



Bone Mineral Density and Its Associated Factors in Naresuan University Staff

Supawitoo Sookpeng*, Patsuree Cheebsumon, Malinee Dhanarun, Thanyavee Pengpan
and Prathan Wongtala

Department of Radiological Technology, Faculty of Allied Health Sciences, Naresuan University, Phitsanulok 65000, Thailand.

Corresponding author. E-mail address: supawitoo_s@yahoo.com (S. Sookpeng)

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Abstract

It is important to calculate the prevalence of osteopenia and osteoporosis to address the overall magnitude of the problem. This will allow us to predict the socioeconomic impact of these preventable chronic conditions. The objective of this study was to determine the prevalence and to assess the factors relating to osteoporosis in Naresuan University staff. A bone densitometer (Panasonic DXA-70) was used to measure the Bone Mineral Density (BMD) of the forearm in a hundred and thirty-three university staff members aged 21 to 60. An analysis of variance (ANOVA) was used to compare the differences in the mean BMD values among the different groups. BMD relations among variables were evaluated by linear regression analysis using Pearson correlation coefficients. Results revealed that the prevalence of osteopenia and osteoporosis was 54.1% and 6.8%, respectively. The BMD was not significantly related to any factors. However, 42.3% of the osteopenia group consumed more than 3 cups of coffee per week, 38.5% did not exercise, and 48.1% sometimes drank soft drinks, but 90.4% and 61.5% were neither cigarette smokers nor alcohol drinkers respectively. In addition, there were 48.1% who drank milk or dairy products more than 3 times per week. In the osteoporosis group, the results showed that 88.9% did not exercise, 66.7% consumed milk or dairy products less than 3 times per week. Furthermore, 77.8% sometimes consumed soft drinks. It can be concluded that the contributing factors related to osteopenia and osteoporosis are lack of exercise, insufficient consumption of milk or dairy products and regular caffeine intake. Therefore, the university efforts should be placed on health promotion of an adequate supply of calcium and exercise to prevent osteopenia and osteoporosis.

Keyword: Prevalence, Osteoporosis, Naresuan University staff

Introduction

Osteoporosis is one of the serious public health problems, especially in developing countries. Osteoporosis is usually found in post menopausal women, thin persons and persons with a family history of osteoporosis (Heany, 1983). The behavioral factors which are important in the pathogenesis of osteoporosis include physical activity, smoking, and alcohol consumption (Cumming et al., 1995). Bone fracture and pain are side effects of osteoporosis leading not only to a low quality of life but also to the high cost of treatment (Jensen et al., 1982). However, osteoporosis can be quickly identified by Bone Mineral Density (BMD) measurement (National Osteoporosis Foundation, 1987). Dual Energy X-ray Absorptiometry (DEXA) is the instrument used for the measurement of the BMD (Barnett and Nordin, 1960; Cameron and Sorensen, 1963; Cullum et al., 1989). DEXA has a very high degree of accuracy and is the popular precision instrument around the world in the assessment of the osteoporosis risk. The T-score obtained from the instrument is used for separating the three bone states—normal, osteopenia and osteoporosis—which is very useful, especially for the osteopenia group (Hansen and Hassager, 1990). The World Health Organization (WHO) defines osteoporosis as BMD that has a 2.5 standard deviation (SD) or more below the young adult mean value (T-score < -2.5), while individuals with BMD between 1 and 2.5 SD below average (T-score = -1 to -2.5) are said to have osteopenia (Kanis et al., 1994).

The Department of Radiological Technology in the Faculty of Allied Health Sciences at Naresuan University carried out a project to measure the BMD of the university staff and gather some knowledge about the behavior that protects against osteoporosis. Furthermore, the results of the measurement were used to determine the prevalence and the contributing factors of osteopenia and osteoporosis in Naresuan University staff.

Materials and Methods

The Naresuan University staff who participated in the project between 29-30 July 2004, which was the 14th anniversary of the establishment of Naresuan University, were interviewed by well trained interviewers using structured questionnaires about behaviors related to osteoporosis such as smoking, exercise, and the consumption of alcohol, coffee, tea, soft drinks, and milk and dairy products. After that, Bone Mineral Density (BMD) (g/cm^2) at the 1/10 distal site of the non-dominant forearm was measured using a bone densitometer (Panasonic model DXA-70). The coefficients of variation of the instrument were less than 1 %. A BMD of more than a 2.5 standard deviation below the mean value of the peak bone mass in young normal men and women was defined as osteoporosis while individuals with a BMD between 1 and 2.5 SD below average (T-score = -1 to -2.5) are said to have osteopenia (Kanis et al., 1994 ; WHO study group, 1994). The data were analyzed in four parts:

- i General data of the subjects.
- ii Behavior relating to osteoporosis: alcohol, coffee, tea, soft drinks, milk and dairy product consumption, and cigarette smoking and exercise.
- iii The prevalence of osteopenia and osteoporosis.
- iv The contributing factors relating to osteopenia and osteoporosis.

