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Original article

The Effect of Nutritional Habits on Bone Minerals Density in Women with Postmenopausal Osteoporosis

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Abstract. *Study Objectives:* It was stated that the effect of dietary habits is of great importance in the prevention, pathogenesis, and treatment of osteoporosis. This descriptive and cross-sectional study was conducted to determine the effect of nutritional habits on bone mineral density in postmenopausal women with osteoporosis. *Methods:* The research was completed with 158 women who applied to the orthopedics and traumatology outpatient clinic with the diagnosis of postmenopausal osteoporosis between October 2020 and April 2021 in a practice and research hospital in Central Anatolia. The data were collected with the DEXA result reports in the patient files and the Patient Identification Form created by the researchers by scanning the literature. *Results:* 94.3% of the women included in the study smoked, 98.1% did not drink alcohol, 48.1% occasionally consumed coffee, 54.4% daily 3 cups of tea, 45.6% decently consumed cereals and cereal products, 39.3% sometimes consumed milk and dairy products. 82.3% of participants do not receive vitamin D and 88% do not receive calcium support therapy. *Conclusion:* It was determined that smoking, tea consumption, and BMI of women did not affect bone mineral density ($p>0.05$). It was determined that coffee consumption, frequently consumed food type, and taking vitamin D and calcium supplements affected bone mineral density ($p<0.05$).

Key words: Bone Mineral Density, Osteoporosis, Biochemistry, Anatomy, Nursing

Introduction

Osteoporosis is defined as a systemic musculoskeletal disease that occurs with the deterioration of the anatomical structure of the bones and the increase in fractures due to decreased bone mass and deterioration of bone tissue (1, 2). It is stated that osteoporosis, which is an important health problem, affected 56 million people in 2000 and 200 million people in 2010(3, 4). In osteoporosis, not only bone fractures but also complications such as limitation of movement, pain, and even death can be encountered. Among the causes of death, osteoporosis ranks third after cardiovascular diseases and cancer-related deaths (3, 5, 6). In the development of osteoporosis, age, gender, use of certain drugs (glucocorticoids, oral contraceptives, tricyclic antidepressants, etc.), secondary osteoporosis, family history of osteoporosis, number of births, body composition, smoking, excessive alcohol or coffee consumption, low exposure to sunlight, menopause and menarche age, hysterectomy, some metabolic diseases such as diabetes, insufficient consumption of calcium-rich milk and dairy products, and lack of physical activity are among the factors affecting bone mineral density (5, 7, 8). The increase in bone mineral loss in postmenopausal women also reveals the risk of developing osteoporosis (9). In the reports published by the World Health Organization, it has been reported that 30% of postmenopausal women aged 50 and over in the world fall within the definition of osteoporosis

and have a high risk for bone fracture. It has been stated that this bone loss that develops in the postmenopausal period is primarily due to the decrease in estrogen. (10) In a study, it was reported that the risk of developing osteoporosis and the incidence of osteoporosis increase with the increase in Follicle Stimulating Hormone (FSH) secretion in postmenopausal women aged 42-60 (11). The World Health Organization emphasizes that adequate calcium, vitamin D and strengthening exercises are important to prevent osteoporosis (12). It is stated that the effect of nutritional habits is of great importance in the prevention, pathogenesis, and treatment of osteoporosis. Calcium, phosphorus, vitamin D, and proteins, primarily; magnesium, copper, vitamin C, vitamin K, and zinc are of great importance in the prevention and treatment of osteoporosis (13).

Therefore, investigating the effect of nutritional habits on bone mineral density in postmenopausal women with osteoporosis is very important in terms of minimizing the development and effects of osteoporosis in the menopausal period, reducing the risk of osteoporosis-related fractures and morbidity and mortality due to secondary fractures, and reducing health costs and hospitalizations (14).

This study, it was aimed to determine the effect of nutritional habits on bone mineral density in postmenopausal women with osteoporosis.

Materials and Methods

Type of Research

This descriptive and cross-sectional study was conducted to determine the effect of nutritional habits on bone mineral density in postmenopausal women with osteoporosis.

