Are female patients and the elderly at a higher risk for Vitamin D deficiency?

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Abstract

Introduction: Vitamin D deficiency is common in healthy Saudi adults. Studies have reported that vitamin D deficiency is more prevalent among females and the elderly.

Objectives: To assess the prevalence of vitamin D deficiency at both gender and age groups

Method: Cross sectional study of 646 adult Saudi patients

Result: 559 participants out of 646 had vitamin D deficiency (86.5%) (<50nmol/l), with more deficiency among males than females (89.3% vs. 84.7%), however the proportion of females who had severe deficiency (<25 nmol/l) was higher than males (40.7% vs. 32.4%) with P value = 0.006.

Conclusion: In contrast to current concepts, this study showed that male and younger patients had higher rates of vitamin deficiency; the exact reasons need to be carefully sought.

Key words: Vitamin D, deficiency, Age, male, female

Introduction

Vitamin D deficiency is a worldwide problem affecting more than one billion people[1] in different countries, mainly those with temperate climates that receive inadequate sunshine, in the middle east where females fully or partially cover their bodies [2-5], and in developed countries where vitamin D fortification has been implemented[6].

According to some studies, the groups that are at risk of vitamin D inadequacy are the following; breastfed infants, older adults, people with limited sun exposure, people with dark skin, people with inflammatory bowel disease and other conditions causing fat malabsorption, and people who are obese or who have undergone gastric bypass surgery[2, 3]

Vitamin D, also known as the sunshine vitamin, can be produced in the body with mild sun exposure or consumed in food or supplements. Vitamin D plays an important role in bone metabolism, when deficiency leads to secondary hyperparathyroidism, increased bone loss and osteomalacia[7-9]. In addition to bone metabolism, vitamin D deficiency is associated with increased cardiovascular risk, mood disorder and depression, type 1 and 2 diabetes mellitus and other health problems[10-12]. The major source of vitamin D for most humans is cutaneous synthesis by exposure to sunlight ultraviolet B radiation which contributes more than 90% to the serum concentration of vitamin D[13, 14].

Vitamin D deficiency affects both genders, at all age groups[15], however there is no consensus between studies regarding which gender or age group is affected more than the other[16-20].

The aim of this study is to assess the variation of vitamin D deficiency between genders and age groups among an adult Saudi population.

Methods

A cross-sectional study of 646 consecutive adult patients (age >18 years) who came for a check-up and other reasons at the Family Medicine Center (Al Yarmouk) at King Abdul-Aziz Medical City for National Guard in Riyadh during the period from September 1st until 30th of December 2014.

Inclusion criteria:
Adult (18 years and above) Saudi patients of both genders who were not a known case of vitamin D deficiency and not on vitamin D supplement.

Exclusion criteria:
Those with a history of any of the following problems: parathyroid gland disease, hyperthyroidism, liver disease, renal disease, epilepsy, cancer, inflammatory bowel disease, malabsorption, celiac disease, gastric bypass, bowel surgery, pregnant or lactating women, or if patient on any medication can affect vitamin D level (such as Calcium or vitamin D supplement), anticonvulsant, osteoporosis drug therapy, chemotherapy and anti-tuberculosis (isoniazid, rifampin).

Vitamin D level testing:
A serum sample of 5ml was obtained from each participant to assess the serum 25(OH) D concentration. Serum 25-OH- vitamin D2/D3 was measured by the LIAISON 25 OH vitamin D, total assay use Chemiluminescent immunoassay (CLIA) technology.

Vitamin D deficiency cut-off is the subject of many debates. The Endocrine Society, the Institute of Medicine (IOM), and the World Health Organization (WHO) have different definitions[21, 22]; according to IOM and WHO, a serum 25(OH)D level above 50 nmol/L is adequate for at least 97.5% of the population[22, 23].

This study used the cut-off value of <50 nmol/L for vitamin D deficiency, because King Abdulaziz Medical City laboratory has recently changed the cut-off from <75 nmol/l to <50 nmol/l by adopting the IOM definition.

Vitamin D deficiency (severe) is considered when the total 25-OH Vitamin (D3 + D2) is <25 nmol/l (10 ng/ml), suboptimal (insufficiency or minimal to moderate deficiency) when the level is 25-50 nmol/l (10-20 ng/ml)[22].

Data was analyzed using the Statistical Package for Social Science (SPSS) version 20., P value of < 0.05 is considered significant.

Results

646 patients were included in the study; 253 (39.2%) were males and 393 (60.8%) were females. Mean age was 54.2±13.1 for all participants, and age for males was 50.9±11.7, while it was 56.3±13.5 for females (P=0.000). Table 2 shows the age, gender distribution and Vitamin D levels. The highest age group was for those ≤ 50 years (47.4%) and they were equally distributed according to gender. Age group of >70 years was the lowest presented (15.0%) and females were more than males (18.1% vs 10.3) in this age group.

The mean vitamin D level is 33.6±17.2 nmol/l for all patients, and the range is (10.0 -116.0 nmol/l). The mean for males and females was almost similar (33.4±14.2 nmol/l for males vs. 33.8±18.9 for females). 559 (86.5%) of the participants had Vitamin D deficiency (<50nmol/l). There was a statistical difference (P=0.006) in vitamin D deficiency (<50 nmol/l) between genders with males having a higher proportion than females (89.3% vs. 84.7%), however the proportion of females who had severe deficiency (<25 nmol/l) was higher than males (40.7% vs. 32.4%). However when the prevalence was recalculated using the higher cut-off of <75 nmol/l, it was 97.1%.

