Vitamin D status among population of Qassim Region, Saudi Arabia

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Abstract:

Objectives: The objectives of this study were to assess serum 25OHD level among healthy Saudi population of Qassim region, besides socio- demographic characters, dietary habits, sun exposure and common symptoms of vitamin D deficiency were also evaluated.

Subjects and Methods: One hundred and eighty healthy males and females subjects above the age of 18 years were randomly selected from five primary health care centers of Qassim region. A predesigned structured questionnaire was administered by the doctor working in Primary Health Care Center and blood sample was obtained for measuring vitamin D (serum 25 OHD) level. Vitamin D sufficiency was defined as serum level of 25 OHD 30ng/ ml or above. A level ranging 20 to 29 ng/ml was considered as vitamin D insufficiency, whereas below 20ng/ml as vitamin D deficiency.

Results: Out of 180 study participants, 51(28.3%) subjects were vitamin D deficient, 71 (39.4%) were vitamin insufficient and 58 (32.2%) had normal vitamin D level. Commonest symptom of vitamin D deficiency was bone pain (20%) and fatigue (11.1%).

Conclusion: Vitamin D inadequacy is a major public health problem in Saudi population. The prevalence of vitamin D deficiency/ insufficiency among healthy Saudi population residing in Qassim region is 67.8%. If the issue is not urgently addressed it could lead to serious health consequences.

Key Words: Vitamin D, Qassim Region, Saudi Arabia

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Introduction

It has been estimated that almost one billion people in the world suffer from vitamin D deficiency or insufficiency. [1] Despite abundant sunshine in the Middle East, allowing vitamin D synthesis all year round, there is low level of vitamin D among the residents of the area. [2] While scientists know for decades that vitamin D deficiency leads to bone diseases like rickets & osteomalacia, recently they have found connections between low vitamin D levels and a wide range of other illnesses, such as diabetes, different type of cancers, autoimmune diseases, psychological disorders, cardiovascular diseases, hypertension, lumbago, pre-eclampsia. [3, 4]

Human body manufactures vitamin D through exposure to sunlight, but some of the sunniest parts of the world have the highest rates of vitamin D deficiency. Several factors have contributed to dangerously low vitamin D blood levels among people in the Saudi Arabia. Due to extreme of temperature people mostly remain inside. The women folks largely stay at home besides the Muslim women wear clothes which apart from face and hands cover all other parts of their bodies. Even if they go out, opportunity to expose their bodies in sunlight is not available due to "Abaya/ Hijab" (a head to toe covering which only has small openings for the eyes). [5] The old and weak also have no exposure to sunlight as they spend almost all of their time inside the houses. Moreover, the dietary habits are also blamed as food with high level of vitamin D level is not being consumed. [6] The color of skin of Saudi population varies from light brown to dark. Dark pigmentation has been found to decrease skin synthesis of vitamin D because ultra violet light cannot reach the appropriate layer of the skin. [7]

Subjects and methods

Objectives

The objective of our study was to evaluate serum vitamin D level among healthy population, both males and females of Qassim Region, Saudi Arabia. We also assessed the demographic features, sunlight exposure, dietary habits and symptoms of vitamin D deficiency among study participants.

Methodology

We conducted a Cross sectional study among normal healthy subjects accompanying the patients in urban and rural Primary Health Care centers of Qassim region. The duration of study was six months, from December 2010 to May 2011. Five PHCs were randomly selected, which were:-

a. King Khalid Primary Health Care Centre (Rural)
b. Janoub Unizah Primary Health Care Centre (Rural)
c. Salhia Primary Health Care Centre (Rural)
d. Muntazh Primary Health Care Centre (Urban)
e. Al-Rabwa Primary Health Care Centre (Semi urban)

From these Primary Health Care Centers, one hundred and eighty healthy subjects, both males and females above the age of 18 years were randomly selected who were accompanying the patients. After taking consent from the individuals, a predesigned structured questionnaire was administered and filled by the doctor working in Primary Health Care Centers. Following subjects were excluded from the study:-

a) Age less than 18 years (age of consent)
b) Non resident of Qassim region and expatriates
c) Subjects who were not willing to participate in the study
d) Subjects who were taking vitamin D ,Calcium with vitamin D or Multivitamins
e) Individuals who suffer from chronic diseases that affect the absorption of vitamin D such as chronic liver disease, kidney disease and other chronic diseases
f) Subjects who are taking drugs that could influence vitamin D status as steroids and anti epileptics

Questionnaire recorded demographic characters, sunlight exposure, dietary habits; symptoms of vitamin D deficiency and use of sun block creams.

