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Editorial

Vitamin D deficiency in Thailand☆

Vitamin D deficiency has received increased attention over the past several years since vitamin D may play an important role not only in bone metabolism but also in a variety of non-skeletal diseases such as diabetes mellitus, autoimmune diseases, infectious diseases, cardiovascular diseases and cancer [1–3]. Vitamin D is primarily synthesized in the skin and is partly derived from dietary sources [4]. During exposure to sunlight, ultraviolet B (UVB) (wavelength 290–305 nm) penetrates the skin and converts 7-dehydrocholesterol to previtamin D_3. Previtamin D_3 is then rapidly converted by a heat dependent process to vitamin D_3 (cholecalciferol) [5,6]. Vitamin D_2 (ergocalciferol), from dietary sources or supplements, and vitamin D_3 are metabolized in the liver to 25-hydroxyvitamin D (25(OH)D), which is the major circulating form of vitamin D and is used to determine an individual's vitamin D status [1]. The circulating 25(OH)D is then metabolized in the kidneys to its biologically more active form, 1,25-dihydroxyvitamin D [1].

Many factors can alter cutaneous vitamin D production such as aging, skin pigmentation, sunscreen usage, time of the day, season and latitude [5,7]. Latitude is an important determinant of vitamin D status since the amount of UVB that penetrates the earth's surface decreases markedly with increasing latitude [8]. People residing far from the equator are at an increased risk for vitamin D deficiency due to decreased cutaneous synthesis of vitamin D [9]. People residing near the equator should have lower prevalence of vitamin D deficiency compared to people living at high latitudes. However, according to the recent studies, vitamin D deficiency is also common in these countries [10,11].

In this issue of Journal of Clinical and Translational Endocrinology, Alissa et al. found that vitamin D insufficiency is common in the sunny climate in Saudi Arabia [3]. Vitamin D deficiency and insufficiency is also common in Thailand (at latitudes between 5°30′ N and 20°30′ N) where adequate UVB exposure is available all year round as shown in Table 1 [12–18]. Chailurkit et al. [12] conducted the largest-scale examination of vitamin D status in Thai population and reported a 45.2% prevalence rate of vitamin D insufficiency, defined as serum 25(OH)D level < 30 ng/mL (<75 nmol/L) a 5.7% prevalence rate of vitamin D deficiency, defined as serum 25(OH)D level <20 ng/mL (<50 nmol/L). Low serum 25(OH)D concentrations were more prevalent in individuals with female gender, younger age and urban versus rural residence in Thailand. Chailurkit et al. [13] and Kruavit et al. [14] assessed vitamin D status in healthy Thai elderly women and found that two-thirds had vitamin D insufficiency and one-third had vitamin D deficiency. Women living in a nursing home have a higher prevalence of vitamin D deficiency than in free-living women, 39.8% compared to 30%, respectively [13]. Soontrapa et al. [15] evaluated vitamin D status in a younger group of premenopausal women found the prevalence of vitamin D insufficiency to be 77.8%, which was as high as the rate found in elderly Thai women living in nursing homes. Nimitphong et al. [16] evaluated vitamin D status in healthy young Thai men and women (age 25–54 years) and found that the prevalence of vitamin D deficiency was three-fold higher in females than in males (43.1% in females compared to 13.9% in males). Charatcharoenwitthaya et al. [17] demonstrated that 83.3% of pregnant Thai women, especially in the 1st trimester of pregnancy, had vitamin D insufficiency but without association with adverse pregnancy outcomes such as spontaneous abortion, gestational diabetes, cesarean section rate and preterm labor. They also demonstrated that intake of prenatal vitamins at the vitamin D dose of 400 IU/day was sufficient to prevent vitamin D deficiency but was not high enough to prevent vitamin D insufficiency. Rojroongwasonkul et al. [18] showed in a recent study in Thai children that vitamin D deficiency was also highly prevalent in school children aged 3–12.9 years. Vitamin D deficiency was found in at least one fourth of children living in rural areas. Over half the children aged 6–12.9 years residing in urban areas had serum 25(OH)D less then 20 ng/mL (50 nmol/L).

