SOCIEDADE BRASILEIRA DE REUMATOLOGIA

REVISTA BRASILEIRA DE REUMATOLOGIA

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Original article

Effect of multiparity on bone mineral density, evaluated with bone turnover markers

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ARTICLE INFO

Article history:
Received 22 January 2015
Accepted 15 July 2015
Available online 9 October 2015

Keywords:
Markers of bone turn-over
Multiparity
Osteoporosis

ABSTRACT

Objective: Our aim was to investigate the effect of parity on osteoporosis by evaluating bone mineral density, markers of bone turn-over and other factors that are effective in osteoporosis in multiparous (five deliveries or more) and nulliparous women in the post-menopausal period.

Methods: A total of 91 multiparous (five deliveries or more) and 31 nulliparous post-menopausal women were included in this study. All patients were interviewed on sociodemographic characteristics, gynecologic history, personal habits, levels of physical activity, and life-long intake of calcium. Bone mineral density was measured at lumbar (L1–4) and femoral neck regions with Dexa.

Results: The mean age of multiparous women was 58.79 ± 7.85 years, and the mean age of nulliparous women was 55.84 ± 7.51. The femoral BMD was 0.94 ± 0.16 and lumbar BMD 1.01 ± 0.16 in multiparous women, femoral BMD was 0.99 ± 0.16 and lumbar BMD 1.07 ± 0.14 in nulliparous women. There were no statistical differences between the femoral and lumbar *T* scores and BMD values of the two groups. Lumbar *T* scores and lumbar BMD showed a decrease with increasing total duration of breast-feeding in multiparous women. The independent risk factors for osteoporosis in the regression analysis of multiparous women were found to be the duration of menopause and body weight of 65 kg and less.

Conclusion: There is no difference between the bone mineral densities of multiparous and nulliparous women. Females with lower body-weight and longer duration of menopause should be followed-up more carefully for development of osteoporosis.

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http://dx.doi.org/10.1016/j.rbre.2015.09.002

Efeito da multiparidade sobre a densidade mineral óssea, avaliada por marcadores de remodelação óssea

Palavras-chave:
Marcadores de remodelação óssea
Multiparidade
Osteoporose

RESUMO

Objetivo: Investigar o efeito da paridade sobre a osteoporose por meio da avaliação da densidade mineral óssea, marcadores de remodelação óssea e outros fatores eficazes na avaliação da osteoporose em multíparas (cinco partos ou mais) e nulíparas no período pós-menopausa.

Métodos: Foram incluídas neste estudo 91 multíparas (cinco partos ou mais) e 31 nulíparas, todas na pós-menopausa. As pacientes foram entrevistadas para a determinação das características sociodemográficas, história ginecológica, hábitos pessoais, níveis de atividade física e ingestão de cálcio ao longo da vida. A densidade mineral óssea foi medida na região lombar (L1-4) e do colo femoral com a Dexa.

Resultados: A média de idade das multíparas e nulíparas foi de 58,79 ± 7,85 anos e 55,84 ± 7,51, respectivamente. Nas multíparas, a DMO femoral e lombar foi de 0,94 ± 0,16 e 1,01 ± 0,16, respectivamente; nas nulíparas, a DMO femoral e lombar foi de 0,99 ± 0,16 e 1,07 ± 0,14, respectivamente. Não houve diferença estatisticamente significativa entre os T-escores femoral e lombar e os valores de DMO dos dois grupos. O T-escore e a DMO lombar mostraram uma diminuição em caso de aumento na duração total da lactação materna em multíparas. Encontrou-se que os fatores de risco independentes para a osteoporose na análise de regressão das multíparas são a duração da menopausa e o peso corporal menor ou igual a 65 kg.

Conclusão: Não há diferença entre a densidade mineral óssea de multíparas e nulíparas. As mulheres com menor peso corporal e maior duração da menopausa devem ser acompanhadas com mais atenção para determinar se há desenvolvimento de osteoporose.