We measured serum Vitamin D level of all study participants, (25- Hydroxy Vitamin D Enzyme Immunoassay for the quantitative determination of 25-hydroxyvitamin D in

serum- EIA). Lab assay were performed according to manufactures' instructions. We classified participants as **normal**, **vitamin D deficient** and **insufficient** as per recently available literature [9]:-

1. **Normal:** 25-Hydrxyvitamin D (25 OHD) 30 ng/ml or above
2. **Vitamin D Insufficient:** 25-Hydrxyvitamin D (25 OHD) 20- 29 ng/ ml
3. **Vitamin D Deficient:** 25-Hydrxyvitamin D (25 OHD) below 20 ng/ml

We assessed the association between vitamin D status of urban and rural population and healthy individuals of different age group and genders. We analyzed the data by SPSS version 15.

The study was approved by the Research and Ethical Committee of the College of Medicine, Qassim University, Saudi Arabia.

Results

A total of 192 subjects agreed to participate in the study, but 12 of the participants refused to give blood sample, so they were excluded and 180 subjects were included in the study. Among them 83 (46.6%) were males and 97 (53.8%) were females. A total of 135(75%) participants were from urban areas and 45(25%) belong to villages or semi urban regions.

Mean age of study participants was 40.8 years with range 19 to 72 years. Mean age for males (N=83) was 43 years and mean age for females (N=97) were 38.5 years,(most of the males belonged to 45 to 64 year age group and females were 35 to 54 years age).

Most (88.3%) of study participants were married, rest of them were unmarried, or divorced. Males were mainly invc office or field work and females were mostly house wives or not working. Basic demographic characters of study population are shown in Table: 1.

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In the study 135 study participants were urban residents with mean level of serum vitamin D level 26.6 ng/ ml. 45 study participants were rural / semi urban, with mean level of serum vitamin D level 28.95 ng/ml.

Mean level of serum vitamin D among female study participants 23.02 ng/ ml with range 13 to 62 ng/ml. whereas mean level of serum vitamin D level of male study participants was 32 ng/ml with range 11 to 100 ng/ ml. Interestingly out all subjects, only one female was using sun block cream. Average daily sun exposure and vitamin D status of study participants both male and females is shown in Table: 2

The study subjects who were consuming fish, eggs, liver and cheese were having normal vitamin D level. Persons who were not consuming these food items were insufficient or deficient levels of vitamin D. (Table: 3)

Commonest symptom was bone pain (20% subjects), followed by fatigue (11.1% subjects). Symptoms of Vitamin deficiency / insufficiency are shown in Table: 4

Vitamin D status of the study participants & average daily sunlight exposure and food consumption rich in vitamin D during last one year is shown in Table 5.

Discussion

Studies in the past indicated that vitamin D (25OHD) level in the ethnic Saudi Arabian population was low but no study has evaluated the level of vitamin D among Saudi population living in Qassim region. Vitamin D is critically important for the development, growth and maintenance of healthy bones, from birth to death. In Saudi Arabia vitamin D deficiency is important public health problem affecting individuals in all stages of life. Correlation had been found by many research studies between low vitamin D levels and a wide range of illnesses, including cancer, autoimmune diseases and cardiovascular disorders. [8]

The most sensitive measure of vitamin D status is concentration of 25- hydroxyvitamin D in serum. There is no absolute consensus on the cut-off value between a normal and low level of vitamin D, but most experts now recommend the **normal** level of 25-hydroxyvitamin D (25OHD) to be 30 ng/ml or more. They have also agreed to define vitamin D **insufficiency** as a level between 20-29 ng/ml and **deficiency** when level is less than 20 ng/ml. We adopted the same criteria for our study. [9]

Results of our study indicate that 51 subjects (28.3%) were having deficient Vitamin D level and 71 (39.4%) were insufficient. Fifty eight study (32.2%) subjects have normal value of 25- hydroxyvitamin D (25OHD) in their serum.

