국내 중년 여성의 골(骨) 건강관련 지식, 자기효능감 및 건강행위

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Bone Health Knowledge, Self-Efficacy, and Behaviors in Middle-Aged Korean Women

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Background: With the rapid growth of the elderly population, osteoporosis has become a major health problem worldwide. Although health knowledge and self-efficacy are important assets to facilitate healthy behaviors and disease prevention, such information as it relates to individuals and their bone health is limited. The purpose of this study was to assess the levels of knowledge, self-efficacy, and health behaviors on promoting bone health in middle-aged Korean women.

Methods: This is a cross-sectional survey study. A convenience sampling of middle-aged women ($\geq$40 years) was done at a community health center in Korea. Bone mineral density was measured by dual energy X-ray absorptiometry with the DEXXUM T. The level of knowledge was measured with the Knowledge of Osteoporosis Scale, and self-efficacy with the Osteoporosis Self-efficacy Scale. A questionnaire for bone health behaviors was developed for this study. Collected data were analyzed through descriptive methods, independent t-test, analysis of variance, and Pearson's correlation analysis.

Results: A total of 150 middle-aged women whose mean age was 59.8±11.5 years participated in the study. Most (74%) were menopausal. Less than one-quarter of participants (22.7%) had osteoporosis and less than half (42%) had osteopenia based on the T-score at the left femur neck site. Level of knowledge (mean score, 10.35) and self-efficacy (mean score, 47.67) ranged from low to moderate. Intake of calcium and vitamin D-rich foods was insufficient in our subjects. Bone health behaviors had significant positive relationships with knowledge (r=0.22, P=0.008) and self-efficacy (r=0.29, P<0.001) on promoting bone health.

Conclusions: These results indicate that educational interventions are needed to enhance knowledge and confidence and to encourage middle-aged women to engage in bone health behaviors.

Korean J Health Promot 2012;12(2):90-99

Keywords: Bone, Health, Knowledge, Self efficacy, Health behavior, Middle aged, Women

INTRODUCTION

Osteoporosis is a skeletal disorder characterized by low bone mass and micro-architectural deterioration of bone tissue, with the consequent increase in bone fragility and susceptibility to fracture.[1] Osteoporotic fractures are a major health problem with substantial morbidity and mortality in postmenopausal women.[2] According to the World Health Organization, the number of hip fractures worldwide increased dramatically from 1.7 million in 1990 to 6.3 million in 2050,[3] as hip fracture incidence rates increase rapidly with aging.[4] In Asia, the incidence of hip fracture was predicted to rise to 37% by 2025,[5] and more

than 50% of all hip fractures will occur in Asia.[6] As growth of the elderly population has been rising, the prevalence of osteoporosis in Korean women older than 65 years is estimated at more than 50% and the socio-economic cost related to muscular bone diseases is about twice the cost of diabetes.[7]

Osteoporosis is generally considered a "woman's disease" because the prevalence of osteoporosis is much higher in women.[8] The National Osteoporosis Foundation estimates there are 9.1 million women with osteoporosis and an additional 26 million with low bone mass, which far exceeds the estimated 2.8 million men with osteoporosis and 14.4 million men with low bone mass.[9] In addition, recent studies showed that the prevalence of osteoporosis among Koreans aged 50-79 years was higher in women than in men.[10,11] Thus, appropriate screening and treatment strategies for middle- and older- women are critical.

Major risk factors of osteoporosis in postmenopausal women are advancing age, genetics, and lifestyle factors, such as low calcium and vitamin D intake, smoking, alcohol intake, low weight, and physical inactivity.[2] Lifestyle modification and management have been recommended to reduce fracture risk as the primary clinical goal of osteoporosis management because it is relatively easy to translate into real life.[12] However, older individuals are unlikely to exercise to the level required to actually build bone or take in adequate amounts of calcium and vitamin D daily.[13] According to the national survey, Korean over 65 years consume only 65.4% of the daily requirement of calcium intake, and Korea is one of the countries with insufficient vitamin D levels.[14]

Knowledge and health motivation play a key role in improving health behaviors.[15-19] Self-efficacy has been evaluated as a predictor of initiation and maintenance of health behaviors and has been used to develop and evaluate programs for improving general health.[18] Previous studies reported that the level of knowledge and self-efficacy on promoting bone health had significant relationships with health behavior changes.[15,19,20] However, information on the level of knowledge, self-efficacy, and health behaviors of bone health is limited among middle-aged women in Korea. Thus, the purpose of this study was to describe knowledge, self-efficacy, and health behaviors on promoting bone health and to examine the relationships among these variables in this defined population.

