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## OBSTETRICS

# Prevalence of osteoporosis in postmenopausal women at Srinagarind Hospital, Khon Kaen University

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**ABSTRACT**

**Objective:** To determine the prevalence of osteoporosis in postmenopausal women

**Materials and Methods:** Retrospectively reviewed medical records of postmenopausal women who attended the menopause clinic during January 2002 to May 2008. All natural postmenopausal women who underwent the bone mineral density (BMD) measurement by Dual-energy X-ray absorptiometry (GE Lunar Prodigy, Japanese software) were included to the study. Osteoporosis was diagnosed by the World Health Organization criteria; BMD value that equal or more than 2.5 standard deviation (SD) below the young adult mean. The exclusion criteria were premature menopause, perimenopause, induced menopause by hysterectomy, bilateral oophorectomy, radiotherapy and chemotherapy and other diseases or medications that affect BMD.

**Results:** Among 245 postmenopausal women, the mean age of these participants was 55.1±5.2 years, mean duration after menopause was 5.9±4.8 years, mean body weight was 57.8±9.1 kg and mean body mass index (BMI) was 24.5±3.5 kg/m$^2$. The prevalence of osteoporosis by utilizing the Japanese BMD cutoff value at the femoral neck (FN) and the lumbar spines (L1-L4) were 1.6% and 10.6%, respectively. When using the Thai BMD cutoff value, the prevalence of osteoporosis was lower than using the Japanese BMD reference (0% for FN and 0.8% for L1-L4). For stratified prevalence estimated according to age group and duration after menopause, the prevalence of osteoporosis was increased with advanced age and duration after menopause for both femoral neck and lumbar spines.

**Conclusion:** The prevalence of osteoporosis at the femoral neck (1.6%) was fewer than the lumbar spines (10.6%). The prevalence of osteoporosis was increased with advanced age and duration after menopause.

**Keywords:** Osteoporosis, osteopenia, postmenopause

## Introduction

Osteoporosis is characterized by low bone mass, microarchitectural deterioration, compromised bone strength and increase in the risk of fracture.[1] The incidence of osteoporotic hip fractures in Asian population was higher in women than in men.[2] The

prevalence of postmenopausal osteoporosis increased with advanced age and the duration of postmenopausal years.[3,4] The common osteoporotic fractures include those at the hip, the spines and the forearm, these provide an important impact on public health. With aging population, the osteoporotic fractures are well-known as a burden condition to society in terms of costs, morbidity and mortality.[5-12] In Thailand, the mortality rate during hospitalization was 2.1%.[13] In addition, median total cost of osteoporotic hip fracture treatment in 1 year was up to 116,458.60 Baht.[14] The prevalence of osteoporosis in Thai women was reported to be increased with age to more than 50% after the age of 70 years.[15] The aged-adjusted prevalence of osteoporosis in Thai women with age 40-80 years using Thai BMD cutoff value were 13.6% and 19.8% for the femoral neck (FN) and the lumbar spines (LS; L1-L4), respectively.[15,16] In postmenopausal women the prevalence of osteoporosis of the femoral neck and the lumbar spines (L1-L4) utilizing Thai BMD cutoff value were 9.5% and 15.7%, respectively.[17] By using a reference value obtained from Khon Kaen young adults, the prevalence of postmenopausal osteoporosis in rural area of Khon Kaen Province were 19.3% at femoral neck, 24.7% at lumbar spines (L2-L4), 18.5 % at ultra distal radius and 26.4 % at mid-shaft radius.[18] The present study was conducted to determine the prevalence of osteoporosis in postmenopausal women who attended the menopause clinic at Srinagarind Hospital. The results of the study would provide the informations regarding the magnitude of problem and could be useful for the therapeutic and preventive programs of osteoporotic fracture.

## Materials and methods

A retrospective study was conducted by reviewed medical records of postmenopausal women who attended the menopause clinic during January 2002 to May 2008. The study was approved by the Ethics Committees of Faculty of Medicine, Khon Kaen University, Thailand. All natural postmenopausal women who underwent BMD measurement were included to the study. The exclusion criteria were premature menopause, perimenopause, induced menopause by hysterectomy, bilateral oophorectomy, radiotherapy and chemotherapy and other diseases or medications that affect BMD.

