The Prevalence of Hypovitaminosis D in the Elderly Women Living in the Rural Area of Khon Kaen Province, Thailand

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This study investigated the prevalence of hypovitaminosis D in the elderly women living in the rural area of Thailand. The subjects were 132 cases (but just 129 cases were used in the statistical analysis?) of the elderly women who were living in the rural area of Khon Kaen province. The mean (± SD) of age and the mean (± SD) of serum 25 (OH) D concentration of these elderly women were 71.55 (± 5.26) years and 44.9 (± 11.02) ng/ml respectively. There was a significant inverse relationship (or correlation? Notice your analysis.) between the serum 25 (OH) D and the PTH concentration. The serum PTH concentration increased significantly when the serum 25 (OH) D concentration was at ≤ 35 ng/ml. As a result, the prevalence of hypovitaminosis D in these selected elderly women was 17.4 per cent.

Keywords: *Prevalence, Hypovitaminosis D, Elderly women, Rural area*

J Med Assoc Thai 2009; 92 (Suppl 5): S21-5
Full text. e-Journal: *http://www.mat.or.th/journal*

Vitamin D is required for the efficient absorption of dietary calcium and for the normal mineralization of bone. The deficiency in vitamin D levels is associated with the impaired calcium absorption and the compensatory rising in the level of parathyroid hormone (PTH)[1-3] which reversely stimulates bone resorption that eventually leads to osteoporosis.

Vitamin D is a fat-soluble vitamin that is rarely found naturally in food, except the food fortified with vitamin D. The principal natural dietary sources of vitamin D are not only fatty fish such as salmon, cod, tuna and shark but also the fish liver oils. The major source of vitamin D for human comes from the sunlight exposing to skin. The skin substance affected by sunlight requires the hydroxylation in the liver to form 25-hydroxyvitamin D [25(OH)D] and then undergoes the hydroxylation in the kidney to form 1, 25-dihydroxyvitamin D. [1, 25$(OH)_2$D] which is biologically an active vitamin D.

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Numerous studies in the western countries have estimated the prevalence of hypovitaminosis D to be between 25 and 54 percent[4-6] while almost all Thai people have believed that hypovitaminosis D does not take place in this country as a matter of fact that Thailand has adequate sunlight in all seasons. In contrast, the finding in our previous study of the elderly women living in the urban area of Khon Kaen province, Thailand was that 65.1% of those women had hypovitaminosis D[7].

The aim of this study is to find out the prevalence of hypovitaminosis D in the elderly women living in the rural area of Khon Kaen province, Thailand.

Material and Method

The protocol was approved by the Ethics Committee of Khon Kaen University. This study had 132 cases of the elderly women living in the rural area of Khon Kaen province. Almost all these women were farmers. They still worked in the farms under the sunlight for ploughing and looking after the cattle as their daily routines no matter at what age they were. None of the participants had paralysis or debility, a

history of metabolic or hormonal disorders which might affect calcium and bone metabolism. Moreover, none had taken any medication acceptably influencing the bone turnover, *e.g.* estrogens, selective estrogen receptor modulators, bisphosphonates, calcitonins, vitamin D, phenytoin, carbamazepine, and rifampicin within 6 months prior to the study.

After completing the written informed consent, the subjects were examined for the clinical characteristics, for instance, height, weight, blood pressure, and general physical conditions. The participants were asked to have an overnight fasting, and then the venipunctures were performed at their homes between 6:00 and 8:00 in February, 2001. A single 10 ml blood sample was collected from each subject. Five ml was kept in a sterile tube for the determination of creatinine, SGOT and alkaline phosphatase; and another 5 ml was kept in an EDTA-anticoagulated tube. After being centrifuged for 15 minutes at 760Xg, the EDTA-plasma was separated and stored at -20°C for the analysis of 25(OH)D and of PTH for a month.

The serum parathyroid hormone samples were measured by using the electrochemiluminescence (ECLIA) technique named an Elecsys 1010. The serum 25(OH)D samples were measured by using the radioimmunoassay (RIA) technique named a DiaSorin, USA. The interassay coefficient of variation for the measurements of the parathyroid hormone was 7.1 percent and the coefficient for the 25(OH)D was between 9.4 and 11.0 percent.

Each bone mineral density (BMD) of the femoral neck, spine, and forearm was measured at Srinagarind Hospital, Khon Kaen University; by the dual energy X-ray absorptiometry named DPX-IQ, Lunar Corp, U.S.A. with the precision error of 1-2% in 129 cases.