Introduction

Osteoporosis is a metabolic bone disorder characterized by a decrease in bone strength and an increase in bone fragility.[1] Genetic, hormonal and environmental factors contribute to osteoporosis development.[2–4] Pregnancy and lactation periods are processes which have an effect on the calcium and bone metabolism of the mother. A BMD loss of 2–9% was reported in the postpartum period.[5] Longitudinal studies have shown that these losses are reversible in especially the women from developed countries.[6] On the other hand, clinical entities such as pregnancy- and lactation-associated osteoporosis,[7] osteoporosis of the hip may develop in the post-partum period in some patients, which may be a cause of serious morbidity.[8] The effects of multiparity on the bone mineral density in the post-menopausal period are still controversial.

While some researchers report an absence of a positive or negative effect of parity on bone mineral density,[9,10] there are others who have reported a positive effect[11] or a negative effect on bone mineral density.[12,13] Increase in body weight during pregnancy, increasing estrogen hormone and multivitamin supplement taken during pregnancy are thought to have positive effects on BMD.[14] On the other hand, inability to compensate the calcium transfer from the mother to the baby during pregnancy and lactation with diet in especially populations with lower socioeconomic status is thought to exert a negative effect on BMD.[15] Turkey is a developing country, where multiparity is quite prevalent. Our aim was to investigate the effects of parity on osteoporosis, by evaluating bone mineral density, markers of bone turnover, age at first pregnancy, duration of lactation and other factors associated with osteoporosis in multiparous (five or more deliveries) and nulliparous women in the postmenopausal period.

Materials and methods

This prospective study was conducted in the Department of Obstetrics and Gynecology, and Department of Physical Medicine and Rehabilitation at Kocaeli Derince Education and Research Hospital. A total of 327 postmenopausal women with five or more deliveries or who had never given birth were offered participation in this study among female patients who were admitted at our institution. Of those, 124 postmenopausal patients refused to participate in the study, and 81 postmenopausal women were excluded due to exclusion criteria. A total of 91 postmenopausal women with ≥5 deliveries and 31 women who had never given birth were included. Data were gathered by personal interviews after the patients were informed about the study and their consents were obtained. The study protocol was performed according to the Helsinki Committee requirements and was approved by the institutional review board of Kocaeli University (KOU KAEK 2012/44).

Postmenopausal women aged between 45 and 75 years were included in this study. Persons with diabetes, chronic renal or pulmonary disease, collagen and rheumatic disease, hypogonadism, serious cardiac disease, thyroid dysfunction, malabsorbtion syndrome, history of drug use that may cause

osteoporosis (steroids, thiazides, anti-dyslipidemic medications, warfarin, chemotherapy), those that were treated for osteoporosis before, patients who were immobilized for prolonged periods of time, and those that had used hormone replacement were excluded.

Sociodemographic data of all patients were recorded. Their body mass indices were calculated. Smoking and alcohol consumption, family histories of osteoporosis and fracture, and gynecologic personal histories were asked. The age at menarche, age at first delivery, duration of menopause, total number of children, number of pregnancies, and duration of lactation were recorded. The lactation duration for each child was separately recorded, and the durations of all children of a patient were added to calculate the total duration of lactation. Clothing styles of the women were categorized as modern or conventional (i.e. covering all the body except the face and hands). Their intake of calcium and level of physical activity were questioned according to European Vertebral Osteoporosis Study (EVOS) questionnaire.[16,17] The total physical activity score and total lifelong calcium intake were calculated. The total activity score was calculated as follows: the duration of walks outside home (scale of 4 points; 0: none, 1: less than half an hour, 2: 1/2–1 h, 3: more than 1 h), physical activity levels for young adult and adulthood periods (scale of 4 points; 1: mild, 2: moderate, 3: intensive, 4: very intensive) and frequency of participating in sportive activities in young adult and adulthood periods (scale of 5 points; 0: none, 1: sometimes, 2: less than 1 h per week, 3: 1–2 h per week, 4: more than 1 h per week) (maximal total activity score: 19 points). Total lifelong intake of calcium score was calculated by adding consumptions of milk and dairy products in childhood and adulthood periods (evaluation system of 4 points; 1: less than once a week, 2: every week, 3: everyday, 4: more than once a day).