METHODS

1. Study design and participants

This study was a cross-sectional descriptive design. The participants were recruited from a community health center in South Korea. Inclusion criteria were: (1) women at least 40 years; (2) no current diseases known to affect bone metabolism, such as carcinomatosis, severe malabsorption, severe renal impairment, severe cardiopulmonary disease, and endocrine diseases; (3) no current pharmacotherapy known to interfere with bone metabolism, such as steroids, vitamin D or its derivatives, bisphosphonates, and raloxifen; (4) no cognitive impairment; and (5) capacity to understand the purpose of the study and to agree to participate. According to the power calculation estimates, 112 women were required for an effect size of 0.30, an alpha of 0.05, and a power of 0.90.

2. Measurements

1) Knowledge on bone health

Knowledge on bone health was measured with the 'Knowledge of Osteoporosis Scale' developed by Waller et al.[17] This scale was developed to examine the knowledge level for promoting bone health in general adults. The original scale was translated into Korean by the researchers of this study. This instrument consists of 27 items categorized into three dimensions- 'osteoporosis in general' (7 items); 'the effects of physical activity, smoking, and alcohol habits on bone mass' (8 items); and 'food products and nutrients such as calcium, vitamins, and minerals' (12 items). Participants answered 'yes' (=1), 'no' (=0), or 'do not know' (=0). The range of knowledge score was from 0 to 27 with higher scores indicating a higher level of knowledge. For internal consistency reliability, the Kuder-Richardson formula was 0.93 for the total items with 0.81 for general knowledge, 0.76 for lifestyle knowledge, and 0.87 for diet knowledge.

2) Self-efficacy on bone health

Self-efficacy was measured using a modified 'Osteoporosis Self-efficacy Scale' developed by Horan et al.[18] Again, the original scale was translated into Korean by the researchers of this study. The scale consists of 21 items with

two subcategories, exercise (10 items) and calcium (11 items). Each of the 21 items was measured on a five-point scale (0=not at all to 4=extremely). Thus, the total score ranged from 0 to 84 with higher scores indicating higher self-efficacy for physical exercise and calcium intake. In the study by Horan et al.,[18] internal consistency reliability for the exercise items was Cronbach's alpha of 0.94 and 0.93 for the calcium intake items. In this study, internal consistency reliability was 0.98 for the total items, 0.97 for the exercise items, and 0.98 for the calcium items.

3) Bone health behavior

Bone health behavior was measured using questionnaires developed by the researchers based on the guidelines from the 'Korea Physician's Guideline for Osteoporosis 2008'[14] and the 'Korean National Examination Health and Nutrition Survey 2005'.[21] The scale consisted of 6 items: alcohol use, smoking, regular exercise, sun exposure, calcium-rich foods intake, and vitamin D-rich food intake. Alcohol use was measured as frequency of intake per month and smoking was measured with a smoking history. Regular physical activity was measured as the number of days of performing exercise a week. Sun exposure was measured as exposure >15 minutes a day. Calcium and vitamin D intake items were measured with 27 questions on milk and dairy products (3 items); fish, seaweed, and legumes (9 items); meat (2 items); grains (2 items); vegetables (8 items); and nuts (3 items) ranging from 0 to 3. Participants were asked to check the frequency of intake of each item a week. The total score of 6 items ranged from 0 to 12 with higher scores indicating better bone health behavior. The internal consistency reliability for bone health behavior, measured by Cronbach's alpha, was 0.77.

4) Bone mineral density

Bone mineral density (BMD, g/cm^2) of the lumbar spine (L1-L4, L2-4), femoral neck, trochanter, and total femur were measured by the Dual Energy X-ray Absorptiometry with the use of the DEXXUM T (OsteoSys Co., Seoul, Korea). The scans were performed by a trained community health nurse practitioner. Quality assurance and instrument stability were assessed by scanning phantoms for calibration at the beginning of each measurement day. Based on the World Health Organization criteria,[22] par-

ticipants were classified as having osteoporosis if the BMD T-score on femoral neck was less than -2.5, or as having osteopenia if the BMD T-score was between -2.5 and -1.0, or as normal BMD if the BMD T-score was higher than -1.0.

5) Data collection procedure and ethical consideration

This study was approved by the institutional review board before the study was initiated. Informed consent was obtained from each participant prior to the study. Potential participants were identified from the clinical registry at a community health center in a rural community. Those who met the inclusion criteria and agreed to participate were given appointments for data collection at the community health center. BMD was measured by a skilled technician during this appointment. Surveys were conducted as individual interviews by a research assistant from July to August 2009.

