Body Mass Index Seems the Most Effective Factor on Bone Mineral Density Comparing Postmenopausal Time, Age or Reproductive Factors in Healthy Postmenopausal Women

Beden Kitle İndeksi; Sağlıklı Postmenopozal Kadınlarda, Menopoz Sonrası Süre, Yaş ya da Gebelik Hikâyesi Faktörlerine Kıyasla Kemik Mineral Yoğunluğu Üzerine En Etkin Faktör Olarak Gözükmektedir

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ABSTRACT Objective: The aim of this study is to determine risk factors on bone mineral density (BMD) in healthy postmenopausal Turkish women. We targeted to understand indications of measuring BMD in postmenopausal women and we tried to choose specific risk groups of them. So, we planned to prevent unnecessary BMD scanning. **Material and Methods:** A total of 260 postmenopausal women who visited our menopause clinic were included in this study. BMDs were determined by dual energy X-ray absorptiometry (DXA) at the lumbar spine and femur in all participants. We compared age, age at menopause, postmenopausal time, and number of pregnancy as risk factors. **Results:** Mean age, age at menopause, and duration since menopause was 48.0 ± 4.3 and 45.4 ± 4.4 years, 31.9 ± 32.4 months respectively. Mean body mass index (BMI) of patients was 28.5±4.5. BMD of lumbar spine (L2-L4) was 1.10 ± 0.16 g/cm^2 and femur was 0.93 ± 0.12 g/cm^2. Mean parity was 3.6 ± 1.9. BMD was correlated to BMI positively. A negative correlation between BMD and parity was found significantly. **Conclusion:** This study revealed us that BMI and parity are important factors on BMD rather than age or time after menopause in postmenopausal women in Turkey.

Key Words: Osteoporosis; osteoporosis, postmenopausal; postmenopause

ÖZET Amaç: Çalışmanın amacı, menopoz sonrası kemik mineral yoğunluğu (KMY) üzerindeki risk faktörlerini Türk kadınlarında saptamaktır. Biz sağlıklı postmenopozal kadınlarda KMY'yi ölçme endikasyonlarını anlamayı hedefledik ve spesifik risk gruplarını seçmeye çalıştık. Böylece gereksiz KMY ölçümünün önlenebileceğini planladık. **Gereç ve Yöntemler:** Menopoz kliniğimize başvuran toplam 260 postmenopozal kadın çalışma grubuna katıldı. Bütün katılımcıların "Dual energy X-ray absorptiometry (DXA)" ile lumbar ve femoral kemik dansiteleri saptandı. Biz yaş, menopoz yaşı, postmenopozal süre ve gebelik sayıları risk faktörleri olarak karşılaştırdık. **Bulgular:** Ortalama yaş, menopoz yaşı, postmenopozal süre sırasıyla 48.0 ± 4.3 ve 45.4 ± 4.4 yıl, 31.9 ± 32.4 aydı. Hastaların ortalama beden kitle indeksi (BKİ) 28.5 ± 4.5 ve lumbar ve femoral kemik dansitesi 1.10 ± 0.16 g/cm^2 ve 0.93 ± 0.12 g/cm^2 idi. Ortalama parite 3.6 ± 1.9 idi. KMY, BKİ ile pozitif korele idi. Parite ve KMY arasında anlamlı negatif korelasyonbulundu. **Sonuç:** Bu çalışma, bize gösterdi ki Türkiye'de postmenopozal kadınlarda KMY üzerine BKİ ve parite; yaş ve postmenopozal süreye göre daha önemli faktörlerdir.

Anahtar Kelimeler: Osteoporoz; osteoporoz, menopoz sonrası; postmenopoz

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Osteoporosis is a metabolic bone disorder characterized by low bone mass and micro architectural deterioration with a subsequent increase in bone fragility and susceptibility to fracture.[1,2] Prevention of the fractures is the only way to reduce osteoporosis-related health expenditures. Since, osteoporosis is a long term event; there is a mandatory need to figure out affecting factors to take precautions.

In order to optimize cost/benefit ratio as a strategy of prevention, it is essential to identify women who will develop fractures in their life. Postmenopausal bone loss is an asymptomatic process and screening procedures should be performed whom postmenopausal bone loss will be higher.[3]

Age, genetic predisposition, life style are risk factors causing primary osteoporosis. However, the results that have been published from studies on reproductive factors and bone mineral density (BMD) are extremely controversial. Some demonstrate a beneficial effect, while others show a detrimental impact of these factors on bone mass.[4] Previous studies have shown a positive correlation between age at menopause and BMD.[5,6] Findings about the relation between parity and BMD are controversial too. A better understanding of these risk factors may provide new opportunities to prevent bone loss and to choose which postmenopausal woman needs early intervention.

