Prevalence of Vitamin D Deficiency in Nurses at the Royal Irrigation Hospital

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Background: *Vitamin D deficiency can cause organ dysfunction in the body, especially the bones and affect calcium metabolism. It is the main cause of osteoporosis and may increase the risk of hip fracture later in life. Furthermore, new studies show that vitamin D deficiency can increase the risk of many chronic illnesses, including common cancers, as well as autoimmune, infectious, and cardiovascular disease.*
Objective: *To determine the prevalence of vitamin D (25(OH)D) deficiency and the factors influencing vitamin D status in relation to serum 25-hydroxy vitamin D, for example: daily sun-protective clothing, food and milk intake, sun exposure, sunscreen usage and bone mineral density (BMD).*
Material and Method: *The present study was approved by the ethics committee of the Royal Irrigation Hospital. Blood samples were collected from 217 nurses working at the Royal Irrigation Hospital. Serum 25(OH)D and bone density were measured by HPLC and DEXA, respectively. Drugs intake, lifestyle, and dietary habits were assessed via a questionnaire. Demographic data were analyzed using descriptive statistics and the correlations between factors and vitamin D level were analyzed using Chi-square.*
Results: *The prevalence of hypovitaminosis D was 95.4%. Sunscreen usage was associated with deficiency ($p < 0.05$).*
Conclusion: *The authors found a high prevalence of hypovitaminosis D in nurses at the Royal Irrigation Hospital.*

Keywords: *Nurse, Vitamin D, Prevalence*

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Vitamin D deficiency can cause organ dysfunction in the body. In children, it can cause growth retardation and skeletal abnormalities. Vitamin D level is related to bone density a low vitamin D level can cause osteopenia and osteoporosis in adults and may increase the risk of fractures[1,2]. New studies have indicated that vitamin D deficiency may also increase the risk of many chronic diseases such as cardiovascular disease, autoimmune disease, and cancers[3-9]. Sunlight, diets, and vitamins are sources of vitamin D in humans.

In Thailand, many medical personnel and healthcare workers believe that people receive adequate sunlight exposure, which would therefore produces a sufficient vitamin D levels in Thai people. However, because of fashion and lifestyle trends such as avoiding the skin-darkening effects of sunlight and using sunscreen for prevention of melanoma. Thai people may lack sufficient sunlight exposure, which may result in hypovitaminosis D[10-14]. This could especially be true for those who work indoors during the day such as nurses, which is why they were selected as the sample group in the present study.

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Material and Method

This cross-sectional study was conducted in Nonthaburi and included 217 volunteer nurses working at the Royal Irrigation Hospital. Volunteers were excluded from the present study if they were pregnant, had renal or thyroid disease, or had taken any medication known to influence vitamin D such as phenytoin, carbamazepine, and rifampicin within the previous three months. The present study was approved by the ethics committee of the Royal Irrigation Hospital and informed consent was obtained from all volunteers. Demographic data for each volunteer were recorded on a questionnaire and included age, sex, height, weight, body mass index, blood pressure, and smoking

history. Estimation of food and milk intake was also performed. Blood samples were collected for testing of creatinine and 25(OH)D. Serum 25(OH)D was analyzed by LC-MS/MS with an Agilent 1200 Infinity liquid chromatograph (Agilent Technologies, Waldbronn, Germany) coupled to a QTRAP® 5500 tandem mass spectrometer (AB SCIEX, Foster City, CA, USA) using a MassChrom® 25-OH-Vitamin D3/D2 diagnostics kit (Chromsystems, Munich, Germany). The summation of serum 25(OH)D2 and serum 25(OH)D3 was used to reflect vitamin D status. The inter-assay and intra-assay coefficients of variation of total serum 25(OH)D level were 6.3% and 5.0%, respectively at Research laboratory center, Ramathibodi Hospital, Mahidol University. Bone mineral density (BMD) of the femoral neck and spine were measured by dual energy x-ray absorptiometry (DEXA) at Health Promoting Hospital Region 1.