Result of our study also shows that study subjects who exposed to sunlight for longer duration of time has adequate level of vitamin D which is statistically significant. Similarly rural / semi urban population has more chances of sun exposure and their vitamin D status was better than urban study subjects.
Mean serum vitamin D level of males was much higher than females. As males work more outdoor than females and have high chances of sun exposure. Interesting finding of our study is that out of all study subjects only one female was using sun block cream.

Study subjects who were consuming fish, liver, milk and cheese had significantly higher level of vitamin D. But those who consumed eggs and margarine had no significant effect on serum vitamin D levels, although egg yolk is rich source of vitamin D.

Globally, South Asia & Middle East are most affected regions where population is insufficient or deficient levels of vitamin D. Avoidance of sun exposure, dietary habits, absence of vitamin D fortification, dress code, dark skin pigmentation, are the main factors associated with low 25(OH) D levels in this area. (10)

The result of our study is similar with other studies carried out in different regions Saudi Arabia. A cross sectional study was carried out among two hundred healthy men living in Eastern Province of Saudi Arabia at King Fahad hospital of the University Al Khobar indicated that prevalence of Vitamin D deficiency was between 28% to 37%. (11)

In a study carried out by King Abdulaziz University, Jeddah, total of 1,172 healthy Saudi women living in Jeddah area were randomly selected and studied. About 80% Saudi women studied exhibited vitamin D deficiency. The study concluded that vitamin D deficiency is highly prevalent in Saudi women and largely attributed to poor exposure to sunlight, poor dietary vitamin D supplementation and obesity. (12)

Another study conducted in Armed Forces Hospital, Riyadh to investigate vitamin D deficiency as a cause for idiopathic chronic low back pain among 360 patients (90% women and 10% men). The study concluded that vitamin D deficiency is a major contributor. Finding of the study showed that 83% of the study patients had an abnormally low level of vitamin D. (14)

Studies in the sunniest areas as Middle East as Saudi Arabia, United Arab Emirates and Lebanon indicates 30 to 50% of children and adults had 25(OH)D under 20 ng/ml and similar studies indicated that 73% of women and 80% of their infants were vitamin D deficient at the time of birth in middle east.(15)

Avoidance of sunlight might be a contributing factor to the high prevalence of low vitamin D in Saudi population. The cultural practice of wearing long sleeves and head cover among males and veil/ Abaya/ Hijab and extensive clothing among females may be contributing factors.

Limitations of the study

The study sample of 180 healthy individuals was small and the fact that blood samples were collected only once during the month of March to May. It would be useful if study subjects were evaluated at different times of the year to study the seasonal variation.

Recommendations

1. Public education and awareness should be made about the importance of sparing time for sun exposure for the sake of obtaining vitamin D.
2. Health education at Primary Health Care centers regarding consumption of diet rich in vitamin D as fish, liver, cheese, margarine and fortified milk etc should be emphasized.
3. Studies indicate that sunlight exposure of arms and legs for 30 minutes without sunscreen to could provide daily need of vitamin D to the human body. It depend skin pigmentation as dark pigmentation has been found to decrease skin synthesis of vitamin D.

Conclusion

In conclusion, even though not representative of all Saudi population living in the country, our study suggests that low vitamin D level is prevalent in apparently healthy Saudi population living in Qassim region. There is an urgent need for public awareness about the role of vitamin D in health and to avoid the complications of vitamin D insufficiency and deficiency.