6) Statistical analysis

Data analysis was performed using Statistical Package for the Social Science (SPSS) for Windows version 15.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to evaluate the demographic and clinical characteristics, as were BMD, knowledge, self-efficacy in promoting bone health, and bone health behaviors. Differences between major variables by demographic and clinical characteristics were analyzed through the independent t-test and analysis of variance, and relationships between major variables were analyzed through the Pearson correlation coefficient.

RESULTS

1. General characteristics of the study participants

A total of 150 women with a mean age of 59.8 years (standard deviation [SD]=11.4) participated in the study. Demographic and disease-related characteristics are presented in Table 1. The mean body mass index (BMI) was 24.27 kg/m^2 and 37.3 percent of participants were overweight (BMI≥25 kg/m^2). Most of the participants (80.0%) were married and menopausal (74.0%). Forty-one participants (27.7%) reported that they were diagnosed as having osteoporosis and 23% had had histories of fractures. In

Table 1. General and disease-related characteristics of study participants (n=150)

Variables	Classification	N	%[a]	Mean±SD
Age, y	<65	95	63.3	59.82±11.48
	≥65	55	36.7	
BMI, kg/m^2				24.27±2.93
Marital status	Married	120	80.0	
	Bereaved	27	18.0	
	Divorced	3	2.0	
Menstruation status	Regular	27	18.0	
	Irregular	7	4.7	
	Just started menopause	5	3.3	
	Postmenopausal	111	74.0	
Economic status	High	8	5.3	
	Moderate	66	44.0	
	Low	76	50.7	
Diagnosis of osteoporosis	Yes	41	27.7	
	No	107	72.3	
Fracture history	Yes	34	23.0	
	No	114	77.0	
Parents' fracture history	Yes	10	6.9	
	No	92	63.4	
	Don't know	43	29.7	
Weakness of eyesight	Yes	32	21.3	
	No	118	78.7	
Limitation in physical activity in last 6 months	Yes	9	6.0	
	No	141	94.0	
Level of daily activity	Stable activity	3	2.0	
	Mild activity	44	29.7	
	Moderate activity	71	48.0	
	Severe activity	30	20.3	
Comorbid conditions	Endocrine diseases	22	14.7	
	Rheumatic diseases	6	4.0	
	Tumors	3	2.0	
	None	119	79.3	
Medications	Glucocorticoids	16	10.7	
	None	134	89.3	
BMD, g/cm^2	Left femur neck			0.71±0.15
	Left femur total			0.76±0.16
Fracture risk (FRAX[b]), %	Major osteoporotic fracture			11.34±11.96
	Hip fracture			3.25±6.15

Abbreviations: SD, standard deviation; BMI, body mass index; BMD, bone mineral density; FRAX, fracture risk assessment tool.
[a]Calculated without missing data.
[b]A Japanese model of the World Health Organization fracture risk assessment tool.

BMD results,[12] 64.7% of our participants had T-score of less than -1.0 (osteopenia 42.0% or osteoporosis 22.7%). The mean 10-year probability of a major osteoporotic fracture assessed by the Fracture Risk Assessment Tool (FRAX®)[22] was 11.34% (SD=11.96) and the mean 10-year probability of hip fracture was 3.25% (SD=6.15).

2. Knowledge on bone health

The level of knowledge on bone health is presented in Table 2. The overall knowledge level was low (mean=10.35, out of 27). The level of knowledge on 'food products and nutrients' (mean=5.36) was relatively higher than those of 'physical activity' (mean=2.71) and 'osteoporosis in general' (mean=2.27). Subjects were most knowledgeable about 'spinach contains much calcium' and least knowledgeable about 'the effect of selenium for preventing osteoporosis'.

3. Self-efficacy on bone health

The level of self-efficacy on bone health is presented in Table 3. The overall self-efficacy was moderate (mean=47.67,

Table 2. Levels of knowledge on bone health (n=150)