Bone marker measurements and laboratory testing

A fasting blood specimen was drawn from each subject. Blood samples were collected between 8:00 a.m. and 10:30 a.m., and parathyroid hormone (PTH), thyroid stimulating hormone (TSH), calcium, and phosphorus levels were measured by automated standard methods. Plasma osteocalcin and beta-CrossLaps (β-CTx) were measured with the electrochemiluminescence method using the Cobas® (Roche, Germany) kit in the Cobas e601® (Roche, Germany) analyzer. The IDS® bone-specific alkaline phosphatase (BS.ALP) (Immunodiagnostic Systems Ltd., UK) was studied using the enzyme linked immunosorbent assay (ELISA) kit in the BioTek® ELISA reader (BioTek Inc., USA). Additionally, 25-hydroxy-vitamin D3 (vitamin D) was chromatographically measured using the D3 Waters® UPLC/MS/MS device (Roche, UK). Hemoglobin A1c levels were measured by high-performance liquid chromatography (HPLC).

Bone mineral density measurement

Bone mineral density at the lumbar spine and femoral neck were measured by dual energy X-ray absorptiometry (Lunar pro). Lumbar spine BMD was defined as the mean of lumbar vertebrae 1–4.

Statistical analysis

Number Cruncher Statistical System (NCSS) 2007 & Power Analysis and Sample Size (PASS) 2008 Statistical Software (Utah, USA) was used for the statistical analysis. Descriptive statistical methods (mean, standard deviation, median, frequency, rate, minimum, maximum) as well as Student's *t* test for comparison of two groups with normal distribution and Mann–Whitney *U* test was used in the comparison of groups without a normal distribution. Fisher–Freeman–Halton test, Fisher's exact test and Yates' continuity correction test (Yates corrected chi-square) were used in the comparison of qualitative data. Spearman correlation analysis was used in the evaluation of associations between parameters. The effects of risk factors on osteoporosis were evaluated with logistic regression analysis (backward) as multivariate analysis. Significance levels of $p<0.01$ and $p<0.05$ were used.

Results

The mean age of multiparous women was 58.79 ± 7.85, while the mean age of nulliparous women was 55.84 ± 7.51. There were no statistically significant differences between these two groups in terms of age, family history of fractures, family history of osteoporosis, smoking or alcohol consumption, clothing style, total intake of calcium, physical activity score, duration of menopause, and age at menopause. The BMI of multiparous women was 31.33 ± 6.12, and the BMI of nulliparous women was 27.16 ± 2.70. The difference between BMI values was statistically significant (Table 1). The mean parity of multiparous women was 6.04 ± 1.80 (5–13), their mean age at first delivery 18.85 ± 2.43, and mean age at last delivery was 35.25 ± 3.22.

There was no significant difference between calcium, ALP, TSH, BS.ALP, magnesium, osteocalcin and CTX levels of the two groups ($p>0.05$). The phosphorus and PTH levels of multiparous women were significantly higher than nulliparous women ($p=0.002$; $p=0.001$; $p<0.01$). The 25 (OH) vitamin D3 levels of multiparous women were statistically significantly lower ($p=0.005$; $p<0.01$) (Table 2).

The femoral BMD of multiparous women was 0.94 ± 0.16 and lumbar BMD 1.01 ± 0.16, while femoral BMD of nulliparous women was 0.99 ± 0.16 and lumbar BMD 1.07 ± 0.14. There were no statistically significant differences between the *T* score L1–4 and BMD and *T* score femur and BMD levels ($p>0.05$) (Table 3).