Osteoporosis was diagnosed by the WHO criteria based on the measurement of BMD by the Dual-energy X-ray absorptiometry (DXA); GE Lunar Prodigy, Japanese software with the precision error (CV%) of 1.1% for femoral neck, L1-L4 and L2-L4: T score normal ≥ –1, osteopenia < –1 and > –2.5, osteoporosis ≤ –2.5. [1]

The prevalence of osteoporosis was determined by using both Japanese and Thai BMD references database. The Japanese BMD database within the DXA software was used for the BMD reference cutoff value in diagnosis of osteoporosis and osteopenia. According to the previous study in Thai women, the cutoff values of BMD for diagnosis of osteopenia were between 0.569 and 0.716 g/cm$^2$, 0.682 and 0.847 g/cm$^2$ at the femoral neck and the lumbar spines (L1-L4), respectively. And the cutoff values of BMD for diagnosis of osteoporosis were <0.569 g/cm$^2$ and <0.682 g/cm$^2$ at the femoral neck and the lumbar spines (L1-L4), respectively.[14]

Statistic analysis was used with SPSS version 11.5 programs (numbers, percentages, mean with standard deviation (SD) and median with range (min-max). The Chi-square test was used for testing the association between the osteoporosis/osteopenia and the age group, duration after menopause and body mass index (BMI). The Fisher's exact test was used instead of the Chi-square test if there was >25% of the expected count that <5 in each cell. p-value <0.05 was considered statistically significance.

## Results

The study population consisted of 245 Thai natural postmenopausal women, the mean age was 55.1±5.2 years and the age range was 42-72 years. They came from 17 different provinces (15 from Northeast region, and 2 from the South). Most of them lived in Khon Kaen province. The average age and SD at the time of menopause was 49.3±3.7 years. The mean duration and SD after menopause was 5.9±4.8 years. The mean body weight and SD was 57.8±9.1 kg and the mean body mass index (BMI) and SD was 24.5±3.5

kg/m$^2$. The majority of subjects were government officer (37.1%) and 35.9% had an income of 20,001-50,000 Baht per month. The demographic data is shown in Table 1.

The average BMD of the femoral neck, the lumbar spines L1-L4 and L2-L4 were 0.851±0.130 g/cm$^2$, 0.998±0.159 g/cm$^2$, and 1.026±0.156 g/cm$^2$, respectively. The stratified BMD according to age group, duration after menopause and BMI were shown in Table 2. The prevalence of osteoporosis according to WHO criteria and using the Japanese BMD cutoff value at the femoral neck, the lumbar spines L1-L4 and L2-L4 were 1.6%, 10.6% and 10.2%, respectively. When using the Thai BMD cutoff value, the prevalence of osteoporosis was 0% for the femoral neck and 0.8% for the lumbar spines L1-L4 (Table 3). For stratified prevalence estimates according to age group, duration after menopause and BMI, the prevalence of osteoporosis and osteopenia were significantly increased with advanced age and duration after menopause for both femoral neck and lumbar spines (Table 4)

**Table 1.** Demographic data of the study subjects

| Characteristics | Total (N=245) | Percent (%) | Mean±SD |
|---|---|---|---|
| Age (years) | | | 55.1±5.2 |
| Age at menopause (years) | | | 49.3±3.7 |
| Duration after menopause (years) | | | 5.9±4.8 |
| Body mass index (kg/m$^2$) | | | 24.5±3.5 |
| Age (years) | | | |
| 40-49 | 31 | 12.7 | |
| 50-59 | 170 | 69.4 | |
| 60-69 | 41 | 16.7 | |
| 70-79 | 3 | 1.2 | |
| Duration after menopause (years) | | | |
| ≤5 | 155 | 63.3 | |
| >5-10 | 50 | 20.4 | |
| >10-20 | 39 | 15.9 | |
| >20 | 1 | 0.4 | |
| Body mass index (kg/m$^2$) | | | |
| <18.5 | 2 | 0.8 | |
| 18.5-24.9 | 147 | 60.0 | |
| 25.0-29.9 | 80 | 32.7 | |
| ≥30 | 16 | 6.5 | |
| Occupation | | | |
| House wife | 74 | 30.2 | |
| Farmer | 26 | 10.6 | |
| Employee | 12 | 5.0 | |
| Shopkeeper | 41 | 16.7 | |
| Government officer | 91 | 37.1 | |
| Other | 1 | 0.4 | |