Statistical analysis

The baseline demographic and clinical characteristics were presented as the mean (± SD) for the continuous variables, numbers and percent for the categorical ones. The plasma levels of 25(OH)D and the PTH concentration of both urban[7] and rural groups were presented as the mean (± 95% CI) while the comparison of the continuous variables such as age, weight, height, BMI, calcidiol and the PTH level between the urban[7] and rural groups was done by using an unpaired t-test. The counted data for the number of osteoporotic and non-osteoporotic subjects and the number of the subjects with vitamin D deficiency in both groups were tested by using the χ^2-test and expressed as the risk using the odds ratio with a 95% CI. For the statistical significance, p-values must be < 0.05.

Results

The baseline clinical characteristics of the subjects: age, BMI, the serum concentration of 25(OH)D, and the PTH levels are shown in Table 1.

The sum of both 105 urban[7] (There were 106 cases mentioned in the study of the urban elderly. Why you used 105?) and 129 rural cases (but there were 132 women mentioned in the Material and Method. Why were there only 129 here?) was 234. The pooled data were used to increase the power of the difference and to calculate the correlation between the serum 25(OH)D and the PTH concentration. There was a significant inverse correlation between the serum 25(OH)D and the PTH concentration ($r = -0.35$, $p < 0.001$) as shown in Fig. 1.

Table 1. The baseline clinical characteristic

Characteristic	Value
Age: mean (SD); years	71.55 (5.26)
BMI: mean (SD); kg/m^2	21.44 (4.15)
Serum 25(OH)D: mean (SD); ng/ml	44.9 (11.02)
Serum PTH: mean (SD); pg/ml	17.9 (15.28)

Baseline characteristic (n = 132 cases)

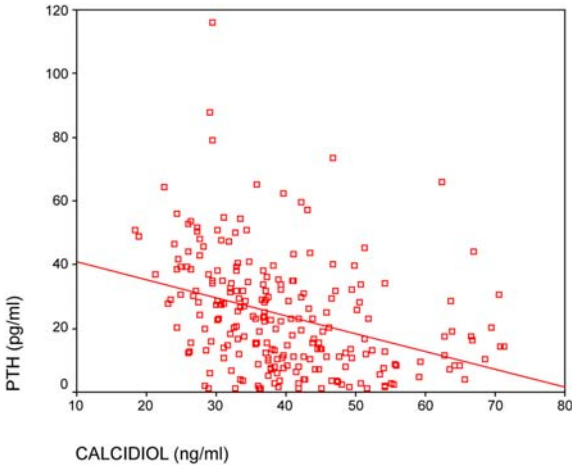

Fig. 1 The correlation between the serum 25(OH)D and the serum PTH

The mean (95% CI) of the PTH concentration increased significantly when the serum 25(OH)D was ≤ 35 ng/ml as shown in Fig 2. This analysis used the one-way ANOVA, Tamhane *post hoc* test p ≤ 0.007) as shown in Fig. 2.

The comparisons of the serum 25(OH)D and the PTH level between the urban[7] and rural elderly women were shown in Fig. 3, and Fig. 4. Each Figure showed a significant difference by the unpaired t-test (p < 0.001).

Table 2 showed BMD in various points between the urban[7] and rural groups. The significant difference (p < 0.001) occurred in BMD of the forearm at ultradistal and at distal one-third of the radius of both groups. These significant values of the rural elderly were higher than the ones of the urban elderly.

Discussion

The elderly women living in the rural area had lower prevalence of hypovitaminosis D, higher serum 25(OH)D, lower serum PTH level and also had higher BMD in forearm than those in the urban area as shown in Fig 2-4. These might be the results of the difference in lifestyle and occupation. Almost all elderly women living in the rural area were farmers. They worked in their farms under the sunlight exposure and usually worked hard, *i.e.* ploughed or herded cattle in the day time. On the contrary, the elderly women in the urban area usually had sedentary lifestyle and avoided sunlight. Lifestyle could be an additional cause of vitamin D problem as it was supported by the study[8]. It stated that the southern Europeans, according to their improper life style, had lower vitamin D level than the northern people although the South of Europe had more sunlight than the northern region.

The level variation of the serum 25(OH)D really affects the estimation of the hypovitaminosis D prevalence on the basis of the serum PTH rising[1]. The PTH levels based on the pooled data of both elderly women in the urban and rural areas (234 cases) started to increase significantly when the serum 25(OH)D concentration was at ≤ 35 ng/ml as shown in Fig. 2.