The total duration of lactation was 108.95 ± 59.87 months. A statistically significant negative correlation was found between the duration of lactation and *T* score L1–4 measurements (with increasing durations of lactation, *T* score L1–4 showed a decrease) 29.9% (r: −0.299; $p=0.004$; $p<0.01$). There was a negative, statistically significant at 31.0% correlation between the duration of lactation and BMD score L1–4 measurements (with increasing durations of lactations, BMD score L1–4 showed a decrease) (r: −0.310; $p=0.003$; $p<0.01$).

Table 1 – Sociodemographic and clinical features of postmenopausal multiparous women and nulliparous women.

		≥5 delivery (n = 91) Mean	No delivery (n = 31) Mean	p
Age (year)		58.79 ± 7.85	55.84 ± 7.51	0.070[a]
BMI (kg/cm^2)		31.33 ± 6.12	27.16 ± 2.70	0.001[a,b]
Total lifelong intake of calcium score		3.68 ± 1.44	4.03 ± 1.43	0.130[a]
Total physical activity score		9.1 ± 3.74	9.8 ± 2.72	0.090[a]
Age at menarche (year)		13.69 ± 1.38	13.32 ± 1.45	0.210[a]
Menopause age (year)		48.14 ± 5.75	49.37 ± 5.32	0.110[a]
Duration of menopause; (year) *(Median)*		9.74 ± 9.09 (11)	8.18 ± 6.20 (3)	0.080[c]
Family histories of fracture	No	82 (%90.1)	28 (%90.3)	1.000[d]
	Yes	9 (%9.9)	3 (%9.7)	
Family histories of osteoporosis	No	70 (%76.9)	28 (%90.3)	0.174[e]
	Yes	21 (%23.1)	3 (%9.7)	
Smoking consumption	No	77 (%84.6)	24 (%77.5)	0.110[d]
	Yes	14 (%15.4)	7 (%22.5)	
Alcohol consumption	No	89 (%97.8)	31 (%100)	1.000[d]
	Yes	2 (%2.2)	0 (%0)	
Clothing styles	Conventional	86 (%94.5)	29 (%93.6)	0.240[d]
	Modern	5 (%5.5)	2 (%6.4)	

[a] Student's t test.
[b] $p < 0.01$.
[c] Mann–Whitney U test.
[d] Fisher's exact test.
[e] Yates' continuity correction test.

Table 2 – The comparison of laboratory values between groups.

	≥ 5 delivery (n = 91) Mean ± SD	No delivery (n = 31) Mean ± SD	p
Calcium	9.43 ± 0.44	9.37 ± 0.30	0.430[a]
Phosphorus	3.45 ± 0.41	3.18 ± 0.41	0.002[a,b]
Magnesium	2.18 ± 0.28	2.08 ± 0.16	0.073[a]
Alkaline phosphatase *(Median)*	82.65 ± 31.79 (78)	73.73 ± 24.96 (71)	0.361[c]
Parathyroid hormone *(Median)*	75.72 ± 34.09 (74)	58.22 ± 27.81 (49)	0.001[b,c]
Thyroid stimulating hormone *(Median)*	1.77 ± 1.04 (1.6)	1.76 ± 0.79 (1.8)	0.769[c]
Bone-specific alkaline phosphatase *(Median)*	22.38 ± 19.35 (8)	19.24 ± 5.82 (10)	0.724[c]
Osteocalcin *(Median)*	21.75 ± 10.66 (20.9)	21.21 ± 5.62 (21.1)	0.637[c]
Vitamin D3 *(Median)*	22.44 ± 17.64 (17.6)	31.89 ± 19.88 (24.1)	0.005[b,c]
CTx *(Median)*	382.27 ± 188.69 (351.0)	409.20 ± 121.97 (390.5)	0.177[c]

[a] Student's t test.
[b] $p < 0.01$.
[c] Mann–Whitney U test.

Table 3 – Comparison of bone mineral density.