Category	Items	Correct (%)	Mean±SD	100 percentile score
Food products and nutrients	Spinach contains much calcium. (T)	88.7	5.36±2.44	44.6
	Sardines contain much calcium. (T)	79.3		
	Kale and broccoli contain much calcium. (T)	77.3		
	Addition of calcium (calcium tablets) reduces the risk of getting osteoporosis. (T)	60.7		
	All kinds of milk, low-fat milk, average-fat milk, or ordinary milk and sour milk contain the same amount of calcium. (T)	57.3		
	Cheese is an important foodstuff in preventing osteoporosis. (T)	56.7		
	Vitamin D is important for the bone density. (T)	49.3		
	Food that contains much fat also contains calcium. (F)	33.3		
	Vitamin B-12 does not affect density of the skeleton. (T)	14.0		
	Root vegetables contain much calcium. (T)	9.3		
	Tomatoes and carrots are the vegetables that contain the highest amounts of calcium. (F)	8.0		
	Selenium is an important mineral that prevents osteoporosis. (F)	2.0		
Lifestyle modification on bone health	Smoking affects the bone mass. (T)	71.3	2.71±1.90	33.9
	Individuals with minor osteoporosis should not be physically active. (F)	57.3		
	Large intake of alcohol does not affect the bone density. (F)	42.0		
	Physical exercise has no effect on the bone mass, only on the muscles. (F)	41.3		
	Running strains the skeleton, which causes reduction of bone mass. (F)	38.0		
	Lifting heavy objects affects the body in a way that causes osteoporosis. (F)	11.3		
	Swimming is a good form of physical activity to increase bone mass. (F)	5.3		
	Cycling is the best physical activity in order to reduce osteoporosis. (F)	4.7		
Osteoporosis in general	The skeleton reaches its maximum strength at 20-30 years of age. (T)	74.0	2.27±1.38	32.4
	Sun rays reduce the risk of getting osteoporosis. (T)	49.3		
	60-year-olds today are more likely to get osteoporosis than 60-year-olds in the 1950s. (T)	48.7		
	Radon-radiation causes decalcification of the skeleton. (F)	16.7		
	The female sex hormone, estrogen hinders strengthening of the skeleton. (F)	16.7		
	Along with rising standard of living the number of fractures has been reduced. (F)	16.0		
	Before women reach 50 years of age they get a reduction of bone mass to a greater extent than men. (F)	6.0		
Total[a]			10.35±5.01	38.3

Abbreviations: T, true; F, false.
[a]Possible total scores range from 0 to 27.

out of 84). Level of self-efficacy for exercise was 22.46 and calcium intake was 25.20, indicating a moderate level of self-efficacy. Participants had the highest self-efficacy for 'remembering to eat calcium-rich foods'. However, self-efficacy for 'doing exercises even when tired' was the lowest.

4. Bone health behavior

Most participants did not smoke (99.3%) nor use alcohol (79.9%). More than 76% of the participants exerciseed four days a week and 71.8% were exposed to the sun >15 minutes a day. Only 8.7% of the participants consumed calcium-rich foods more than once a day and no one consumed vitamin D-rich foods on a daily basis (Table 4).

5. Differences in level of knowledge, self-efficacy, and bone health behaviors based on participants' characteristics

The level of knowledge and self-efficacy were significantly different by age ($P<0.001$), marital status ($P<0.001$), menstruation status ($P<0.001$), economic status ($P<0.001$), fracture history ($P<0.05$), and BMD ($P<0.001$). However, bone health behaviors were significantly different only by BMD ($P=0.010$) (Table 5).

6. The relationships between knowledge, self-efficacy, and health behavior on bone health

Bone health behavior was positively related with knowledge ($r=0.22$, $P=0.008$) and self-efficacy ($r=0.29$,

Table 3. Levels of self-efficacy in promoting bone health (n=150)

Category	Items[a]	Mean±SD	100 percentile score
Exercise	Put forth the effort required to exercise.	2.86±0.87	
	Do the type of exercises you are supposed to do.	2.77±0.83	
	Do exercises even if they are difficult.	2.75±0.86	
	Begin a new or different exercise program.	2.74±0.95	
	Change your exercise habits.	2.57±0.91	
	Exercise at least three times a week.	2.46±1.03	
	Exercise for the appropriate length of time.	2.34±0.92	
	Maintain a regular exercise program.	2.20±1.00	
	Stick to your exercise program.	2.09±0.92	
	Do exercises even if they are tiring.	2.03±0.93	
Subtotal		22.46±8.01	56.2
Calcium	Remember to eat calcium-rich foods.	3.07±0.81	
	Increase your calcium intake.	2.94±0.80	
	Begin to eat more calcium-rich foods.	2.93±0.80	
	Eat calcium-rich foods as often as you are supposed to.	2.83±0.81	
	Consume adequate amounts of calcium-rich foods.	2.82±0.85	
	Obtain foods that give an adequate amount of calcium.	2.66±0.84	
	Eat calcium-rich foods on a regular basis.	2.60±0.92	
	Stick to a diet which gives an adequate amount of calcium.	2.57±0.94	
	Take calcium supplements if you don't get enough calcium from your diet.	2.55±1.06	
	Change your diet to include more calcium-rich foods.	2.39±0.93	
Subtotal		25.20±8.97	57.2
Overall[b]		47.67±15.81	56.7

[a]For each item, score is from 0 (not at all confident) to 4 (very confident).
[b]Scores range from 0 to 84.