Table 2. The comparison of the BMD in various points between the urban and rural elderly women

BMD	Rural elderly (129 cases)	Urban elderly (98 cases)	p-value
Femoral neck: mean (SD)	0.69 (0.11)	0.70 (0.13)	0.44
Spine: mean (SD)	0.82 (0.23)	0.84 (0.20)	0.49
Ultradistal radius: mean (SD)	0.29 (0.07)	0.24 (0.07)	<0.001
Distal 1/3 of radius: mean (SD)	0.59 (0.12)	0.48 (0.08)	<0.001

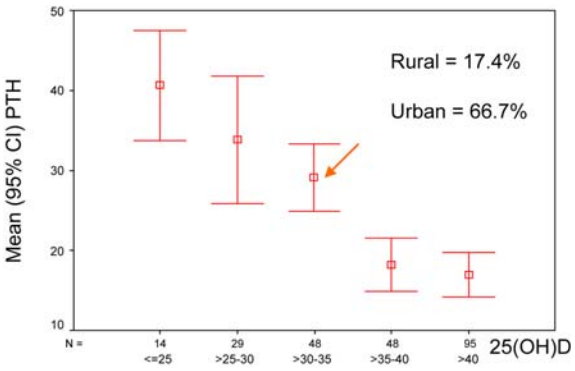

Fig. 2 The relationship (or correlation?) between the serum 25(OH)D and the mean (95% CI) of the serum PTH of the urban and rural groups

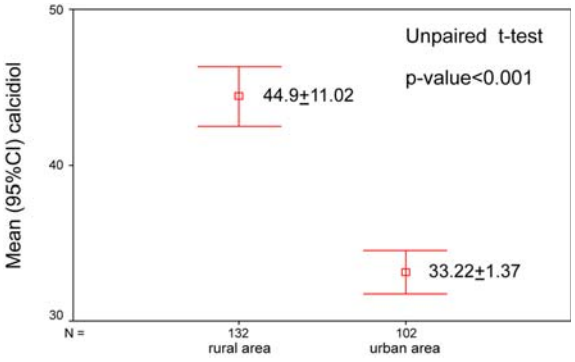

Fig. 3 The comparison of the calcidiol levels between the urban and rural elderly women

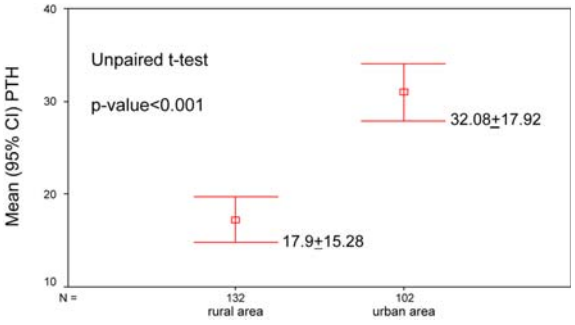

Fig. 4 The comparison of the PTH levels between the urban and rural elderly women

The level of serum 25(OH)D $\leq$ 35 ng/ml showing hypovitaminosis D in the previous study[7] was the same level in this study.

There was a significant inverse relationship between the serum 25(OH)D and the PTH concentration based on the pooled data of both elderly women in the urban and rural areas (234 cases) as shown in Fig. 1. This result corresponded to the previous studies[9-13].

Conclusion

The lifestyle and occupation of the rural elderly women might cause the lower prevalence of hypovitaminosis D.

These data could be useful for further studies of the metabolic bone diseases in the Thai population.

Acknowledgments

The authors are very grateful that this study has been supported by a research grant of Khon Kaen University.

The authors sincerely thank Associate Professor Viraphong Lulitanond, Department of Microbiology, Faculty of Medicine, Khon Kaen University, for his kindly help with the measurement of the serum PTH assay, and also deeply appreciate Associate Professor La-or Chailurkit Department of Medicine, Ramathibodi Hospital, Mahidol University, for her helpfulness in the measurement of the serum 25(OH)D assay.

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ความชุกของภาวะวิตามินดีในกระแสเลือดต่ำของสตรีวัยสูงอายุซึ่งอาศัยอยู่ในเขตชนบท จังหวัดขอนแก่น

สุกรี สุนทราภา, ศุภศิลป์ สุนทราภา, พัชรี บุญศิริ, เตือนจิต คำพิทักษ์

การศึกษานี้ใช้กลุ่มตัวอย่างคือผู้สูงอายุ อาศัยอยู่ในเขตชนบท จังหวัดขอนแก่น จำนวน 132 ราย ค่าเฉลี่ย (± ค่าเบี่ยงเบนมาตรฐาน) ของอายุและระดับวิตามินดีในกระแสเลือดเท่ากับ 71.55 (± 5.26) ปี และ 44.9 (± 11.02) นาโนกรัมต่อมิลลิลิตร ตามลำดับ มีความสัมพันธ์แบบเส้นตรงเชิงผกผันอย่างมีนัยสำคัญระหว่างค่า PTH และวิตามินดี พบว่าค่าวิตามินดีที่ ≤ 35 นาโนกรัมต่อมิลลิลิตร เป็นระดับที่ทำให้ค่า PTH เพิ่มขึ้นอย่างมีนัยสำคัญ พบความชุกของภาวะวิตามินดีในกระแสเลือดต่ำของสตรีวัยสูงอายุอาศัยอยู่ในเขตชนบท จังหวัดขอนแก่นเท่ากับร้อยละ 17.4