Setting

The cross-sectional planned study was conducted with 158 women who applied to the orthopedics and traumatology outpatient clinic with the diagnosis of postmenopausal osteoporosis between October 2020 and April 2021 in a practice and research hospital located in Central Anatolia of Turkey. There is an orthopedics and traumatology outpatient clinic in the hospital where the study was conducted.

Population and Sample of the Research

The population of the study consisted of women who applied to the orthopedics and traumatology outpatient clinic with the diagnosis of postmenopausal osteoporosis in a research hospital located in Central Anatolia of Turkey. The women who applied to the outpatient clinic between October 2020 and April 2021, who did not choose the sample and accepted the study, and met the inclusion criteria, were included in the study. Women younger than 65 years of age, who did not have a physical/mental disability, had no history of fracture, were diagnosed with postmenopausal osteoporosis, entered menopause naturally, and whose DEXA results were checked, were included in the study. 252 women applied to the polyclinic on the specified dates. The study was completed with 158 women by excluding 94 women (22 people over 65 years old, 47 people not diagnosed with postmenopausal osteoporosis, 9 people with a history of fracture, 14 people who did not agree to participate in the study) who did not meet the inclusion criteria and did not agree to participate in the study.

Data Collection

Data were collected by face-to-face interview technique in an empty room next to the orthopedics and traumatology outpatient clinic between October 2020 and April 2021. The data to be taken from the patient file were obtained immediately after the interviews were completed. Data collection took approximately 20 minutes for each patient. The data were collected with the DEXA result reports in the patient files and the Patient Identification Form created by the researchers by scanning the literature.

Patient Identification Form; It consists of 17 questions in which some socio-demographic, obstetric, osteoporosis-related characteristics, and nutritional habits of women are questioned (10-16).

DEXA score; According to the criteria determined by the World Health Organization, the bone mineral density of individuals is measured, and low bone density is evaluated based on the T score (17). The T score

is the standard deviation above and below the mean bone mineral density for a normal young adult.

T score; > -1.0 normal,

-1 > T score > -2.5 osteopenia,

T score < -2.5 osteoporosis and

T score < -2.5 and one or more fractures are also considered as established osteoporosis (17).

Z and T and scores are used to determine the DEXA score. The T score is the standard deviation above and below the bone mass of the young adult population. It is used when diagnosing osteoporosis in men over 50 and postmenopausal women.

The Z score is the comparison of the patient's bone mineral density measurements with the mean values of the normal population of the same age and sex, and the difference is defined as the standard deviation. It is used when diagnosing osteoporosis in women and men under the age of 50 (15,16).

Statistical Analysis

The data were evaluated in the computer environment. First of all, the Shapiro-wilk normality test was performed to test the conformity of the data to the normal distribution. Independent sample t-test and one-way ANOVA were performed when the data were normally distributed. Games-Howell post hoc test was used to determine which group caused the difference in multiple groups.

Ethical Principles

Ethics committee approval was obtained from the hospital where the study will be conducted and the ethics committee to which it is affiliated, before starting the study. Written and verbal informed consent forms were obtained by explaining the purpose of the study to the women participating in the study.

Results

The mean age, menstrual age, and first gestational age of the postmenopausal women with osteoporosis included in the study were calculated as 56.26±2.41, 12.30±4.67, 19.48±4.16, respectively. 81.6% of the women are married, 89.2% of them are equal to their income, 49.4% are secondary school graduates, and 93.7% are not working. The mean BMI of the participants was 29.02±4.18, 56.3% were less active, 46.8% were obese, 82.9% had a conservative dressing style, 60.1% had a chronic disease and 93.7% did not sunbathe every day (Table 1).

Table 1. Distribution of some characteristics of women (n=158)

Features	**n**	**%**
Mean age (years)	56.26±2.41	
Mean age of menstruation	12.30±4.67	
Mean age at first pregnancy	19.48±4.16	
marital status		
The married	129	81.6
Single	29	18.4
Economical situation		
Income less than expenses	11	7
Income equals expense	141	89.2
Income more than expenses	6	3.8
Educational status		
Illiterate	15	9.5
Literate	61	38.6
secondary education	78	49.4
Graduated from a University	4	2.5
Working Status		
Working	10	6.3
Inoperative	148	93.7
BMI		
Normal (18.50-24.99)	31	19.6
Overweight (between 25,000 and 29.99)	53	35.5
Obese 1. Obese (between 30.00 and 35.00)	74	46.8
BMI average	29.02±4.18	
conversation of dressing		
No	27	17.1
Yes	131	82.9
Usually in motion		
Still	27	17.1
less active	89	56.3
medium motion	42	26.6
Sunbathing situation every day		
Sunbathing	10	6.3
not sunbathing	148	93.7