The mean BMDs were presented in 10 year age groups. The Statistical Package for Social Sciences (SPSS) was used to calculate the prevalence of osteopenia and osteoporosis for the mean and standard deviation of the BMD classified by age groups (Cook and Campbell, 1979; Norusis, 1985). An analysis of variance (ANOVA) was used to compare the differences in the mean BMD values among the different groups and the BMD relations among the variables was evaluated by linear regression analysis using Pearson correlation coefficients.

Results and Discussion

General data of the subjects

One hundred and thirty-three university staff members participated in the project, Twenty-three were males (17.3%) and 110 were females (82.7%). Fifteen females were postmenopausal. The range of the sample age was from 21 to 60 years old. The mode of age was 21-30 years (48.1 %), and the average age of the sample was approximately 35 years.

Behavior relating to osteoporosis

As shown in Table 1, the results indicated that 94.0% (n=125) of the subjects were not cigarette smokers and 68.4% (n=91) were not alcohol drinkers. The behavior for coffee consumption showed that 47.4% (n=63) of the subjects usually drank coffee (more than three cups a week). However, 30.8% (n=41) did not drink coffee. In addition, 43.6% (n=58) did not drink tea, and 37.6% (n=50) drank less than three cups of tea a week. The behavior for soft drink consumption showed that 47.4% (n=63) of the subjects sometimes drank soft drinks (3 times per week or less) and 31.6% (n=42) did not drink soft drinks. The behavior for milk and dairy product consumption showed that 47.4% (n=63) of the subjects usually consumed milk and dairy products (more than three times a week), and 34.6% (n=46) consumed milk and dairy products only sometimes. Moreover, data from questionnaires about exercise showed that 47.4% (n=63) of the subjects did not exercise. However, 23.3% (n=31) always exercised (more than 3 times per week) and the other 29.3% (n=39) exercised sometimes (3 times per week or less).

Table 1 The percentage of subject in behavior relating to osteopenia and osteoporosis

Behavior	Percentage of subjects (n=133)			
	Never	Usually*	Sometimes**	Used to
Cigarette smoking	94.0	3.8	-	2.2
Exercise	47.4	23.3	29.3	-
Alcohol consumption	68.4	3.0	27.8	0.8
Coffee consumption	30.8	47.4	21.1	0.8
Tea consumption	43.6	18.8	37.6	-
Soft drink consumption	31.6	19.5	47.4	1.5
Milk and diary product consumption	18.0	47.4	34.6	-

Note: * Usually = More than 3 times/cups per week

** Sometimes = 3 times/cups per week or less.

The prevalence of osteopenia and osteoporosis

The results of the BMD measurement showed that 39.1% of all subjects (n=52) who had a T-score higher than -1 SD or normal BMD where as 54.1% (n=72) had a T-score between -1 SD and -2.5 SD or osteopenia, and the remaining 6.8% (n=9) had a T-score lower than -2.5 SD or osteoporosis.

As shown in Table 2, considering the range of the subject ages, it was found that the prevalence of osteopenia and osteoporosis in the subjects between 21 and 30 years of age was 62.5% and 4.7%, respectively. The prevalence of osteopenia and osteoporosis in the subjects aged between 31 and 40 years was 42.4% and 6.1%, respectively. Whereas, the prevalence of osteopenia and osteoporosis in the subjects aged between 41 and 50 years and 51 and 60 years was 50.0 and 8.3%, and 50.0 and 16.7%, respectively.

Table 2 The prevalence of osteopenia and osteoporosis classify by age

	Age group (years)			
	21-30 (n=64)	31-40 (n=33)	41-50 (n=24)	51-60 (n=12)
Normal	32.8 %	51.5 %	41.7 %	33.3 %
Osteopenia	62.5 %	42.4 %	50.5 %	50.5 %
Osteoporosis ^a	4.7 %	6.1 %	8.3 %	16.7 %

Note: ^a P< 0.001 from t-test among different age groups

However, the bone densitometer used in this study (Panasonic model DXA-70) was a peripheral BMD strategy. It was high sensitivity but might miss many individuals with osteoporosis. Therefore, it was used for a peripheral scanning method only.