Among the age group of ?50 years, 148 (96.1%) females had vitamin D deficiency (<50 nmol/l) compared with 141 (92.9%) males, and had more severe vitamin D deficiency (<25 nmol/l) compared with males (54.5% vs. 32.9%).

The odds ratio (OR) for females in this age group is 1.9 times to have vitamin D deficiency (<50 nmol/l) more than males (Table 3), while for the age group of 50 - 70 years, the OR of females was 0.5 and for the age group >70 years, the OR was 0.3 and lastly, the OR for females in all age groups was 0.66.

The OR for younger (<50 years) female to have severe Vitamin D deficiency (<25 nmol/l) is 2.5, while it was 0.5 in all age groups.

Younger patients (<50 years) had the lowest level of vitamin D, mean is 29.2 + 13.5, while age groups (50-70 years) had higher levels, 35.7 + 18.9 and the highest level 42.1 + 19.2 for those >70 years old. This result is reemphasized by a significant positive correlation between age and vitamin D levels (r=0.308 and P=0.000), with more deficiency among younger age groups and Figure 1 shows a positive relationship between vitamin D level and age.

Discussion

In spite of the fact that Saudi Arabia is located in 18o latitude and sunshine is adequate all year round [24], vitamin D deficiency among the participants of this study was high (86.5%), which was supported by many reports from Saudi Arabia[2-4, 25-31] and other countries [3, 20, 32-38]. However, some reports found that lifestyle may influence vitamin D level more than the latitude[18].

Recently, the National Guard hospital laboratory has changed the cut-off of vitamin D deficiency from <75 nmol/l to <50 nmol/l, adopting the IOM definitions. The use of different cut-off levels would significantly change the prevalence of vitamin D deficiency. Results from studies

that used the cut-off of <50 nmol/l documented a congruence of bone beneficial effects at that level but not at <75nmol/l[3, 39].

Females were at lower risk for vitamin D deficiency than males (OR = 0.66), a finding that few studies reported[16, 20]. However, this finding contradicts the notion that a female is at more risk for vitamin D deficiency[18, 28, 29, 31, 37, 40].

Many studies supported this study that younger females were more severely vitamin D deficient than males (OR = 2.5)[25, 27, 30]. Nabi et al discussed various factors that contribute to female vitamin D deficiency in Saudi Arabia, like, housing design, religious rules, lifestyle and dark skin color[25].

Many studies reported that age is an independent predictive risk factor for vitamin D deficiency[5, 29], and unlike other reports, this study documented that vitamin D deficiency was associated with younger age. Few studies supported this finding [18, 26, 37, 40] however, other studies found that vitamin D deficiency was more among elderly people. Moreover, elderly are at risk for vitamin D deficiency[16, 18, 28, 29].

A number of factors are associated with vitamin D deficiency, these are: low vitamin D intake, racial (dark skin), high BMI, young age group, low salmon consumption, shorter duration outdoors, and higher coffee consumption[40].

In this study, vitamin D level was found to be increasing with age, contradicting other reports. Several studies found that serum 25(OH)D level decreased with increasing age[4, 40]. This may be attributed to the fact that aging decreased the capacity of the skin to produce 7-dehydrocholesterol[41]. However, there were also reports that support the finding of our study, documenting that younger individuals had a lower serum 25(OH)D level compared to older subjects[41-43]. This discrepancy between studies may be due to other factors like socio-cultural factors, such as a tendency to work indoors and avoidance of sunlight exposure in the younger generation. However, the reason for the higher level of serum 25(OH)D and age in this study was not known.

Vitamin D plays an important role in diverse physiological functions, in addition to its role in bone homeostasis. Vitamin D deficiency can be serious if untreated, because it can lead to many health problems. These include rickets, osteomalacia, and osteoporosis that can lead to pathological bone fracture and disability [1, 14, 44].

Vitamin D deficiency is related also to all the elements of the metabolic syndrome, hypertension, obesity, insulin resistance and glucose intolerance. Many studies demonstrated the effect of vitamin D as an immune-modulator on a variety of autoimmune diseases such as multiple sclerosis (MS), rheumatoid arthritis (RA), inflammatory bowel disease and systemic lupus erythematosus (SLE)[45, 46],

Vitamin D deficient patients may present with one or more of these symptoms: bone pain, muscle cramps, weakness and tingling. They may present with symptoms related to specific diseases that are caused by vitamin D deficiency[24, 44-49].

Arabs in general, including the Saudi Arabian population have dark skin, which may be a contributing factor for high prevalence of vitamin D deficiency. Experimental studies showed that individuals with darker skin pigmentation had a lower 25(OH)D level after UVB radiation exposure[50, 51]. The effect of skin color was also shown in a study in the United States, where the prevalence of vitamin D deficiency varies between white and black populations, and showed that hypovitaminosis D was observed in 11.7% among white American people vs 43.1% in black[34, 35].

Avoidance of sunlight in summer is probably the main factor contributing to vitamin D deficiency in Saudi Arabia[52, 53].

There are limitations of the study, such as; the participants may not represent the whole Saudi population community because it was conducted in one family medicine centre, with participants who share common features. The confounder factors were not studies which may affect the results if included. Finally the reasons for vitamin D deficiency were not sought.

Conclusion

The result of this study is contradicting the current notion, where females and the elderly are considered independent risk factors for vitamin deficiency. This study found that males and young individuals are at a higher risk for vitamin D deficiency. The exact reasons for these findings need to be carefully studied.

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