Table 4. Levels of bone health behaviors (n=150)

Variables	Classification	Possible score	N[a]	%
Smoking	Non-smoker	1	148	99.3
	Smoker	0	1	0.7
Alcohol use	None	2	119	79.9
	<1 time/mo	1	7	4.7
	≥1 time/mo	0	23	15.4
Regular exercise	4 d/wk	2	111	76.0
	1-3 d/wk	1	21	14.4
	Not at all	0	14	9.6
Sun exposure duration	≥15 min/d	1	107	71.8
	<15 min/d	0	42	28.2
Calcium-rich foods intake	≥7 time/wk	3	13	8.7
	4-7 time/wk	2	73	48.6
	1-4 time/wk	1	64	42.7
	0 time/wk	0	0	0
Vitamin D-rich foods intake	≥7 time/wk	3	0	0
	4-7 time/wk	2	2	1.3
	1-4 time/wk	1	121	80.7
	0 time/wk	0	27	18.0
Total[b] (mean±SD)	6.17±1.36			

Abbreviation: SD, standard deviation.
[a]Missing data excluded.
[b]Scores range from 0 to 12.

$P<0.001$). In addition, knowledge on bone health was positively related with self-efficacy ($r=0.49$, $P<0.001$) (Table 6).

DISCUSSION

This study found that the levels of knowledge, self-efficacy, and health behaviors on bone health were low among

Table 5. Differences in knowledge, self-efficacy, and bone health behaviors based on demographics and clinical characteristics (n=150)

Variables	Categories	N (%)	Knowledge		Self-efficacy		Bone health behavior	
			Mean±SD	F/t (P)[a]	Mean±SD	F/t (P)[a]	Mean±SD	F/t (P)[a]
Age, y	<65	95 (63.3)	12.41±3.92	7.859	53.11±12.02	5.644	6.33±1.41	1.911
	≥65	55 (36.7)	6.78±4.71	(0.001)	38.27±17.21	(0.001)	5.89±1.24	(0.058)
BMI, kg/m²	<23	52 (34.7)	11.06±4.91	1.852	47.65±14.61	0.015	6.33±1.30	0.510
	23-25	42 (28.0)	10.81±5.23	(0.161)	48.00±15.85	(0.985)	6.07±1.40	(0.602)
	≥25	56 (37.3)	9.34±4.87		47.43±17.08		6.09±1.40	
Marital status	Married	120 (80.0)	11.27±4.72	4.816	50.57±14.58	4.816	6.18±1.36	0.150
	Bereaved/divorced	30 (20.0)	6.67±4.51	(0.001)	36.07±15.42	(0.001)	6.13±1.38	(0.881)
Menstruation status	Postmenopausal	111 (74.0)	9.13±4.98	-6.759	44.85±16.37	-4.682	6.07±1.33	-1.485
	Premenopausal	39 (26.0)	13.82±3.18	(0.001)	55.69±10.73	(0.001)	6.45±1.43	(0.140)
Economic status	High	8 (5.3)	13.25±4.33	19.229	54.63±15.40	20.020	6.14±0.90	1.356
	Moderate	66 (44.0)	12.58±4.09	(0.001)	55.11±10.25	(0.001)	6.37±1.34	(0.261)
	Low	76 (50.7)	8.11±4.84		40.47±16.65		5.99±1.41	
Diagnosis of osteoporosis	Yes	41 (27.7)	9.46±5.21	-1.417	44.95±16.54	-1.286	6.10±1.52	-0.279
	No	107 (72.3)	10.76±4.88	(0.159)	48.70±15.61	(0.200)	6.17±1.32	(0.780)
Fracture history	Yes	34 (23.0)	8.50±4.76	-2.577	40.85±15.46	-2.916	6.27±1.40	0.562
	No	114 (77.0)	10.96±4.93	(0.011)	49.69±15.53	(0.004)	6.12±1.37	(0.575)
Parents' fracture history	Yes	10 (6.9)	12.50±5.46	1.359	57.00±9.90	1.912	6.40±1.65	0.588
	No/don't know	135 (93.1)	10.31±4.88	(0.176)	47.27±15.83	(0.058)	6.14±1.33	(0.558)
Weakened eyesight	Yes	32 (21.3)	11.81±4.87	1.880	51.94±14.53	1.735	6.48±1.45	1.401
	No	118 (78.7)	9.95±5.00	(0.062)	46.51±16.00	(0.085)	6.09±1.33	(0.163)
Physical activity limit during last 6 months	Yes	9 (6.0)	8.22±5.07	-1.314	47.00±20.74	-0.130	6.13±1.36	-0.089
	No	141 (94.0)	10.48±5.00	(0.191)	47.71±15.54	(0.897)	6.17±1.37	(0.930)
BMD classification[b]	Normal	53 (35.3)	11.60±4.46	16.052	52.26±11.94	12.235	6.53±1.43	4.801
	Osteopenia	63 (42.0)	11.40±4.58	(0.001)	49.62±15.38	(0.001)	6.17±1.32	(0.010)
	Osteoporosis	34 (22.7)	6.44±4.74		36.88±17.27		5.62±1.18	

