Difference in Serum Calcidiol and Parathyroid Hormone Levels between Elderly Urban vs Suburban Women

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The present study initially included 106 volunteers, elderly women living in urban or suburban Khon Kaen, Thailand. One case was excluded because of extremely high levels of alkaline phosphatase. The means (±SD) of the serum calcidiol and the PTH concentrations in the urban vs suburban groups were 31.45(±1.15) ng/mL vs 36.15(±2.4) pg/mL and 41.53(±3.94) ng/mL vs 17.43(±2.88)pg/mL, respectively. The urban group had a higher percentage and a higher risk of hypovitaminosis D and osteoporosis of the femoral neck than the suburban group, an odds ratio of more than 4 times higher.

Keywords: *Calcidiol, PTH, Urban vs Suburban*

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Vitamin D is required for efficient absorption of dietary calcium and for normal mineralization of the bone. Reduction in vitamin D levels is associated with impaired calcium absorption and a compensatory increase in the level of parathyroid hormone (PTH),[1-3] which in turn stimulates bone resorption and bone loss. Advancing age is associated with reductions in sun exposure, intake and skin activation of vitamin D, and vitamin D absorption, all of which contribute to low vitamin D levels.[4,5]

In a previous study of elderly Thai women in Khon Kaen municipality, Thailand,[6] 66.3% of those 60 or over had vitamin D deficiency. Differences in lifestyle might make people from certain defined areas more prone to vitamin D deficiency.

The authors' aim was to compare the serum 25(OH)D and the serum parathyroid hormone concentrations of elderly women living in urban vs suburban areas of Khon Kaen municipality.

Material and Method

This was part of the study on the prevalence of hypovitaminosis D in elderly women in Khon Kaen municipality, Thailand,[6] that included 106 elderly volunteers. Seventeen cases lived in a nursing home, 48 in urban areas attending activities at a senior's center, and 41 living in Ban Moung village located in a suburban area near Khon Kaen University. None of the participants had paralysis or debility, a history of metabolic or hormonal disorders which might affect calcium and bone metabolism, and none had taken any medication within the last 6 months known to influence bone turnover (*i.e.* estrogens, selective estrogen receptor modulators, bisphosphonates, calcitonins, vitamin D, phenytoin, carbamazepine, and rifampicin). The Ethics Committee of Khon Kaen University approved the experimental protocol.

After completing written informed consent, the subjects were examined for clinical characteristics including height, weight, blood pressure, and general physical condition. Participants were asked to fast overnight then venipunctures were performed at their homes between 06:00 and 08:00 in February of 2001. A single 10 mL blood sample was collected from each subject: 5 mL, in a sterile tube, for determination of creatinine, SGOT and alkaline phosphatase; and another 5 mL, collected in an EDTA-anticoagulated tube. After being centrifuged for 15 minutes at 760Xg, the EDTA-plasma was separated and stored at -20°C for analysis of 25(OH)D and PTH, about a month later.

The serum parathyroid hormone samples were measured using the electrochemiluminescence (ECLIA) technique on an Elecsys 1010. The serum 25(OH)D samples were measured using the radioimmunoassay (RIA) technique by a DiaSorin, USA. The interassay coefficients of variation were 7.1 percent for the mea-

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surements of the parathyroid hormone and between 9.4 and 11.0 percent for the 25(OH)D.

The bone mineral density (BMD) of the femoral neck was measured in 99 elderly women (as 7 dropped out) at Srinagarind Hospital, Khon Kaen University, using dual energy X-ray absorptiometry on a DPX-IQ, Lunar Corp, USA, with a precision error of 1-2%.

The mean age among participants in the nursing home group was significantly older than those going to the seniors' center (Table 1), while other recorded characteristics were unremarkable. The authors therefore, grouped the two together and re-named it the *urban* group. The elderly group at Ban Moung village was named the *suburban* group.

Statistical Analysis

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

Results

One subject from the suburban group had a very high alkaline phosphatase level (*i.e.* 366 U/L, whereas the normal range is between 42 and 121 U/L), so she was excluded from the statistical analysis.

The clinical and demographic characteristics for the urban and suburban groups are presented in Table 2.

The elderly in the urban group were significantly heavier and had a higher BMI and alkaline phosphatase level than those in the suburban group.

Calcidiol level

Fig. 1 and Table 3 show that the mean (±95%CI) serum calcidiol concentration in the suburban group was significantly higher than the urban group (p-value = 0.002).

In a previous study of hypovitaminosis D prevalence in elderly women in Khon Kaen municipality, Thailand[6], a calcidiol level of £35 ng/mL defined vitamin D deficiency. Accordingly, the urban group had significantly more vitamin D deficient participants than the suburban group (p-value<0.001), odds ratio 4.45 (95%CI: 1.89-10.51) (Table 4).

Parathyroid hormone (PTH) level

Fig. 2 and Table 3 show that the mean (±95%CI) serum PTH concentration in the suburban group was significantly lower than the urban group (*p-value* <0.001).

Table 1. Clinical characteristics of the elderly at the nursing home vs the seniors' center

Characteristic	Nursing home group n=17 (mean±SD)	Seniors' center group (n=48) (mean±SD)	*p-value
*Age (years)	71.47±7.65	67.31±5.66	*p=0.021
Weight (kg)	5.25±12.89	56.42±10.72	p=0.72
Height (cm)	147.69±6.46	149.48±5.01	p=0.25
BMI (kg/m^2)	25.20±5.14	25.21±4.40	p=0.99
Calcidiol level (ng/mL)	29.64±4.64	32.09±6.60	p=0.16
PTH level (pg/mL)	47.51±13.20	39.41±16.38	p=0.07
Alkaline phosphatase (U/L)	96.77±25.47	102.03±23.56	p=0.44

* level of significance is <0.05 (unpaired student t-test)

Table 2. Demographic and clinical characteristics for the urban and suburban groups

Characteristics	Urban group n=65 (mean±SD)	Suburban group n=40 (mean±SD)	p-value
Age (years)	68.4±6.43	70.65±6.64	0.089
Weight (kg)	56.12±11.21	49.17±10.77	0.002*
Height (cm)	49.03±5.41	147.5±5.37	0.162
BMI (kg/m^2)	25.21±4.55	22.54±4.42	0.004*
Alkaline phosphatase (U/L)	100.65±23.98	87.9±23.84	0.009*

Table 3. Mean (and 95%CI) calcidiol and PTH levels of the urban and suburban groups

	Urban group n=65 (mean±95% CI)	Suburban group n=40 (mean±95% CI)	p-value
Calcidiol level	31.45±1.54	36.15±2.41	0.002
PTH level	41.53±3.94	7.43±2.88	<0.001

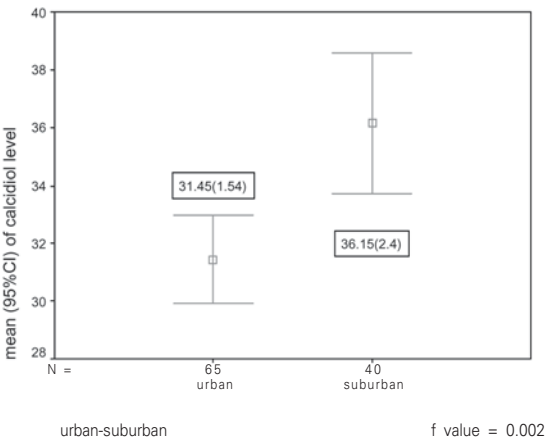

Fig. 1 A comparison of the mean (and 95%CI) of calcidiol levels in the urban (n=65 cases) vs the suburban groups (n=40 cases)

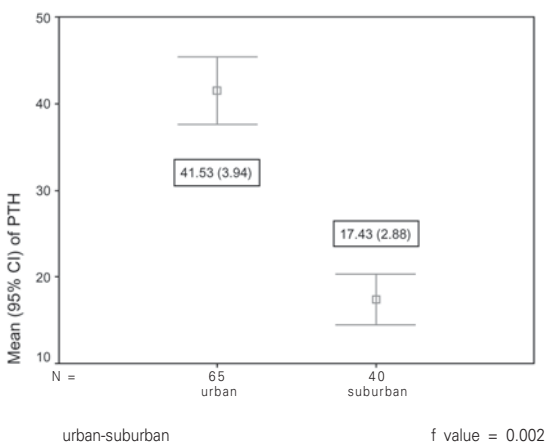

Fig. 2 Comparison of the mean (and 95%CI) parathyroid hormone levels of the urban group (n=65 cases) vs suburban groups (n=40 cases)

The risk of osteoporosis

According to WHO criteria,[7] a T-score of the femoral neck £ -2.5 defines osteoporosis. Table 5 shows the number of subjects in both the urban and suburban groups with osteoporosis. Significantly more subjects in the urban group had osteoporosis than the suburban group (p-value=0.002); 4 times the risk (odds ratio= 4.35; 95%CI: 1.69-11.11).

Discussion

The calcidiol level in the urban group was significantly lower than that in the suburban group (p=0.002) (Table 3) strongly suggesting an indoor or sedentary urban lifestyle deprives its denizens of needed solar exposure, whereas the suburban group get sun when they go out-of-doors to garden, farm or herd.

A diagnosis of vitamin D deficiency was made if the serum calcidiol level was ≤35 ng/mL.[6] At this level more than 78% of the urban group were vitamin D deficient, whereas only 45% of the suburban group were (p<0.001), odds ratio=4.45 and 95%CI=1.89 to 10.51 (Table 4).

More than three-quarters of the elderly subjects in the urban group had hypovitaminosis D and elevated PTH levels (Table 4). The vitamin D deficiency in the urban group could lead to increased bone remodeling and bone loss and osteoporosis because of secondary hyperparathyroidism. This was confirmed by the significantly higher-level alkaline phosphatase in the urban group than in the suburban group (Table 2). The data in Table 5 indeed shows that the urban group had a higher risk of osteoporosis of the femoral neck than the suburban group (*i.e.* odds ratio= 4.35 and 95%CI= 1.69 to 11.11.)

Table 5. The number of subjects in the urban and suburban groups considered osteoporotic vs non-osteoporotic

	Urban group n=58	Suburban group n=40	Total
Osteoporosis	30	8	38
Non-osteoporosis	28	32	60
Total	58	40	98

x^2-test indicated a significant difference (*p-value*=0.002) Odds ratio (95%CI) for the urban vs. suburban groups was 4.35 (1.69-11.11)

Table 4. The number and percent of subjects in both urban and suburban groups considered vitamin D deficient (calcidiol level ≤ 35 ng/mL)

Group	Calcidiol level (ng/mL) ≤35	>35	Total	p-value	Odds ratio	95%CI
Urban n (%)	51 (78.46)	14 (21.54)	65 (100)	<0.001	4.45	1.89-10.51
Suburban n (%)	18 (45)	22 (55)	40 (100)			
Total	69	36	105			

Conclusion

The difference in lifestyle between the urban and suburban participants is perhaps responsible for the higher calcidiol and lower PTH levels and lower risk of osteoporosis of femoral neck in the suburban vs the urban elderly subjects.

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ความแตกต่างของระดับ Calcidiol และ PTH ในกระแสโลหิตระหว่างสตรีผู้สูงอายุที่อาศัยอยู่ในตัวเมืองและชานเมือง

ศุภศิลป์ สุนทราภา, สุกรี สุนทราภา, ละออ ชัยลือกิจ

ได้ทำการศึกษาสตรีผู้สูงอายุซึ่งอาศัยอยู่ในตัวเมืองและอาศัยอยู่ชานเมือง ของเขตเทศบาลเมืองจังหวัดขอนแก่น จำนวน 106 ราย ผู้สูงอายุหนึ่งรายถูกคัดออกเนื่องจากมีระดับของ alkaline phosphatase สูงผิดปกติ พบว่า ค่าเฉลี่ยของระดับ serum calcidiol และ PTH ในกระแสโลหิตระหว่างผู้สูงอายุที่อยู่เขตชานเมืองและเขตเมืองอยู่ที่ 31.45(±1.15) ng/mL ต่อ 36.15(±2.4) pg/mL และ 41.53(±3.94) ng/mL ต่อ 17.43(±2.88) pg/mL ตามลำดับ และพบว่ากลุ่มผู้สูงอายุ ที่อยู่ในเขตเมือง มีความเสี่ยงต่อการขาดวิตามินดีและการเกิดโรคกระดูกพรุนของคอกระดูกต้นขาสูงกว่ากลุ่มผู้สูงอายุ ที่อยู่เขตชานเมือง อย่างมีนัยสำคัญ โดยมีความเสี่ยงสูงกว่าถึง 4 เท่า