Data analysis

Results were expressed as frequency and percentage for categorical data and mean ± standard deviation for continuous data. The correlation between vitamin D level and risk factors was analyzed using Chi-square test with p-value was set at $p < 0.05$ for statistically significant. SPSS version 18 was used for analysis.

Results

Of the 217 volunteers, recruited into the study, 208 were female and 9 were male. The mean age was 42.16 ± 11.8 years. Clinical characteristics including sex, age, BMI, and smoking history are shown in Table 1. The prevalence of vitamin D deficiency, vitamin D insufficiency, and normal vitamin D was 49.8, 45.6, and 4.6% respectively while the prevalence of osteoporosis osteopenia and normal bone density in volunteers was 11.1, 35.5, and 53.5%, respectively (Table 2). The relationship between vitamin D level and factors of hypovitaminosis D are demonstrated in Table 3-8. There were no correlations between vitamin D level and risk factors except for sunscreen usage.

Table 1. Baseline clinical characteristics (n = 217)

Characteristics	Number	Percent
Sex		
Male	9	4.1
Female	208	95.9
Age (years)		
21-30	59	27.2
31-40	19	8.8
41-50	73	33.6
51-60	66	30.4
Mean	42.16	
Body mass index (BMI)		
< 18.5 underweight	17	7.8
18.5-22.9 normal	111	51.2
23.0-24.9 overweight	37	17.1
25.0-29.9 obese	38	17.5
> 30 morbidly obese	14	6.5
Mean	22.9559	
Smoking history		
Non-smoker	217	100

Table 2. Vitamin D level and bone mineral density

	Number	Percent
Vitamin D level		
< 20 ng/ml	108	49.8
21-30 ng/ml	99	45.6
> 30 ng/ml	10	4.6
Bone mineral density		
Normal	116	53.5
Osteopenia	77	35.5
Osteoporosis	24	11.1

Table 3. Correlation between vitamin D level and body mass index (BMI)

Body mass index (BMI)	Vitamin D level/number (percent)			Total
	≤ 20 ng/ml	21-30 ng/ml	≥ 30 ng/ml	
< 18.5 underweight	6 (2.76)	10 (4.61)	1 (0.46)	17 (7.83)
18.5-22.9 normal	56 (25.80)	48 (22.12)	7 (3.23)	111 (51.15)
23.0-24.9 overweight	19 (8.76)	18 (8.29)	0 (0)	37 (17.05)
25.0-29.9 obese	18 (8.29)	18 (8.29)	2 (0.92)	38 (17.51)
> 30 morbidly obese	9 (4.15)	5 (2.30)	0 (0)	14 (6.45)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
p-value = 0.688				

Table 4. Correlation between vitamin D level and sun protective clothing

Daily sun protective clothing > 50%	Vitamin D level/number (percent)			Total
	≤ 20 ng/ml	21-30 ng/ml	≥ 30 ng/ml	
Shirt and pants	10 (4.61)	6 (2.76)	1 (0.46)	17 (7.83)
Shirt and long pants/skirt	95 (43.78)	92 (42.48)	8 (3.69)	195 (89.80)
Long sleeved shirt and long pants	3 (1.38)	1 (0.46)	1 (0.46)	5 (2.30)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
p-value = 0.33				

Table 5. Correlation between vitamin D level and sunlight exposure

Sunlight exposure	Vitamin D level/number (percent)			Total
	≤ 20 ng/ml	21-30 ng/ml	≥ 30 ng/ml	
No sunlight exposure	7 (3.23)	9 (4.15)	0 (0)	16 (7.37)
Daily sunlight exposure > 10 min	39 (17.97)	34 (15.67)	3 (1.38)	76 (35.02)
Daily sunlight exposure < 10 min	62 (28.57)	56 (25.81)	7 (3.23)	125 (57.60)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
p-value = 0.809				