Abbreviations: SD, standard deviation; BMD, bone mineral density.
[a]Calculated by independent *t*-test or one-way analysis of variance.
[b]Classified according to the World Health Organization criteria.

Table 6. Correlations between knowledge, self-efficacy, and health behavior on bone health (n=150)[a]

Variables	Knowledge	Self-efficacy
Self-efficacy	0.491 (*P*<0.001)	1
Bone health behavior	0.219 (*P*=0.008)	0.293 (*P*<0.001)

[a]Calculated by Pearson correlation analysis.

middle-aged Korean women, and these variables were significantly related. Our subjects showed high percent rates of osteopenia (42.0%) and osteoporosis (22.7%). This was expected considering the fact that prevalence of osteoporosis is 12.4-32.6% in Korean women aged 50 years and older.[10,23] The mean 10-year probabilities of major osteoporotic fractures and the mean hip fractures using the FRAX Japanese model were 11.34% and 3.25%, respectively. These results are consistent with those of previous reports. In the study by Lee et al.,[23] the 10-year probabilities of major osteoporotic and hip fractures for postmenopausal Korean women (mean age, 77.0 years) were 25.0% and 10.4%, respectively, and were 7.5-14.5% and 1.1-2.7% based on the presence of clinical risk factors

in the study by Fujiwara et al.[24] As these prevalence rates were determined in a small sample of Korean women with a large age range, further research is required to determine a more accurate osteoporosis prevalence rate in middle- and older women.

The low level of knowledge in our study participants is consistent with previous reports.[19,20,25,26] Among the percentage of correct answers for each question on knowledge, the lowest number of correct answers was for the item, 'selenium is an important mineral that prevents osteoporosis' followed by 'cycling is the best physical activity in order to reduce osteoporosis'. Middle-aged women may not be familiar with certain terminologies such as 'selenium'. In addition, generally people believed that any

kind of exercise would be helpful to prevent osteoporosis. The level of knowledge in participants older than 65 years with low T-scores (≤-2.5) was significantly low. This indicates that specific and tailored educational information should be provided to this population. Although, the Korean Society of Bone Metabolism has been disseminating information on osteoporosis prevention program to the general public since 2008,[14] the outcome may not be as effective as hoped for. These findings imply that more rigorous efforts are needed to enhance public awareness about bone health.

Self-efficacy scores indicated that participants have low confidence about taking calcium (57.2 out of 100) and exercising regularly (56.2 out of 100). These findings are slightly lower than those from previous studies.[15,25-27] The lower scores for self-efficacy were 'changing diet including more calcium-rich foods' and 'doing exercises even when tired'. It may be difficult for middle-aged women to change their lifestyle because approximately half of our participants did moderate levels of work in their lives already. In order to achieve adequate calcium absorption from food sources among women living in the community, food selection decisions should reflect their usual dietary menus and the attainability of calcium-rich food in their regional environment. Self-efficacy is considered to be the most important factor to behavioral change. Shin et al.[27] pointed out that perceived self-efficacy had the most influence on commitment to a plan for exercise. Strategies for improving individual self-efficacy in a community through regular group education or health promotion programs would be effective for middle-aged women.

The mean score of health behavior revealed that participants did not actively engage in preventive behaviors, especially consuming calcium- and vitamin D-rich foods. Calcium intake in Korean adults aged 50-65 years is approximately 500 mg/day, which is much less than the recommended intake of 1200 mg/day and, the amount of calcium intake is lower in women than men.[28] Not helping this situation, Korea has been identified as one of the countries with insufficient vitamin D levels.[14] In addition, intense and strength-loaded exercise training was difficult for this group because of the lack of facilities and motivation. With the higher prevalence of osteoporosis in middle-aged women along with insufficient healthy behaviors, public health needs to work harder to increase the awareness of healthy bone behaviors[27,29] as should healthcare providers pay more attention to promoting lifestyle for healthy bones. In this study, >76% of participants reported that they regularly exercised 4 days per week, while the Korea National Health and Nutrition Examination Survey reported that about 13% of Korean women do strength exercises regularly and about twice more men do strength exercises than women aged 40-59 years.[21] Of note, since the study participants were engaged in daily farming activities, they might have thought and reported these farming activities as exercise, which may not always be so. Thus, preventive strategies for bone health should be developed and systematic health education programs would be helpful in providing accurate information. In addition, future studies should allow for long term tracking of lifestyle changes related to bone health.