We aimed to find the risk factors on BMD of healthy postmenopausal Turkish women in this study. So that, we may put forward early indications of measuring BMD and choose specific risk groups of postmenopausal women. We also tried to find out how we can avoid using unnecessary diagnostic tools without giving up early intervention and prevention of osteoporosis in risk groups that will help improving public health policies.

MATERIAL AND METHODS

The participants were selected from postmenopausal women who visited our menopause clinic in 2009. We excluded women from the study who had any hormone therapy or drug intake effective on bone density, menopause due to surgically removed ovaries or early menopause (under the age of 40), smoking and alcohol intake, any history of disease effective on bone density. A total of 260 participants were included in this study. A written informed consent was signed by all participants.

Age, age at menopause, duration since menopause, number of pregnancy and birth, height and weight of the participants was recorded. BMD was measured at the lumbar spine between L2-L4 and femur using dual energy X-ray absorptiometry (Lunar corp., Madison, WI).

Body mass index (BMI) was calculated as weight (kg)/height (m^2). BMI of the participants were grouped as <25, 25<.

Duration after menopause were grouped as <12, 13-24, 25-60, 60< months.

Statistical analysis was performed with the SPSS 13.0. Analysis of variance (ANOVA) was used to compare means of the groups. Pearson correlation analysis was used in the evaluation of correlations. Findings with a p value of less than 0.05 were considered to be significant. Each factor's correlation was analyzed by controlling other risk factors. Results were evaluated with Bonferroni's.

RESULTS

A total of 260 postmenopausal women participated in the study according to inclusion criteria. Mean age of the participants were 48.0 ± 4.3 years (range in 40-62 years) (Table 1). Mean age at menopause was 45.4 ± 4.4 (range in 40-54) years. Mean duration since menopause was 31.9 ± 32.4 (range in 6-168) months (Table 1). Mean BMI was 28.5 ± 4.5 (minimum 17, maximum 39). BMD of lumbar spine (L2-

TABLE 1: Demographic characteristics and BMDs of patients.

	Mean	Std. Deviation
Age+	48.00	4.31
Age at menopause+	45.44	4.40
Duration since menopause‡	31.90	32.39
BMI*	28.55	4.48
Lumbar BMD (g/cm^2)**	1.10	0.16
Lumbar t score	-0.44	1.38
Lumbar z score	-0.28	1.28
Femur BMD (g/cm^2)**	0.93	0.12
Femur t score	-0.39	1.05
Femur z score	0.14	1.02
Pregnancy	5.25	2.83
Parity	3.61	1.93

+ year.
‡ Month.
* Body Mass Index.
** Bone Mineral Density.

L4) and femur were 1.10 ± 0.16 g/cm² and 0.93 ± 0.12 g/cm² respectively. All demographic findings of patients and BMDs are shown at Table 1.

Age of the patients was not correlated to BMD. The results was not statistically significant (r:-0.107, p: 0.19 for lumbar and r:-0.127, p: 0.12 for femur) (Table 2).

Age at menopause was not correlated to BMD of patients significantly in our study (r: 0.109, p: 0.18 for lumbar and r: 0.132, p: 0.10 for femur) (Table 2).

We found that time after menopause was not correlated to either lumbar or femur BMD (r: 0.075, p: 0.36 and r: 0.109, p: 0.18). Table 2 shows BMD's correlations with time after menopause.

BMI was found related to bone densities significantly in our study (r: 0.307, p< 0.001 for lumbar and r: 0.387, p< 0.001 for femur) (Table 2).

As pregnancy increases, BMD decreases. But, relationship between BMD and pregnancy was not strong. The result was not statistically significant (r: -0.113, p: 0.09 for lumbar and r: 0.076, p: 0.26 for femur). Parity correlated to lumbar BMD significantly (r: -0,133, p: 0.04 for lumbar and r: 0.023, p: 0.73 for femur) (Table 2). But the results were not strong as BMI's (Table 3).

We divided the study group according to BMIs (Table 3). Mean age of BMI lower than 25 was different than mean age of BMI higher than 25 statistically (47.10 and 48.31, p: 0.038). Mean BMDs of the groups were different (p: 0.001 for lumbar and p< 0.001 for femur).

We also divided the patients according to duration after menopause into four groups (Table 4). Mean BMDs of the groups were seen at Table 4. Only patients with more than 60 months after menopause has lower BMD than other groups (p< 0.001 for lumbar and p: 0.03 for femur).

DISCUSSION

Our study shows us that the major independent determinant of BMD is BMI in Turkish postmenopausal women. BMIs were strongly correlated to lumbar and femur BMDs of patients (r: 0.307, p< 0.001 for lumbar and r: 0.387, p<0.001 for femur). No significant associations with BMD were found for age and age at menopause (Table 2). Only more than 5 years (60 months) duration after menopause was significantly associated with lower BMD (Table 4). Although number of pregnancy of patients had negative effect on BMD, the correlation was weaker than that of BMI of patients (Table 2).