Table 6. Correlation between vitamin D level and sunscreen usage

Sunscreen usage	Vitamin D level/number (percent)			Total
	≤ 20 ng/ml	21-30 ng/ml	≥ 30 ng/ml	
No sunscreen usage	12 (5.53)	13 (5.99)	5 (2.30)	30 (13.82)
Sunscreen usage SPF > 50	10 (4.61)	7 (3.23)	0 (0)	17 (7.83)
Sunscreen usage SPF 30-50	37 (17.05)	30 (13.82)	2 (0.92)	69 (31.80)
Sunscreen usage SPF 15-30	49 (22.58)	49 (22.58)	3 (1.38)	101 (46.54)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
p-value = 0.047				
Area sunscreen usage				
No sunscreen usage	12 (5.53)	13 (5.99)	5 (2.30)	30 (13.82)
Only face area	63 (29.03)	57 (26.27)	3 (1.38)	123 (56.68)
Face and body	33 (15.21)	29 (13.36)	2 (0.92)	64 (29.49)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
p-value = 0.02				

Table 7. Correlation between vitamin D level and workplace

Type of workplace	Vitamin D level/number (percent)			Total
	≤ 20 ng/ml	21-30 ng/ml	≥ 30 ng/ml	
Indoor	97 (44.78)	89 (41.01)	9 (4.15)	195 (89.86)
Indoor and outdoor	11 (5.07)	10 (4.61)	1 (0.46)	22 (10.14)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
p-value = 1.00				

Discussion

Hypovitaminosis D is a risk factor for osteoporosis and bone fracture. Among the many factors that influence vitamin D level are sunlight exposure, skin pigmentation, lifestyle, and clothing habits. Serum 25(OH)D is an indicator of vitamin D status but there is no consensus on the cut off point for hypovitaminosis D. In the present study, the authors classified vitamin D deficiency as a vitamin D level less than 20 ng/ml, vitamin D insufficiency as a vitamin

Table 8. Correlation between vitamin D level and dietary intake

	Vitamin D level/number (percent)			Total
	≤ 20 ng/ml	21-30 ng/ml	≥ 30 ng/ml	
Salmon				
No	41 (18.89)	38 (17.51)	5 (2.30)	84 (38.71)
Yes	67 (30.88)	61 (28.11)	5 (2.30)	133 (61.29)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
Tuna				
No	20 (9.22)	19 (8.76)	4 (1.84)	43 (19.82)
Yes	88 (40.55)	80 (36.87)	6 (2.76)	174 (80.18)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
Mackerel				
No	44 (20.28)	40 (18.43)	7 (3.23)	91 (41.94)
Yes	64 (29.49)	59 (27.19)	3 (1.38)	126 (58.06)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
Fish oil				
No	68 (31.34)	60 (27.65)	7 (3.23)	135 (62.21)
Yes	40 (18.43)	39 (17.97)	3 (1.38)	82 (37.79)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
Egg yolk				
No	5 (2.30)	0 (0)	1 (0.46)	6 (2.76)
Yes	103 (47.47)	99 (45.62)	9 (4.15)	211 (97.24)
Total	108 (49.77)	99 (45.62)	10 (4.61)	217 (100)
p-value = 0.753, 0.259,0.183,0.822, 0.06				

D level was more than 20 but less than 30 ng/ml and normal vitamin D as a vitamin D level was more than 30 ng/ml. The authors found a high prevalence of hypovitaminosis D in our volunteers (95.4%) this was considerably higher than the results of a previous study (Chailurkit L et al 2011) where the prevalence of vitamin D insufficiency in Bangkok was 64.6% and in municipal areas except Bangkok 46.7%[15].