Bone health behaviors showed a statistically significant positive relationship with knowledge and self-efficacy in promoting bone health. Also, level of knowledge showed a positive relationship with self-efficacy. Many studies have found similar result with these variables.[25-27] Educational programs may be targeted at older women, especially those not performing behaviors for healthy bones such as regular exercise and adequate calcium and vitamin D intake.

There are several limitations in this study. Generalizability may be problematic because of geographical limitation and convenient sampling. In addition, some specific terms in knowledge instrument might be difficult to understand or confusing to middle-aged women. Culturally adaptable instruments are needed. Therefore, the findings of this study should be interpreted with caution. In conclusion, tailored educational programs need to be developed to enhance and improve middle-aged women's confidence in engaging in bone health behaviors.

요   약

연구배경: 최근 고령 인구가 빠르게 증가함에 따라, 골다공증은 국내 중년 이후 여성의 건강을 위협하는 주요 문제로 대두되었다. 따라서 본 연구는 골다공증의 예방 및 관리를 위하여 중년 여성들의 골 건강상태와 골 건강을 위한 지식, 자기효능감 및 건강행위의 수준 등을 파악하는 것이다.

방법: 본 연구는 횡단적 서술조사 연구로, 국내 일 지역

의 보건진료소에 등록된 만 40세 이상의 중년 여성 150명을 대상을 임의로 선정하여 실시하였다. 골밀도는 이중 골밀도 X선 흡수법으로 DEXXUM T기기를 이용하여 측정하였으며, 자가기입식 설문지를 활용하여 인구사회학적 특성, 골 건강관련 지식, 자기효능감 및 골 건강행위를 측정하였다. 수집된 자료는 Statistical Package for the Social Science 15.0을 이용하여 분석하였다.

결과: 연구대상자 150명의 평균 연령은 59.8세로, 74.0%가 폐경 상태였다. 골밀도 측정 결과, 좌측 대퇴골 경부를 기준으로 대상자의 22.7%가 골다공증, 42.0%가 골감소증으로 나타났다. 골 건강관련 지식의 평균 점수는 10.35점으로 낮았고, 자기효능감 수준은 47.67점으로 중간수준이었다. 골 건강행위 수준은 칼슘과 비타민 D가 풍부한 식이 섭취 영역이 저조하였다. 또한 골 건강행위는 지식 수준(r=0.22, P=0.008)과 자기효능감 수준(r=0.29, P<0.001)이 통계적으로 유의한 양적 상관관계가 있었다.

결론: 본 연구의 결과, 중년 여성들의 골 건강행위를 실천할 수 있도록 골 건강관련 지식과 자기효능감을 증진시키기 위한 교육적 중재가 필요하다.