**Table 1.** Demographic data of the study subjects. (cont.)

| Characteristics | Total (N=245) | Percent (%) | Mean±SD |
|---|---|---|---|
| Incomes (Baht per month) | | | |
| <5,000 | 39 | 15.9 | |
| 5,000-10,000 | 46 | 18.8 | |
| 10,001-20,000 | 56 | 22.9 | |
| 20,001-50,000 | 88 | 35.9 | |
| >50,000 | 16 | 6.5 | |
| Living area | | | |
| Khon Kaen | 166 | 67.8 | |
| Other provinces in Northeast region | 76 | 31.0 | |
| Provinces in North region | 3 | 1.2 | |

**Table 2 .** The BMD of different age group, duration after menopause and body mass index (BMI)

| Characteristics | BMD ($g/cm^2$) | | |
|---|---|---|---|
| | Femoral neck | L1-L4 | L2-L4 |
| Age group (years) | | | |
| 40-49 | 0.913±0.104 | 1.028±0.137 | 1.047±0.142 |
| 50-59 | 0.857±0.102 | 1.016±0.164 | 1.046±0.155 |
| 60-69 | 0.794±0.206 | 0.916±0.131 | 0.942±0.141 |
| 70-79 | 0.696±0.094 | 0.820±0.056 | 0.827±0.059 |
| Duration after menopause (years) | | | |
| ≤5 | 0.864±0.111 | 1.020±0.160 | 1.051±0.150 |
| >5-10 | 0.852±0.087 | 0.994±0.167 | 1.016±0.172 |
| >10-20 | 0.803±0.215 | 0.925±0.122 | 0.944±0.127 |
| >20 | 0.729 | 0.745 | 0.748 |
| BMI ($kg/m^2$) | | | |
| <18.5 | 0.916±0.007 | 0.948±0.029 | 0.972±0.010 |
| 18.5-24.9 | 0.835±0.110 | 0.988±0.148 | 1.009±0.154 |
| 25.5-29.9 | 0.876±0.161 | 1.004±0.182 | 1.042±0.158 |
| ≥30 | 0.864±0.121 | 1.071±0.143 | 1.101±0.155 |

**Table 3 .** The prevalence of osteoporosis according to various BMD cutoff value.

| Measurement sites | BMD references | | | |
|---|---|---|---|---|
| | Japanese* | | Thai** | |
| | N=245 | % | N=245 | % |
| Femoral neck | | | | |
| Osteoporosis | 4 | 1.6 | 0 | 0.0 |
| Osteopenia | 67 | 27.3 | 29 | 11.8 |
| Normal | 174 | 71.1 | 216 | 88.2 |
| Lumbar spines L1-L4 | | | | |
| Osteoporosis | 26 | 10.6 | 2 | 0.8 |
| Osteopenia | 96 | 39.2 | 33 | 13.5 |
| Normal | 123 | 50.2 | 210 | 85.7 |
| Lumbar spines L2-L4 | | | | |
| Osteoporosis | 25 | 10.2 | | |
| Osteopenia | 87 | 35.5 | | |
| Normal | 133 | 54.3 | | |

WHO references T-scores: Normal ≥ -1, Osteopenia < -1 and > -2.5, Osteoporosis ≤ -2.5

| | Osteopenia | Osteoporosis |
|---|---|---|
| *Japanese BMD cutoff value: | >0.630, <0.810 g/cm$^2$ for FN | ≤0.630 g/cm2 for FN |
| | >0.810, <0.990 g/cm$^2$ for L1-L4 | ≤0.810 g/cm2 for L1-L4 |
| | >0.860, <1.093 g/cm$^2$ for L2-L4 | ≤0.860 g/cm2 for L2-L4 |
| ** Thai BMD cutoff value: | >0.569, <0.716 g/cm$^2$ for FN | ≤0.569 g/cm2 for FN |
| | >0.682, <0.847 g/cm$^2$ for L1-L4 | ≤0.682 g/cm2 for L1-L4 |

**Table 4 .** The prevalence of osteoporosis in different age group, duration after menopause and body mass index (BMI).

| | Femoral neck | | | Lumbar spines L1-L4 | | | Lumbar spines L2-L4 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Normal N(%) | Osteopenia N(%) | Osteoporosis N(%) | Normal N(%) | Osteopenia N(%) | Osteoporosis N(%) | Normal N(%) | Osteopenia N(%) | Osteoporosis N(%) |
| Age group (years)* | | | | | | | | | |
| 40-49 | 27(87.1) | 4(12.9) | 0(0.0) | 17(54.8) | 12(38.7) | 2(6.5) | 18(58.0) | 11(35.5) | 2(6.5) |
| 50-59 | 120(76.5) | 38(22.3) | 2(1.2) | 95(55.9) | 62(36.5) | 13(7.6) | 101(59.4) | 55(32.4) | 14(8.2) |
| 60-69 | 16(39.0) | 23(56.1) | 2(4.9) | 11(26.8) | 21(51.2) | 9(22.0) | 14(34.1) | 19(46.3) | 8(19.6) |
| 70-79 | 1(33.3) | 2(66.7) | 0(0.0) | 0(0.0) | 1(33.3) | 2(66.7) | 0(0.0) | 2(66.7) | 1(33.3) |
| Duration after menopause (years)* | | | | | | | | | |
| ≤5 | 117(75.5) | 36(23.2) | 2(1.3) | 87(56.1) | 58(37.4) | 10(6.5) | 94(60.6) | 50(32.3) | 11(7.1) |
| >5-10 | 38(76.0) | 12(24.0) | 0(0.0) | 23(46.0) | 19(38.0) | 8(16.0) | 23(46.0) | 20(40.0) | 7(14.0) |
| >10-20 | 19(48.7) | 18(46.2) | 2(5.1) | 13(33.3) | 19(48.7) | 7(18.0) | 16(41.0) | 17(43.6) | 6(15.4) |
| >20 | 0(0.0) | 1(100.0) | 0(0.0) | 0(0.0) | 0(0.0) | 1(100.0) | 0(0.0) | 0(0.0) | 1(100.0) |
| BMI (kg/m$^2$)** | | | | | | | | | |
| <18.5 | 2(100.0) | 0(0.0) | 0(0.0) | 0(0.0) | 2(100.0) | 0(0.0) | 0(0.0) | 2(100.0) | 0(0.0) |
| 18.5-24.9 | 99(67.3) | 6(31.3) | 2(1.4) | 71(48.3) | 56(38.1) | 0(13.6) | 76(51.7) | 53(36.1) | 18(12.2) |
| 25-29.9 | 60(75.0) | 9(23.8) | 1(1.2) | 41(51.3) | 33(41.2) | 6(7.5) | 46(57.5) | 27(33.7) | 7(8.8) |
| ≥30 | 13(81.3) | 2(12.5) | 1(6.2) | 11(68.8) | 5(31.2) | 0(0.0) | 11(68.8) | 5(31.2) | 0(0.0) |

*p<0.05

**p>0.05

## Discussion

According to the WHO criteria and using the Japanese BMD cutoff value, the present study showed that the prevalence of osteoporosis at the femoral neck, the lumbar spines L1-L4 and L2-L4 were 1.6%, 10.6% and 10.2%, respectively. When using the Thai BMD cutoff value, the prevalence of osteoporosis was 0% for the femoral neck and 0.8% for the lumbar spines. The prevalence of osteoporosis by using the Thai BMD cutoff value was lower than using the Japanese BMD cutoff value because the difference of population for the BMD reference in diagnosis of osteoporosis resulting the significant differences of bone mass (differences in geographical location area, ethnic, genetics and environmental factors such as diet, exercise, calcium and vitamin D status, smoking, alcohol and caffeine intake).[19-31]

The persent study also showed that the prevalence of postmenopausal osteoporosis at the femoral neck was lower than the lumbar spines, as same as many previous study.[32,33] Osteoporosis/osteopenia at the lumbar spines was more higher than the femoral neck because the trabecular bone was the main component of the vertebral bone.[34,35] Especially in early postmenopause, bone loss in trabecular bone is dominant by disruption of trabecular microstructure and loss of trabecular elements.[32,33] However, the prevalence of postmenopausal osteoporosis in the present study was lower than the study conducted by Ponchaiyakul C et al,[18] because differences of the study population, genetic and environment, living area, DXA machine used, BMD reference database, duration after menopause and socioeconomic status might be explained for this difference.[22,25-31] The difference in the DXA machine used causes the difference in BMD results because of Anthropometric variation.[24]

The prevalence of postmenopausal osteoporosis increased with the duration of postmenopausal years.[3,4] Most of the population in Pongchaiyakul's study had a longer duration after menopause than the present study (>20 years vs. ≤5 years). In addition, with poor socioeconomic status usually had the deprivation of calcium intake that might be the cause of osteoporosis at an early age that was found more frequent in Ponchaiyakul's study.[31] (The majority of the present study population was government officers and had income 20,001-50,000 Baht per month while the majority of Ponchaiyakul's population was farmers and had income 833.40-4,166.70 Baht per month).

Furthermore, the present study showed that the prevalence of osteoporosis was lower than Taechakraichana's study.[17] Population of Taechakraichana's study[17] lived mainly in Bangkok and measured BMD by DXA;Hologic QDR 2000 while population of the present study lived mainly in Khon Kaen province and measured BMD by DXA;GE Lunar Prodigy. However, the duration after menopause of both studies were hospital-based.[17]

Moreover, the prevalence of osteoporosis in the present study was lower than the study of Limpaphayom KK et al (the present study also used the same Thai BMD cutoff value to diagnosis of osteoporosis).[15,16] Population of Limpaphayom's study lived in 6 provinces from 4 regions of Thailand and measured BMD by 6 different DXA machines while population of the present study lived in 17 provinces from 2 regions of Thailand and measured BMD by the same DXA machine.

In addition, the prevalence of osteopenia and osteoporosis in the present study were significantly increased with advanced age and duration after menopause for both femoral neck and lumbar spines which were similar to the studies of Limpaphayom KK et al, Jarupanich T et al and Ravn P et al.[3,4,15] However, the results suggested that osteopenia/ osteoporosis could be present in the early age group of postmenopausal women. Pasco JA et al. reported that fractures in women with osteopenia had fracture risk as same as women with osteoporosis.[34] For clinical application, early detection of ostepenia/osteoporosis is important for prevention and early treatment of osteoporotic fracture. According to the limitation of the DXA machines that are not widely available in many provinces in Thailand, the clinical risk index either the Osteoporosis Self-Assessment Tools for Asians (OSTA) (35) or the Khon Kaen Osteoporosis Study Scoring (KKOS)[36] may be appropiate tool for screening osteoporosis in women with high risk. Finally,

the authors would like to suggest for further study that the health care providers should be used their own BMD reference population database for the diagnosis of osteoporosis.

## Conclusion

The prevalence of osteoporosis by utilizing the Japanese BMD cutoff value at the femoral neck (FN) and the lumbar spines (L1-L4) were 1.6% and 10.6%, respectively. Using the Thai BMD cutoff value, the prevalence of osteoporosis was lower than using the Japanese BMD reference. The result of the study showed that the prevalence of osteoporosis at the femoral neck was fewer than the lumbar spines and the prevalence of osteoporosis was increased with advanced age and duration after menopause.

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## *การศึกษาความชุกของโรคกระดูกพรุน ในสตรีวัยหลังหมดระดู โรงพยาบาลศรีนครินทร์ มหาวิทยาลัยขอนแก่น*

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***วัตถุประสงค์*** *เพื่อศึกษาความชุกของโรคกระดูกพรุนในสตรีวัยหลังหมดระดู*

***สถานที่ทำการวิจัย*** *โรงพยาบาลศรีนครินทร์*

***วัสดุและวิธีการ*** *ศึกษาข้อมูลย้อนหลังในทะเบียนประวัติสตรีวัยหลังหมดระดู ที่หมดระดูโดยธรรมชาติ ที่มารับบริการตรวจรักษาที่คลินิกสตรีวัยหมดระดู โรงพยาบาลศรีนครินทร์ คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่น ระหว่างวันที่ 1 มกราคม พ.ศ.2545 ถึง 31 พฤษภาคม พ.ศ.2551 และได้รับการตรวจวัดความหนาแน่นของกระดูก (Bone mineral density: BMD) โดยใช้เครื่อง Dual-energy X-ray absorptiometry: GE Lunar Prodigy, Japanese software ในการวินิจฉัยโรคกระดูกพรุนของงานวิจัยนี้ใช้เกณฑ์การวินิจฉัยขององค์การอนามัยโลก คือ ค่าความหนาแน่นของกระดูก ที่ต่ำกว่าค่าเฉลี่ยในวัยหนุ่มสาวเกินกว่าหรือเท่ากับ 2.5 ของส่วนเบี่ยงเบนมาตรฐาน ส่วนเกณฑ์ที่คัดออกจากการศึกษา ได้แก่ สตรีที่หมดระดูจาก ภาวะหมดระดูก่อนกำหนด การถูกตัดมดลูก การถูกตัดรังไข่ 2 ข้าง การฉายแสงและเคมีบำบัด สตรีวัยใกล้หมดระดู และสตรีที่มีโรคประจำตัวหรือใช้ยาที่มีผลกับกระดูก*

***ผลการศึกษา*** *สตรีวัยหลังหมดระดูจำนวน 245 ราย มีอายุเฉลี่ย 55.1±5.2 ปี หมดระดูมาเป็นเวลา 5.9±4.8 ปี มีน้ำหนักตัว 57.8±9.1 kg และมีค่าดัชนีมวลกาย 24.5±3.5 kg/m$^2$ ความชุกของโรคกระดูกพรุนที่กระดูกคอสะโพก (femoral neck) และกระดูกสันหลังส่วนเอว (L1-L4) โดยใช้ค่าอ้างอิงของคนญี่ปุ่น เท่ากับร้อยละ 1.6 และ 10.6 ตามลำดับ แต่ถ้าใช้ค่าอ้างอิงของคนไทยจะพบความชุกของโรคกระดูกพรุนของทั้งกระดูกคอสะโพกและกระดูกสันหลังส่วนเอว เท่ากับร้อยละ 0.0 และ 0.8 ซึ่งน้อยกว่าการใช้ค่าอ้างอิงของคนญี่ปุ่น นอกจากนี้ยังพบว่าเมื่อหาความชุกของโรคกระดูกพรุนโดยแยกตาม ช่วงอายุ และปีหลังจากหมดระดู พบความชุกของโรคกระดูกพรุน มากขึ้นตามอายุที่มากขึ้น และระยะเวลาที่นานขึ้นภายหลังจากหมดระดู*

***สรุป*** *ความชุกของโรคกระดูกพรุนที่กระดูกคอสะโพกและกระดูกสันหลังส่วนเอว เท่ากับร้อยละ 1.6 และ 10.6 ตามลำดับ ความชุกของโรคกระดูกพรุนที่กระดูกคอสะโพก (ร้อยละ 1.6) พบได้น้อยกว่าที่กระดูกสันหลังส่วนเอว (ร้อยละ 10.6) ความชุกของโรคกระดูกพรุนพบได้มากขึ้นตามอายุที่มากขึ้นและระยะเวลาที่นานขึ้นภายหลังจากหมดระดู*