	≥ 5 delivery (n = 91) Mean ± SD	No delivery (n = 31) Mean ± SD	p
T score L1–4 *(Median)*	−1.48 ± 1.28 (−1.6)	−1.03 ± 1.04 (−1.2)	0.057[a]
BMD score L1–4 *(Median)*	1.01 ± 0.16 (1.0)	1.07 ± 0.14 (1.0)	0.052[a]
T score femur *(Median)*	−0.66 ± 1.05 (−0.8)	−0.37 ± 0.92 (−0.4)	0.120[a]
BMD score femur *(Median)*	0.94 ± 0.16 (0.9)	0.99 ± 0.16 (1.0)	0.098[a]

[a] Mann–Whitney U test.

There were no statistically significant associations between the durations of lactation and T score Femur, and BMD score Femur measurements ($p > 0.05$) (Fig. 1).

Multiparous women were divided into two groups according to the presence of osteoporosis at the lumbar or femoral regions. There were 36 (39.6%) multiparous women with osteoporosis and 55 (60.4%) multiparous women without osteoporosis. There were no statistically significant differences between these two groups in terms of number of deliveries, duration of menopause, number of pregnancies, age at first delivery, age at last delivery, duration of lactation, age at menarche, age at menopause, levels of calcium, phosphorus, ALP, magnesium, TSH, BS.ALP, Osteocalcin and CTX ($p > 0.05$). The age, body weight, duration of menopause, PTH and 25 (OH) Vitamin D3 levels were statistically significantly different ($p < 0.05$) (Table 4).

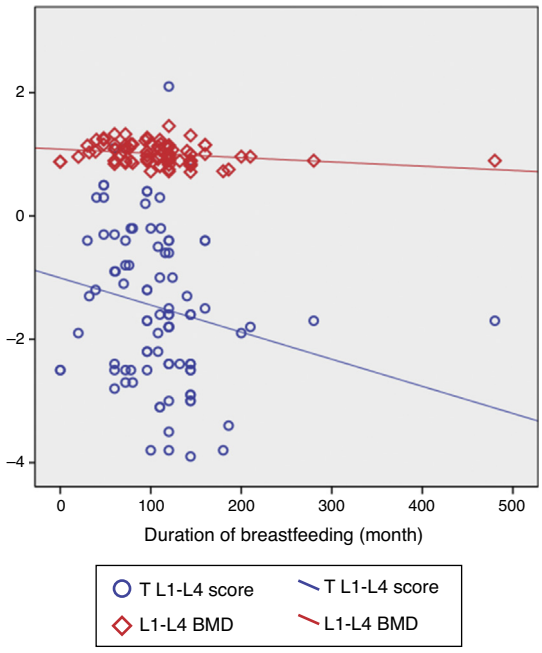

Fig. 1 – The relationship between duration of breastfeeding and BMD.

Age, body weight, duration of menopause, PTH and vitamin D3 levels that have an effect on osteoporosis in multiparous women were evaluated with logistic regression analysis (backward). The model for risk factors for osteoporosis that were created after four steps is shown in Table 5. Risk factors for osteoporosis such as body weight and duration of menopause are seen to create a significant model. The explanation coefficient of the model is 78%, which is a good level. According to the model, body weight below 65 kg increase osteoporosis 3321 times (95% CI: 1.243–8.872). An unit increase in the duration of menopause increase the risk of osteoporosis 1108 times (95% CI: 1.028–1.194). Although the level of vitamin D3 did not reach statistical significance in this model, it had an effect on osteoporosis that is very near significance ($p = 0.056$; $p > 0.05$).

Discussion

A statistically significant difference was not found between postmenopausal multiparous and nulliparous women in terms of femoral and lumbar *T* scores and BMD scores. As the total duration of lactation increases, lumbar *T* scores and lumbar BMD values decrease in multiparous women. The duration of menopause, body weight below 65 kg were found to be independent risk factors for osteoporosis in multiparous women.

The effect of parity on bone mineral density in the postmenopausal period is still controversial. Hillier et al. could not

Table 4 – