SUMMARY REPORT

ILSI Southeast Asia Region Seminar on
Vitamin D in Nutrition and Health
11 November 2014
Hanoi, Vietnam

Vitamin D is an essential nutrient, well known for its role in skeletal health. Recent studies in Southeast Asia have shown that deficiency of this vitamin is highly prevalent, particularly in children. At the same time, the growing body of research examining the broader role of vitamin D in health beyond skeletal health has been gaining interest among the health and nutrition community. Currently there is scientific debate about the optimal requirement for vitamin D, with some nations revising recommended intake. More research in this area, including on appropriate cut-offs for assessment of vitamin D status, is clearly required. More importantly, awareness of vitamin D deficiency, its health implications and corrective actions need to be raised and addressed in the Southeast Asian region.

ILSI Southeast Asia Region, together with the National Institute of Nutrition, Vietnam and in collaboration with the Nutrition Association of Vietnam (VINUTAS) held a one-day seminar ‘Vitamin D in Nutrition and Health’ in Hanoi, Vietnam on November 11, 2014. The objectives of the seminar were to provide an update on the multiple potential health benefits of vitamin D; update on the status and optimal levels of vitamin D among populations in SE Asia; provide an overview of current understanding of the physiological role of vitamin D in human nutrition across the life span; examine the role and importance of sources of vitamin D (sunlight vs food vs fortification vs supplementation); and update on issues related to assessment of vitamin D status and discuss the development of recommended intakes for vitamin D in SE Asia. The seminar was attended by 90 delegates from the academic, industry and government sectors as well as healthcare professionals.

The seminar was officially opened by Mr. Tran Dac Phu, Director, General Department of Preventive Medicine, Ministry of Health, Vietnam followed by a welcome address from ILSI SEA Region Executive Director Mrs. Boon Yee Yeong. The first speaker, Professor Robin Daly, Deakin University, Australia, presented a comprehensive research update on vitamin D and health. Prof. Daly noted that vitamin D plays a key role in calcium metabolism and bone health via its positive effects on intestinal calcium absorption and bone mineralization. Beyond its classic roles, vitamin D also exerts an effect on muscle, with numerous studies linking low serum 25-hydroxyvitamin D \([2(\text{OH})\text{D}]\) concentrations with muscle weakness, impaired muscle function and an increased risk of falls. Current data indicates that vitamin D treatment at doses of at least 800 IU/d together with a serum 25(\text{OH})\text{D} level > 60 nmol/L, when combined with adequate dietary calcium (at least 1000 mg/d), can significantly reduce the risk of non-vertebral fractures, particularly in the elderly. Beyond muscle and bone, serum 25(\text{OH})\text{D} concentrations have also been associated with a range of non-skeletal diseases, including CVD and related disorders, type 2 diabetes, certain types of cancer, autoimmune diseases, infectious diseases, some neurological and mental health conditions as well as all-cause and cardiovascular mortality. However a limitation with many of these studies is that they are confounded by multiple factors and the findings cannot be used to support a causal association. Prof. Daly concluded that there remains a need for large scale randomised controlled trials and dose-response data to evaluate the effects of vitamin D on chronic disease outcomes.
A/Prof. Dr. Le Bach Mai, Deputy Director of the National Institute of Nutrition, Vietnam presented findings on the **vitamin D status in young children and women of reproductive age in Vietnam**. In many developing countries including Vietnam, data are lacking on vitamin D and calcium deficiencies. Dr. Mai’s group completed a cross-sectional study collecting data on daily diet, socioeconomic group, anthropometric status and plasma concentrations of calcium and vitamin D from 595 women of reproductive age and 532 children <5 years from 19 provinces of Vietnam to determine the overall prevalence of vitamin D and calcium deficiencies and their nutritional related risk factors in this population. The prevalence of vitamin D deficiency (25(OH)D <30 nmol/L) and insufficiency (25(OH)D between 30–49.9 nmol/L) was high, at 17% and 40% in women and 21% and 37% in children, respectively. Overweight/obese women had a 2 times lower risk for vitamin D deficiency than non-overweight and non-obese women. Women and children consumed about 1% of the Institute of Medicine (IOM) recommended nutrient intake (RNI) for vitamin D. Dr. Mai’s research suggested that vitamin D deficiency represents a major public health concern in Vietnam, and concluded that actions to improve the vitamin D and calcium status of the Vietnamese population should be considered.

**Vitamin D status and intakes in the Southeast Asia** were examined by Prof. Geok Lin Khor, International Medical University, Malaysia. She noted that due to their ready access to sunlight, tropical countries were not expected to have a vitamin D deficiency problem however recent studies have shown widespread low blood status and dietary intake of vitamin D, especially in young children, women and older persons in countries within the tropics. In Southeast Asia, prevalence of insufficiency levels of vitamin D of primary school age children aged 6-12 years ranged from 30% to nearly 70% in Malaysia, Thailand, Vietnam and Indonesia, depending on urban-rural locations and gender, and based on a cut-off point of <50 nmol/L 25OH(D). While some studies reported positive correlations between overweight/obesity and blood vitamin D status, (Malaysia, Thailand), others did not (Indonesia, Vietnam). A consistent finding throughout the region was low dietary intake of vitamin D in all age groups, principally due to low consumption of animal food products, fish and dairy products generally. Prof. Khor discussed factors associated with current low vitamin D status in Southeast Asia, including insufficient sun exposure due to an increase in indoor activities, cultural preference for fair skin resulting in direct avoidance of the sun, and the religious practice of covering up the entire body thus reducing sun penetration to the skin. She called for concerted public health education and policy measures to ameliorate the low vitamin D status in the region, suggesting that schools of all levels be actively engaged on the importance of the children carrying out physical activity in the sun. Prof. Khor added that the fortification of selected low-cost commonly consumed foods with vitamin D could contribute somewhat toward the amount of vitamin D consumed by vulnerable population groups.

Professor Shi-an Yin, Chinese Center for Disease Control and Prevention, discussed the **influence of maternal vitamin D on birth outcomes**, noting that vitamin D deficiency is highly prevalent world-wide in pregnant women, with deficiency during pregnancy continuing throughout lactation. Data on vitamin D status in pregnant women in Asia have shown rates of vitamin D insufficiency and deficiency (defined as serum 25OHD concentration of <50 nmol/L and <25 nmol/L respectively) of more than 80%, closely dependent on the season, level of sunlight exposure and race/ethnicity. Vitamin D deficiency during pregnancy has been shown to be linked with a number of foetal, neonatal and maternal health problems. The maternal consequences of vitamin D deficiency during pregnancy may include higher prevalence of infertility, preeclampsia, insulin resistance and gestational diabetes, an increased rate of caesarean section and osteomalacia, however based on currently available data causality still needs to be determined. Low maternal vitamin D concentration during pregnancy has been associated with a state of hypovitaminosis D in the foetus with long-term detrimental effects on neonates and infants. Other outcomes include small size, neonatal hypocalcaemia and seizures, impaired growth, and skeletal problems including rickets and low BMD. Prof. Yin went on to outline strategies for prevention of vitamin D deficiency in pregnant women, noting that vitamin D requirement cannot be adequately met through daily food consumption. He recommended routine vitamin D supplementation for pregnant women from the second and/or third trimester, however he noted that important questions such as how much vitamin D is required to achieve the desired normal range (75 nmol/L or 50 nmol/L) in pregnant women, the frequency of supplementation (every day, once a month or one large dose) and what level of supplementation on vitamin D is likely to lead to toxicity, remain difficult to answer.
Vitamin D deficiency in children is associated with impaired muscle function and strength with adverse consequences on growth, development, physical activity, and bone health noted Dr. Umaporn Suthutvoravut, Ramathibodi Hospital, Mahidol University, Thailand, in her presentation on the importance of vitamin D in child health. Adequate maternal vitamin D status during pregnancy promotes foetal bone development and vitamin D accretion, with research indicating that maternal vitamin D supplementation during lactation can increase breast milk vitamin D concentration. However further studies are needed regarding safety and appropriate dosage in this area. Numerous scientific studies support the importance of vitamin D in the immune response including barrier function, innate immunity, antigen presentation, and adaptive immunity. Evidence from randomized controlled trials in children is limited however observational studies reveal an inverse relationship between vitamin D status and development of infectious and autoimmune diseases. Adequate vitamin D intakes from foods and vitamin D-fortified foods and appropriate sunlight exposure are recommended for children. The re-emergence of rickets and the importance of vitamin D functions have prompted some countries to develop recommendations for vitamin D supplementation in infants, children, and adolescents, however Dr. Suthutvoravut cautioned that well-designed studies are needed to generate convincing scientific evidence for translation into clinical practice and public policy for the promotion of improved vitamin D status in children.

Mr. Peter Liu, DSM Nutritional Products Asia Pacific, Singapore, presented an overview on the importance of Vitamin D in Healthy Ageing. He noted that the elderly, particularly those living in aged-care facilities, are perhaps the most vulnerable to low vitamin D status. Several factors may contribute to poor vitamin D status in the aged, including the decline of the skin’s ability to effectively produce vitamin D that occurs with age, lack of adequate exposure to sunlight for home-bound or institutionalised residents, and insufficient dietary vitamin D intake due to loss of appetite with ageing. Vitamin D supplementation has been shown to reduce falls in the elderly, a major risk factor for osteoporotic fracture. Mr. Liu suggested that increased vitamin D intake in the elderly, through supplementation or fortified foods could help to reduce substantial healthcare cost and add more healthy years for the ageing population.

The relationship between vitamin D and UV exposure including its benefits vs risks, barriers to exposure and how much is needed was presented by Prof. Robyn Lucas, Telethon Kids Institute/Australian National University, Australia. In many locations exposure of the skin to ultraviolet (UV) radiation is the main source of vitamin D, with only small amounts coming from dietary sources. However exposure of the skin to UV radiation is also the main cause of melanoma and non-melanoma skin cancers. Vitamin D deficiency appears to be common in Southeast Asian populations living in Australia, whilst in Vietnam one study has reported that 30% of women and 16% of men living in the northern regions of Vietnam had low vitamin D status. Prof. Lucas noted the importance of acknowledging that widespread measurement issues with vitamin D assays could lead to both under- and over-estimation of the prevalence of deficiency, with the optimal level still highly debated. She discussed the cultural, biological and behavioural barriers to sun exposure, but also noted the increasing recognition that some sun exposure is required, both to maintain vitamin D status and also for non-vitamin D related benefits. Prof. Lucas noted that it was not possible to define exactly how much time should be spent outdoors, as it varies according to location, time of year, time of day, in addition to a range of personal factors such as skin pigmentation and skin sun sensitivity. She concluded that frequent short periods of sun exposure with maximum skin exposed are most efficient for vitamin D production and should also minimise UV-induced DNA damage.

Mr. Geoffrey Smith, Essential Micronutrients Foundation, Singapore, examined food sources of vitamin D, including fortified food, and supplementation in Southeast Asia. He began by noting that it is becoming increasingly recognized that vitamin D status of large segments of the populations in SE Asia have low vitamin D status, despite relatively high and regular levels of UVB rays from sunshine in the region. Although moderate sun exposure can provide complete requirements of vitamin D, due to a range of religious, cultural and lifestyle factors, this may be difficult to achieve in SE Asian populations. Natural food sources such as some plant species can provide vitamin D in the form of ergocalciferol or vitamin D2, and vitamin D3 (cholecalciferol) can be found in some species of fish. However, the level of vitamin D in these foods varies significantly, and these foods are not widely consumed in SE Asia. Fortification of foods with vitamin D has been used since the 1920’s, predominantly in high latitude countries where vitamin D deficiency was more widely recognized. Many of the foods traditionally fortified with vitamin D, such as
dairy products, are also not widely consumed in SE Asia, although there has been a reported increase in milk consumption in some countries. Mr. Smith noted that other foods had now been fortified with vitamin D including edible oil, which is more widely consumed in Asia, and could be a potential vehicle. Estimated intakes of vitamin D from fortified edible oil have now been modelled for Vietnam and compared to estimated requirements.

**Methodologies and cut-offs for measuring/evaluating vitamin D status** was discussed by Dr. Mei Chung, Tufts University School of Medicine, USA. The measurement of serum total 25-hydroxyvitamin D [25(OH)D] concentration is widely used to assessing an individual’s vitamin D status, with a variety of methods to determine 25(OH)D level, including commercial 25(OH)D assay kits, automated clinical chemistry platform, and automated equipment featuring either UV or mass spectrometric detection. It has been recognized that there is substantial within-assay variation in 25(OH)D measurement and even greater between-assay variability, hindering attempts to define the diagnosis of hypovitaminosis D. As part of efforts to advance scientific understanding of the importance of vitamin D to health, the US Office of Dietary Supplements (ODS) of the National Institutes of Health (NIH) established the Vitamin D Standardization Program (VDSP) in November 2010, with the primary goal to promote standardization of all 25(OH)D laboratory procedures worldwide—both commercial and laboratory-developed—in order to improve clinical and public health. The VDSP defines standardization, in the vitamin D context, as a standardized laboratory measurement of total 25(OH)D that is accurate and comparable over time, location, and laboratory procedure to the values obtained using reference measurement procedures developed at the US National Institute of Standards and Technology (NIST) and Ghent University, Belgium. Lack of standardization of 25(OH)D assays has made synthesis of 25(OH)D results from different studies in systematic reviews for the specific purpose of determining dose-response and/or clinical cut-points problematic. Dr. Chung discussed the clinical and public health implications of non-standardized or poor vitamin D status measurements, noting that although substantial progress is being made to standardize 25(OH)D measurements, large assay variation remains a critical barrier to developing clinical and public health guidelines or recommendations on optimal vitamin D status or intake level.