Table. 1 (*continued*)

Features	n	%
The state of having a chronic illness		
the one	63	39.9
Non	95	60.1
Total	**158**	**100**

94.3% of the women included in the study do not smoke, 98.1% do not drink alcohol, 48.1% drink coffee occasionally, 54.4% drink 3 cups of tea every day, 45.6% often consume cereals and cereal products, and 39.3% occasionally consume milk and dairy products. 82.3% of the participants do not receive vitamin D and 88% calcium supplements (Table 2).

DEXA scores of women with postmenopausal osteoporosis, respectively; T L1-L4 mean -2.87±-0.45, Z L1-L4 mean -2.57±-0.44, femur total T score mean -2.95±-0.62, femur total Z score mean -2.77±-0.54 (Table 3).

The distribution of DEXA results according to the nutritional behaviors of the women is given in Table 4. It was determined that smoking, tea consumption, and BMI of women did not affect DEXA scores ($p>0.05$). It was determined that women who consumed three cups of coffee a day had significantly lower femur total T and Z scores compared to other groups, while women who frequently consumed milk and dairy products had significantly higher TL1-L4, femur T, and Z scores compared to other groups ($p<0.05$). It was found that the femur total T score was significantly higher in those who took vitamin D supplementation, and TL1-L4, femur total T, and Z scores were significantly higher in women who took calcium supplements ($p<0.05$).

Table 2. Distribution of dietary habits of women (n=158)

Features	n	%
Smoking status		
Using	9	5.7
not using	149	94.3
Alcohol use status		
Using	3	1.9
not using	155	98.1
Frequency of coffee consumption		
never consumed	37	23.4
consuming occasional	76	48.1
Consuming one or two cups a day	36	22.8
Consuming 3 cups daily	9	5.7
Frequency of consumption of tea		
never consumed	11	7.0
consuming occasional	21	13.3
Consuming one or two cups a day	40	25.3
Consuming 3 cups daily	86	54.4
Commonly consumed food type		
Milk and milk products	12	7.5
Meat and meat products	19	12.0
Greengrocery	55	34.8
Grain products	72	45.6
Frequency of consumption of milk and dairy products		
Everyday	46	29.2
Sometimes	62	39.3
Rare	39	24.6
No	11	6.9
Status of taking vitamin D supplements		
Domain	28	17.7
not received	130	82.3
Status of taking calcium supplements		
Domain	19	12
not received	139	88
Total	**158**	**100**

Discussion and Conclusion

It has been stated that the most effective approach to prevent osteoporosis, which adversely affects the lives of women in the postmenopausal period, is to prevent bone mass loss (18-20). For this reason, applications that will increase bone mineral density and prevent bone loss are very important. Especially in all life periods, taking foods rich in protein and calcium, eating a balanced diet in terms of carbohydrates and fats, exercising regularly, and adopting healthy lifestyle behaviors are effective practices in preventing osteoporosis. It is also very important to avoid caffeine-containing foods such as tea and coffee, and not to smoke and alcohol.

Table 3. Distribution of participants' DEXA scores (n=158)

	$\bar{X}$±*SD*	Min.	Max.
DEXA scores			
T L1-L4	-2.87±-0.45	-1.50	-4.60
Z L1-L4	-2.57±-0.44	-1.42	-4.20
Femur Total T score	-2.95±-0.62	-1.50	-4.30
Femur Total Z score	-2.77±-0.54	-2.20	-4.80

Table 4. Distribution of DEXA scores according to dietary habits of women (n=158)