중심단어: 골, 건강, 지식, 자기효능감, 건강행위, 중년, 여성

REFERENCES

1. Emaus N, Omsland TK, Ahmed LA, Grimnes G, Sneve M, Berntsen GK. Bone mineral density at the hip in Norwegian women and men--prevalence of osteoporosis depends on chosen references: the Tromsø Study. Eur J Epidemiol 2009;24(6):321-8.
2. The North American Menopause Society. Management of osteoporosis in postmenopausal women: 2010 position statement of The North American Menopause Society. Menopause 2010;17(1):25-54.
3. World Health Organization. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Report of a WHO Study Group. World Health Organ Tech Rep Ser 1994;843:1-129.
4. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. Lancet 2002;359(9319):1761-7.
5. Gullberg B, Johnell O, Kanis JA. World-wide projections for hip fracture. Osteoporos Int 1997;7(5):407-13.
6. Cooper C, Campion G, Melton LJ 3rd. Hip fractures in the elderly: a world-wide projection. Osteoporos Int 1992;2(6):285-9.
7. Kang HY, Park SE, Kang DR, Kim JY, Jang YH, Choi WJ, et al. Estimating medical expenditure associated with osteoporotic hip fracture in elderly Korean women based on the National Health Insurance Claims Database 2002-2004. Value Health 2009;12 Suppl 3:S93-6.
8. Cawthon PM. Gender differences in osteoporosis and fractures. Clin Orthop Relat Res 2011;469(7):1900-5.
9. National Osteoporosis Foundation. America's Bone Health: The State of Osteoporosis and Low Bone Mass in Our Nation. Washington, DC:National Osteoporosis Foundation;2002. p.1-110.
10. Cui LH, Choi JS, Shin MH, Kweon SS, Park KS, Lee YH, et al. Prevalence of osteoporosis and reference data for lumbar spine and hip bone mineral density in a Korean population. J Bone Miner Metab 2008;26(6):609-17.
11. Shin CS, Choi HJ, Kim MJ, Kim JT, Yu SH, Koo BK, et al. Prevalence and risk factors of osteoporosis in Korea: a community-based cohort study with lumbar spine and hip bone mineral density. Bone 2010;47(2):378-87.
12. National Osteoporosis Foundation. Clinician's Guide to Prevention and Treatment of Osteoporosis. Washington, DC: National Osteoporosis Foundation; 2010. [Accessed October 18, 2011]. http://www.nof.org/sites/default/files/pdfs/NOF_ClinicianGuide2009_v7.pdf.
13. Delaney MF. Strategies for the prevention and treatment of osteoporosis during early postmenopause. Am J Obstet Gynecol 2006;194(2 Suppl):S12-23.
14. The Korean Society of Bone Metabolism. Physician's Guide for Diagnosis and Treatment of Osteoporosis. Seoul: The Korean Society of Bone Metabolism; 2008. [Accessed October 18, 2011]. http://ksbmr.org/html/member/sub3/04_sub.asp.
15. Doheny MO, Sedlak CA, Estok PJ, Zeller R. Osteoporosis knowledge, health beliefs, and DXA T-scores in men and women 50 years of age and older. Orthop Nurs 2007;26(4):243-50.
16. Sedlak CA, Doheny MO, Jones SL. Osteoporosis education programs: changing knowledge and behaviors. Public Health Nurs 2000;17(5):398-402.
17. Waller J, Eriksson O, Foldevi M, Kronhed AC, Larsson L, Löfman O, et al. Knowledge of osteoporosis in a Swedish municipality--a prospective study. Prev Med 2002;34(4):485-91.
18. Horan ML, Kim KK, Gendler P, Froman RD, Patel MD. Development and evaluation of the Osteoporosis Self-Efficacy Scale. Res Nurs Health 1998;21(5):395-403.
19. Gemalmaz A, Oge A. Knowledge and awareness about osteoporosis and its related factors among rural Turkish women. Clin Rheumatol 2008;27(6):723-8.
20. Shakil A, Gimpel NE, Rizvi H, Siddiqui Z, Ohagi E, Billmeier TM, et al. Awareness and prevention of osteoporosis among South Asian women. J Community Health 2010;35:392-7.
21. Korea Centers for Disease Control and Prevention. The Third Korea National Health and Nutrition Examination Survey (KNHANES III). Seoul:Korea Centers for Disease Control and Prevention;2005. p.151-228.
22. Watts NB, Lewiecki EM, Miller PD, Baim S. National Osteoporosis Foundation 2008 Clinician's Guide to Prevention and Treatment of Osteoporosis and the World Health Organization Fracture Risk Assessment Tool (FRAX): what they mean to the bone densitometrist and bone technologist. J Clin Densitom 2008;11(4):473-7.
23. Lee DY, Lim SJ, Moon YW, Min YK, Choi D, Yoon BK, et al. Determination of an applicable FRAX model in Korean women. J Korean Med Sci 2010;25(11):1657-60.
24. Fujiwara S, Nakamura T, Orimo H, Hosoi T, Gorai I, Oden A, et al. Development and application of a Japanese model of the WHO fracture risk assessment tool (FRAX). Osteoporos Int 2008;19(4):429-435.
25. Shin SJ, Shin KR, Yi HR, Ju SK. Knowledge, health belief, and self-efficacy related to osteoporosis. J Korean Acad Nurs 2005;35(5):850-7.
26. Kim MH, Kim MS. A study on the relationships between

knowledge about osteoporosis and cognitive factors in middle-aged women. Korean J Women Health Nurs 2005;11(1):52-7.

27. Shin YH, Hur HK, Pender NJ, Jang HJ, Kim MS. Exercise self-efficacy, exercise benefits and barriers, and commitment to a plan for exercise among Korean women with osteoporosis and osteoarthritis. Int J Nurs Stud 2006;43(1):3-10.

28. Korea Centers for Disease Control and Prevention. The Fourth Korea National Health and Nutrition Examination Survey (KNHANES IV-2). Seoul:Korea Centers for Disease Control and Prevention;2009. p.24-36.

29. Lee HY. A study of correlation among the knowledge of the disease, health promoting behaviors and the quality of life in the female patients with osteoporosis. J Rhuma Health 2001;8(1):65-85.