BMI is the most important factor on bone density in postmenopausal women in our study. Our patients have higher BMI with higher age. Obesity can protect the skeleton through two mechanisms: the mechanical stimulation exerted by corporal weight and conversion of androgens to estrogen by fat tis-

TABLE 2: Correlations of effecting factors on BMD.

	Lumbar BMD	Lumbar t score	Lumbar z score	Femur BMD	Femur t score	Femur z score
Age	r: -0.107	r:-0.090	r: -0.021	r:-0.127	r:-0.125	r:-0.112
	p: 0.19	p:0.27	p:0.80	p:0.12	p:0.13	p:0.17
Age at menopause	r:0.109	r:0.091	r:0.035	r:0.132	r:0.130	r:0.130
	p:0.18	p:0.27	p:0.67	p:0.10	p:0.11	p:0.11
Duration since menopause	r:0.075	r:0.056	r:0.004	r:0.109	r:0.107	r:0.110
	p:0.36	p:0.49	p:0.95	p:0.18	p:0.19	p:0.18
BMI	r:0.307	r:0.309	r:0.091	r:0.387	r:0.386	r:0.375
	p<0.001	p<0.001	p:0.26	p<0.001	p<0.001	p<0.001
Pregnancy	r:-0.113	r:-0.124	r:-0.143	r:0.076	r:0.082	r:0.074
	p:0.09	p:0.05	p:0.03	p:0.26	p:0.21	p:0.27
Parity	r:-0.133	r:-0.146	r:-0.176	r:0.023	r:0.006	r:0.025
	p:0.04	p:0.02	p:0.009	p:0.73	p:0.92	p:0.71

TABLE 3: BMD values of BMI groups.

	Group 1*(82)		Group 2**(178)		
	Mean	Std dev±	Mean	Std dev±	P
Lumbar BMD	1.04	0.15	1.12	0.16	0.001
Lumbar t score	-0.94	1.26	-0.24	1.38	<0.001
Lumbar z score	-0.43	1.31	-0.22	1.26	0.27
Femur BMD	0.86	0.10	0.96	0.12	<0.001
Femur t score	-0.89	0.85	-0.17	1.06	<0.001
Femur z score	-0.39	0.81	0.38	1.01	<0.001

* BMI lower than 25

** BMI higher than 25.

sue. Fat tissue is not only effective in postmenopausal period, but also effective in premenopausal period.[7] The effect of BMI on BMD and duration of exposure to endogenous estrogen is difficult to interpret. A high BMI is associated with more adipose tissue. Adipose tissue is capable of turning androstenedione and testosterone into estrogens and continues doing so after menopause.[8] At the same time, a high BMI means a higher physical load on the bones, which may increase bone mass.[9] Douchi et al. concluded that the strenght of correlation between BMI and BMD was significantly greater in postmenopausal women than premenopausal women.[10] They stated that obese premenopausal and postmenopausal women have high aromatized estrogen levels in circulation during reproductive age. The effect of extraglandular estrogen on bone density is masked by the greater amount of ovarian estrogen in premenopausal women. So that they found BMI had no direct influence on non-weight bearing bone density in normal premenopausal women.[10]

During pregnancy, mineralization of fetal skeleton increases reabsorption of calcium from maternal bone stores. Otherwise estrogen levels are elevated during pregnancy. These findings have suggested that parity may be the risk of osteoporosis. Clinical and epidemiological data are inconsistent showing both an increased and a reduced risk in parous women.[11-13]

CONCLUSION

As a conclusion, we found that postmenopausal women with BMIs' lower than 25 and postmenopausal time more than five years have greater risk for osteoporosis than other postmenopausal women in Turkish population. Number of pregnancy was not found as a strong factor affecting on BMD negatively. Postmenopausal time was only effective on BMI after 5 years in our study. According to our study, parity should not be considered as an indication for screening osteoporosis.

TABLE 4: Mean BMD values of groups according to time after menopause.

Groups	≤ 12 months	13-24 months	25-60 months	>60 months	p
Number of patients	102	28	72	30	
Lumbar BMD	1.14 ± 0.13	1.05 ± 0.11	1.09 ± 0.20	1.00 ± 0.15	<0.001
Lumbar t score	-0.07 ± 1.16	-0.86 ± 0.89	-0.46 ± 1.69	-1.33 ± 1.21	
Lumbar z score	0.01 ± 0.94	-0.84 ± 1.01	-0.30 ± 1.65	-0.91 ± 1.22	
Femur BMD	0.96 ± 0.11	0.90 ± 0.10	0.91 ± 0.10	0.86 ± 0.16	0.03
Femur t score	-0.06 ± 1.01	-0.70 ± 0.96	-0.47 ± 0.89	-0.98 ± 1.30	
Femur z score	0.36 ± 0.98	-0.02 ± 0.82	0.03 ± 1.01	-0.18 ± 1.24	

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