Features	**DEXA**			
	T L1-L4	**L L1-L4**	**Femur Total T skoru**	**Femur Total Z skoru**
	$\bar{X}$±*SD*	$\bar{X}$±*SD*	$\bar{X}$±*SD*	$\bar{X}$±*SD*
Smoking status				
Yes	-2.71±-0.71	-2.30±-0.51	-2.98±-0.28	-2.71±-0.47
No	-2.88±-0.45	-2.58±-0.44	-2.95±-0.64	-2.80±-0.56
Test[1]	-1.154	-1.867	0.148	-0.474
P	*0.250*	*0.064*	*0.883*	*0.636*
Frequency of coffee consumption				
never consumed	-2.87±-0.59	-2.53±-0.46	-2.94±-0.71	-2.71±-0.61
consuming occasional	-2.88±-0.38	-2.61±-0.41	-2.80±-0.67	-2.83±-0.52
Consuming one or two cups a day	-2.88±-0.45	-2.55±-0.51	-3.01±-0.58	-2.80±-0.57
Consuming 3 cups daily	-2.83±-0.33	-2.44±-0.39	-4.23±-0.21*	-4.27±-0.26*
Test[2]	0.036	0.604	12,867	20.709
P	*0.991*	*0.613*	***0.000***	***0.000***
Frequency of consumption of tea				
never consumed	-2.93±-0.32	-2.44±-0.39	-3.00±-0.65	-2.74±-0.53
consuming occasional	-2.82±-0.29	-2.51±-0.40	-3.03±-0.44	-2.85±-0.43
Consuming one or two cups a day	-2.87±-0.42	-2.50±-0.47	-2.90±-0.57	-2.66±-0.52
Consuming 3 cups daily	-2.88±-0.50	-2.63±-0.44	-2.95±-0.68	-2.85±-0.59
Test[2]	0.162	1.271	0.241	1.208
P	0.921	0.286	0.867	0.309
Commonly consumed food type				
Milk and milk products	-2.15±-0.78*	-2.52±-0.72	-1.68±-0.36*	-1.73±-0.47*
Meat and meat products	-2.96±-0.29	-2.66±-0.34	-2.96±-0.73	-2.94±-0.53
Greengrocery	-2.94±-0.33	-2.60±-0.43	-3.00±-0.72	-2.94±-0.64
Grain products	-2.83±-0.53	-2.50±-0.48	-3.04±-0.68	-2.82±-0.69
Test[2]	4.445	0.914	4.822	4.493
P	***0.005***	*0.436*	***0.003***	***0.005***

Table. 4 (*continued*)

Features	DEXA			
	T L1-L4	L L1-L4	Femur Total T skoru	Femur Total Z skoru
	$\bar{X}$±SD	$\bar{X}$±SD	$\bar{X}$±SD	$\bar{X}$±SD
Frequency of consumption of milk and dairy products				
Everyday	-2.77±-0.44	-2.59±-0.42	-2.95±-0.63	-2.59±-0.68*
Sometimes	-2.93±-0.40	-2.54±-0.45	-3.01±-0.69	-2.85±-0.66
Rare	-2.88±-0.57	-2.57±-0.51	-2.99±-0.83	-2.98±-0.74
No	-2.87±-0.34	-2.57±-0.39	-2.83±-1.01	-3.10±-0.76
Test[2]	1.001	0.115	0.173	2.811
P	*0.394*	*0.951*	*0.915*	***0.041***
Status of taking vitamin D supplements				
Domain	-2.51±-0.53	-2.49±-0.55	-2.71±-0.90	-2.79±-0.85
not received	-2.95±-0.40	-2.58±-0.43	-3.03±-0.67	-2.82±-0.67
Test[1]	-4.855	-0.895	-2.097	-0.216
P	***0.000***	*0.372*	***0.038***	*0.829*
Status of taking calcium supplements				
Domain	-2.46±-0.56	-2.46±-0.60	-2.57±-0.80	-2.41±-0.62
not received	-2.92±-0.41	-2.57±-0.43	-3.01±-0.71	-2.84±-0.69
Test[1]	-4.296	-1.046	-2.505	-2.604
P	***0.000***	*0.297*	***0.013***	***0.010***
BMI				
Normal (18.50-24.99)	-2.61±-0.50	-2.53±-0.48	-2.86±-0.80	-2.75±-0.74
Overweight (between 25,000 and 29.99)	-2.93±-0.48	-2.55±-0.51	-3.06±-0.71	-2.88±-0.78
Obese 1. Obese (between 30.00 and 35.00)	-2.93±-0.39	-2.58±-0.40	-2.96±-0.68	-2.75±-0.62
Test[2]	6.396	0.163	0.737	0.572
P	0.002	0.850	0.480	0.565