Table: 1
Demographic Characters of Study Participants

	Males	Females	Total / Percent
Number	83(46.1%)	97(53.9%)	180
Housing			
City	59(43.7%)	76(56.3%)	135
Village	24(53.3%)	21(46.7%)	045
Total	83(46.1%)	97(53.9%)	180
Age Group			
18-25 years	09	10	19 (10.6%)
26-34 years	13	21	34 (18.9%)
35-44 years	14	25	39 (21.7%)
45-54 years	22	22	44 (24.4%)
55-64 years	19	09	28 (15.6%)
65-74 years	06	08	14 (07.8%)
Above 75 years	00	02	02 (01.1 %)
Total	83(46.1%)	97(53.9%)	
Educational level (Highest level achieved)			
Primary or less	14	29	43(23.9%)
Middle	22	16	38(21.1%)
Intermediate	27	18	45(25.0%)
Graduate	20	27	47(26.1%)
Postgraduate	00	07	07(03.9%)
Marital Status			
Married	77	82	159(88.3%)
Widow	01	06	07 (03.9%)
Unmarried	05	09	14(7.8%)
Occupation/ work			
Office(indoor)	22	08	30(16.7%)
Field (outdoor)	24	04	28(15.6%)
Both	28	02	30(16.7%)
House wife/ not working	03	77	80 (44.4%)
Others	06	06	12(06.7)

Table No: 2
Average daily sunlight exposure and vitamin D status

Average Daily sunlight exposure in last year	Vitamin D Status						Total	P value
	Deficient (Up to 20 ng/ml)		Insufficient (21 to 29 ng/ml)		Normal (30 ng/ml & above)			
	Male	Female	Male	Female	Male	Female		
Less than 5 Minutes/ Day	15	10	16	8	8	6	63	0.015
5-15 Minutes/ Day	12	7	18	16	15	12	80	
15-30 Minutes/ Day	3	4	4	3	8	1	23	
More than 30 minutes/Day	2	-	3	-	8	1	14	
Subtotal	32	21	41	27	39	20	180	
TOTAL	**53**		**68**		**59**		**180**	

Table: 3

Correlation between consumption of vitamin D rich food & vitamin D status - both sexes

	Normal 25 OHD 30 ng/ml or above		Insufficient 25 OHD 20-29 ng/ml		Deficient 25 OHD Below 20ng/ml		Total	P value
Gender / Variables	Males	Females	Females	Males	Females	Males		
Consumption of milk /day	>2 cup/wk		1 – 2 cup/wk		Not Taking			0.043
	1	2	67	47	15	48	180	
Consumption of eggs/week	>2 eggs/wk		2 eggs/wk		Nothing			0.073
	15	13	11	11	57	73	180	
Consumption of fish /week (one serving)	>2 /wk		1 - 2/wk		No Taking			0.040
	1	3	32	60	50	34	180	
Consumption of Liver/week(one serving)	>2 /wk		1 - 2/wk		Not Taking			0.043
	7	5	39	47	37	45	180	
Consumption of Cheese/week (one serving)	>2 /wk		1 - 2/wk		Not Taking			0.430
	18	21	53	65	12	11	180	
Consumption of Margarine/week (one serving)	>2 /wk		1 - 2/wk		Not Taking			0.950
	3	7	48	38	33	51	180	

P values indicate the statistical significance of differences between item of food consumption and level of 25 OHD in both sexes.

Table No: 4
Vitamin D status and Symptoms of vitamin D deficiency/ insufficiency

	Bone Pain	Muscle weakness	Joint pain	Fatigue	Low mood	Two or more	Total	No Symptom
Deficient (Up to 20 ng/ml)	18	8	6	10	6	25	73	4
Insufficient (21 to 29 ng/ml)	10	6	6	5	6	20	53	9
Normal (30 ng/ml and above)	8	4	4	5	3	7	31	10
TOTAL	36	18	16	20	15	52	157	23

Table: 5
Vitamin D level versus Sun exposure and Food Consumption Rich in Vitamin D (n=180)

Vitamin D level	Sun exposure			Food Consumption Rich in Vitamin D		
	Poor	Average	Good	Poor	Average	Good
11-15 ng/ml	03	04	6	1	5	9
16-20 ng/ml	02	05	18	1	7	16
21-25 ng/ml	06	6	21	5	11	20
26-30 ng/ml	8	11	23	1	15	29
> 30 ng/ml	14	15	38	4	17	39
Sub total	33	41	106	12	55	113
Total respondents	180			180		

P value = 0.001

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