The contributing factors relating to osteopenia and osteoporosis

From Table 3 and Table 4, the analysis of factors relating to osteopenia and osteoporosis showed that the BMD was not significantly related to any factor (smoking, exercise or alcohol, coffee, tea, soft drinks, milk and diary product consumption). However, for the osteopenia group, 42.3% consumed more than 3 cups of coffee per week over a long time (average about ten years or more), 38.5% did not take any exercise, and 48.1% sometimes drank soft drinks. However, 90.4% and 61.5% of the group were neither cigarette smokers nor alcohol drinkers, respectively. Moreover, 48.1% of the group usually consumed milk and diary products (more than three times a week) over a long time (average six years). The data from the osteoporosis group showed that 88.9% of the group did not take exercise, 66.7% consumed milk and diary products less than 3 times per week. Moreover, 77.8% of the subjects also sometimes drank soft drinks.

Table 3 The percentage of subject in behavior relating to osteopenia

Behavior	Percentage of subjects (n=133)			
	Never	Usually*	Sometimes**	Used to
Cigarette smoking	90.4	7.7	-	1.9
Exercise	38.5	32.7	28.8	-
Alcohol consumption	61.5	3.8	34.6	-
Coffee consumption	34.6	42.3	23.1	-
Tea consumption	51.9	19.2	28.8	-
Soft drink consumption	42.3	9.6	48.1	-
Milk and diary product consumption	23.1	48.1	28.8	-

Note: * Usually = More than 3 times/cups per week

** Sometimes = 3 times/cups per week or less.

Table 4 The percentage of subject in behavior relating to osteoporosis

Behavior	Percentage of subjects (n=133)			
	Never	Usually*	Sometimes**	Used to
Cigarette smoking	77.8	22.2	-	-
Exercise taking	88.9	-	11.1	-
Alcohol consuming	55.6	-	33.3	11.1
Coffee consuming	44.4	33.3	22.2	-
Tea consuming	44.4	33.3	22.2	-
Soft drink consuming	11.1	11.1	77.8	-
Milk and diary product consuming	11.1	22.2	66.7	-

Note: * Usually = More than 3 times/cups per week

** Sometimes = 3 times/cups per week or less.

The prevalence of osteopenia and osteoporosis in Naresuan University staff was 54.1% and 6.8%, respectively. It was notable that osteopenia was most prevalent in subjects between 21 and 30 years of age. Osteoporosis was most prevalent in the subjects between 51 and 60 years of age.

A study conducted by Tungthitwong and associates (Tungthitwong et al., 2004), which determined the prevalence of osteopenia and osteoporosis in Bangkok among females between 41-50 years of age in 1996, reported that the prevalence of osteopenia and osteoporosis in the Bangkok female population was 41.6% and 10.4%, respectively. Compared with our research, the prevalence of osteopenia in our subjects aged between 41 and 50 years was 50.0% which was more than the subjects in Tungthitwong and associates's study and the prevalence of osteoporosis was 8.3% which was less. However, the two studies were conducted at different times and places with the subjects having different socio-demographic characteristics.

An analysis of the contributing factors relating to osteopenia and osteoporosis showed that the BMD was not significantly related to any of the factors. However, the majority of subjects in both groups did not exercise. This finding was in accordance with the research on factors influencing BMD which reported that exercise played an important role in BMD. Persons who did not exercise always possessed low BMD (Pocock et al., 1986; Riggs and Melto, 1986). Moreover, our research found that the majority of subjects in the osteoporosis group consumed low amounts of milk and diary products, and the majority of both groups always drank coffee (a cup per day or more). Research has shown that coffee is a risk factor for osteoporosis whenever taken more than 4 cups a day (Albanese, 1977).

Conclusion

Data from measuring BMD and interviewing Naresuan University staff using a structured questionnaire between 29 and 30 July 2004 showed that 39.1% had normal BMD whereas 54.1% and 6.8% already showed osteopenia and osteoporosis, respectively. The highest prevalence of osteopenia was in the subjects between 21-30 years of age, and the highest prevalence of osteoporosis was in the subjects between 51-60 years of age. The prevalence of osteopenia and osteoporosis in the subjects between 21 and 30 years of age was 62.5 and 4.7%, respectively. The prevalence of osteopenia and osteoporosis in the subjects between 31 and 40 years of age was 42.4 and 6.1%, respectively. The prevalence of osteopenia and osteoporosis in the subjects between 41 and 50 years of age and 51 and 60 years of age were 50.0 and 8.3%, and 50.0 and 16.7%, respectively.

The contributing factors relating to osteopenia were the frequent consumption of coffee and soft drinks, and lack of exercise. The contributing factors relating to osteoporosis were lack of exercise, inadequate intake of milk and dairy products, and consumption of soft drinks.

Determining the prevalence and contributing factors relating to osteopenia and osteoporosis is important for planning and laying out a policy for the prevention of osteopenia and osteoporosis. From this research, we conclude that half of the subjects, have osteopenia which may later develop into osteoporosis. So, the university should promote an adequate intake of calcium and exercise, and measure BMD once a year to prevent osteopenia and osteoporosis.

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