When dietary factors such as consumption of salmon, tuna, fish oil, egg yolk, and milk were considered, there was no statistically significant difference between ever and never eating them. This is because in Thailand, those foods contributed no significant added vitamin D. However, sunlight exposure daily, sun protective clothing, and sunscreen usage were important factors. Thailand is located near the equator where abundant sunlight provides adequate UV exposure all year round with none of the seasonal fluctuations seen in many other parts of the world. In the present study, there was no statistically significant difference between sunlight exposure and vitamin D level. This might be due to too a small a sample size or because the authors could not collected all blood samples for analysis of 25(OH)D at the same time because of the nurses work schedules. However, there were significant differences for the sunscreen usage group. The authors found that wearing sunscreen was correlated with a reduced amount of vitamin D. However, there was no statistically significant correlation between bone mineral density and vitamin D level because others factors also affect bone mineral density such as calcium level and estrogen hormones.

Conclusion

The authors found a high prevalence of hypovitaminosis D in nurses at the Royal Irrigation Hospital. Sunscreen usage was associated with vitamin D deficiency ($p < 0.05$).

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Potential conflicts of interest

None.

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การสำรวจหาภาวะขาดวิตามินดีในพยาบาลของโรงพยาบาลชลประทาน

ยงยส หัถพรสวรรค์, สุพรรณี ปังสุวรรณ, บุญส่ง องค์พิพัฒนกุล, อุมาพร อุดมทรัพยากุล

ภูมิหลัง: *ภาวะขาดวิตามินดี (vitamin D deficiency) เป็นภาวะที่เป็นสาเหตุทำให้เกิดความผิดปกติในระบบต่าง ๆ ของร่างกาย โดยเฉพาะระบบกระดูกและกล้ามเนื้อ ทำให้เกิดกระดูกพรุนในผู้ใหญ่ รวมทั้งมีผลแทรกซ้อนที่สำคัญ คือ กระดูกหัก นอกจากนี้ ในปัจจุบันพบว่า วิตามินดีมีส่วนในการทำงานของเนื้อเยื่อและเซลล์ต่าง ๆ ของร่างกาย และมีส่วนเกี่ยวข้องกับการเกิดโรคเรื้อรังต่าง ๆ เช่น โรคมะเร็ง ความผิดปกติของภูมิคุ้มกันต่าง ๆ โรคติดเชื้อ รวมทั้งโรคทางระบบหัวใจและหลอดเลือด*

วัตถุประสงค์: *เพื่อจะหาความชุกของภาวะขาดวิตามินดีในพยาบาลของโรงพยาบาลชลประทาน และปัจจัยที่มีผลเกี่ยวข้อง เช่น ค่าดัชนีมวลกาย ลักษณะของการใส่เสื้อผ้า การรับประทานอาหารและนม การสัมผัสแสงแดด การใช้ครีมกันแดด และค่าความหนาแน่นของกระดูก*

วัสดุและวิธีการ: *การศึกษานี้ได้ผ่านการรับรองจากคณะกรรมการจริยธรรมการวิจัยของโรงพยาบาลชลประทาน ก่อนดำเนินการโดยกลุ่มตัวอย่างเป็นพยาบาลที่ทำงานในโรงพยาบาลชลประทาน 217 ราย มีการเจาะเลือดเพื่อตรวจระดับวิตามินดี และตรวจเอกซ์เรย์หาความหนาแน่นของกระดูก กลุ่มตัวอย่างทุกรายจะได้รับการประเมินเรื่อง อาหาร ยา พฤติกรรมในชีวิตประจำวันจากแบบสอบถาม ข้อมูลต่างจะถูกนำมาวิเคราะห์ทางสถิติ*

ผลการศึกษา: *พบว่าความชุกของระดับวิตามินดีต่ำกว่าปกติในพยาบาลที่ทำงานในโรงพยาบาลชลประทานคิดเป็นร้อยละ 95.4 และมีความสัมพันธ์กันอย่างมีนัยทางสถิติ ระหว่างระดับวิตามินดีและการใช้ครีมกันแดด ($p < 0.05$) ในกลุ่มตัวอย่างที่ทำการศึกษา*

สรุป: *พบมีความชุกของระดับวิตามินดีที่ต่ำกว่าปกติ สูงในพยาบาลที่ทำงานในโรงพยาบาลชลประทาน*