights were self-reported in more than half of cases.

This study shows a very high prevalence of vitamin D deficiency in a sample of Iranian women, especially those in reproductive ages. We would recommend fortification of daily food with vitamin D and encouraging women to spend more time in direct sunlight.

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Authors' Contributions

Sadaf Alipour: Designing the study, writing the manuscript, Patient's examination. Azin Saberi: Patients examination. Akram Seifollahi: Supervising in laboratory tests, performing Laboratory tests. Nooshin shirzad: Patients examination. Ladan Hosseini: Analyzing the data, and writing the manuscript.

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