Life style and environmental factors are the major factors that determine vitamin D status in Thai people. Thai women are at risk for vitamin D insufficiency likely due to sunscreen usage and sun avoidant behavior due to the desire to maintain a fair complexion. Living in urban areas such as in Bangkok, increases the risk of vitamin D insufficiency due to increased pollution, which decreases the amount of UVB available for cutaneous vitamin D synthesis. Also at increased risk for vitamin D insufficiency are young Thai people living in urban areas in Thailand who have less leisure time and spend less time in the sunlight. Furthermore, in Thailand dairy products are not fortified with vitamin D and very few vitamin D-rich foods are part of the Thai diet. Thus, dietary intake of vitamin D in Thai people is generally low.

In summary, despite a location near the equator where sunlight is available year round, Thai people are at risk for vitamin D insufficiency due to environmental, cultural, lifestyle and dietary factors. The relatively high prevalence of vitamin D insufficiency may have important health implications for Thai people as the science of vitamin D continues to be unraveled.

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Table 1
Summary of vitamin D status in Thai people

Study	Chailurkit et al. [12]	Chailurkit et al. [13]	Kruavit et al. [14]	Soontrapa et al. [15]	Nimitphong et al. [16]	Charatcharoen-witthaya et al. [17]	Rojroongwasonkul et al. [18]
Year	2011	2011	2012	2009	2013	2012	2013
Number of subjects	2641	446	93	356	1990	120	3119
Mean age ± SD (year)	40.3 ± 0.3[a] (range 15–98)	67.5 ± 6.0 (range 60–97)	75.2 ± 6.0 (range 61–97)	35.2 ± 0.5[a] (range 20–50)	40.1 ± 0.2[a] (range 25–54)	29.3 ± 5.7 (range 18–40)	N/A (range 3–12.9)
Sex	M 50% F 50%	F 100%	F 100%	F 100%	M 72.8% F 27.2%	F 100%	N/A
Mean 25(OH)D ± SD, ng/mL (nmol/L)	31.8 ± 0.3[a] (79.3 ± 0.8[a])	27.1 ± 6.3 (67.6 ± 15.7)	25.8 ± 6.0 (64.3 ± 14.9)	29.1 ± 0.4 (72.6 ± 1.1)	M 26.0 ± 0.2[a] (M 65.0 ± 0.5[a]) F 21.4 ± 0.2[a] (F 53.5 ± 0.5[a])	Trimester of pregnancy 1st 25.7 ± 6.7 (1st 61.4 ± 16.6) 2nd 33.8 ± 8.2 (2nd 84.4 ± 20.4) 3rd 36.1 ± 8.9 (3rd 90.0 ± 22.3)	N/A
Percent of subjects with 25(OH)D < 30 ng/mL (<75 nmol/L)	45.2%	54.0%	77.4%	77.8%	N/A	Trimester of pregnancy 1st 83.3% 2nd 30.9% 3rd 27.4%	Age 3–5.9 years[b] - Urban 31.3% - Rural 24.5%
Percent of subjects with 25(OH)D < 20 ng/mL (<50 nmol/L)	5.7%	31.8%	21.5%	N/A	M 13.9% F 43.1%	Trimester of pregnancy 1st 26.7% 2nd 1.8% 3rd 2.3%	Age 6–12.9 years[b] - Urban 52.2% - Rural 29.2% Total[b] - Urban 45.6% - Rural 27.7%

M, male; F, female; N/A, not available.
[a] Data was expressed as mean ± SEM.
[b] Data was expressed as percent of subjects with 25(OH)D < 20 ng/mL (<50 nmol/L).

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Oranan Siwamogsatham, MD
Samitivej Srinakarin Hospital, Bangkok Hospital Group, Bangkok, Thailand

Boonsong Ongphiphadhanakul, MD
Department of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Vin Tangpricha, MD, PhD*
Division of Endocrinology, Metabolism and Lipids, Department of Medicine, Emory University School of Medicine, 101 Woodruff Circle NE, WMRB1301, Atlanta, GA, 30322, USA

* Corresponding author. Tel.: +1 404 727 7254; fax: +1 404 592 6257.
E-mail address: vin.tangpricha@emory.edu (V. Tangpricha)

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