[1] Independent Sample T-Test, [2] One-Way Analysis of Variance *Group from which the difference originated (Games-Howell post hock test was performed)

Although it is stated in the literature that there is an inverse relationship between BMI and bone mineral density, low BMI is defined as a risk factor (21). However, in our study, it was found that BMI Levels did not affect DEXA scores. In a study by Ersoy et al., 2006 in which the relationship between BMI and DEXA levels in dialysis patients was evaluated, it was stated that the incidence of osteopenia and osteoporosis increased in correlation with the decrease in BMI (22).

In another study, it was emphasized that there were statistically significant differences in terms of lumbar T values between groups classified as ideal, overweight, and obese according to BMI (23). In studies evaluating the effect of BMI on DEXA scores in the literature, women were generally divided into thin, normal, and overweight groups. There were no thin women in our study sample. It can be thought that the difference between the literature and our study may be due to this situation. Studies have shown that smoking causes bone loss, especially in postmenopausal women, and that there is a negative relationship between smoking and bone mineral density (24,25). In our study, it was determined that smoking status did not affect bone mineral density. In a study, it was

found that smoking causes an increase in blood cortisol levels and negatively affects bone density (26). In a study conducted by Onat et al., 2013, it was stated that smoking is a risk factor for low bone mineral density in the lumbar region (23). In our study, the number of women who used alcohol and cigarettes was very small, although they did not even make up 6% of our sample. Therefore, it is thought that smoking and alcohol use does not affect DEXA scores. Studies suggesting that smoking causes a decrease in bone mineral density in the literature are studies examining whether smoking alone is a risk factor for osteoporosis. And the number of women smoking in the same studies is higher than this study. Drinks such as coffee and tea containing caffeine have diuretic effects and may adversely affect bone health as they cause excessive calcium excretion in the urine. In our study, it was determined that tea consumption did not affect DEXA scores, and those who consumed more than 3 cups of coffee a day had lower femur total T and Z scores. Although there are studies in the literature stating that excessive consumption of tea and coffee affects bone mineral density negatively, there are also studies stating that it does not (26-28). However, tea consumption in Turkish society is higher than coffee consumption. The frequency of tea consumption among women in the study group was three cups or more per day. Therefore, it is thought that the frequency of tea consumption did not affect the bone mineral density in our study.

In some studies in the literature, it is stated that there is a positive relationship between dietary calcium and bone mineral density, while in others there is no relationship between them (29,30). In our study, it was determined that the frequency of consumption of milk and dairy products did not affect DEXA scores. In our study, it was determined that taking calcium supplements in the diet positively affects bone mineral density. In a study, it was emphasized that regular dietary calcium intake is effective in preventing osteoporosis (31). Onat et al., 2013, found that insufficient dietary calcium intake was associated with both lumbar and low femur bone mineral values (23). In this study, the nutritional habits of women before osteoporosis were not questioned. Their current eating habits, that is, their habits in the postmenopausal osteoporosis period, were questioned. Studies have reported that the effects of calcium intake are not sufficient after osteoporosis develops, that patients with calcium deficiency in the early stages of osteoporosis are identified and that adequate calcium consumption in the diet decreases bone loss, and that there is a positive correlation between calcium level and bone density (32). In the literature, the effects of calcium supplementation on bone mineral density in the postmenopausal period are contradictory. In order to maintain bone health, adequate amounts of calcium, vitamin D, and protein should be taken in all periods of life. Studies have shown that regular use of vitamin D during the menopause period reduces bone mineral loss and is effective in preventing fractures (33-35). Our study results support the literature.

It can be recommended to evaluate the nutritional habits of women with a diagnosis of postmenopausal osteoporosis and to make recommendations about vitamin D, calcium intake, and limited tea and coffee consumption.

Conflicts of interest: The authors declare that there is no conflict of interest about this manuscript.

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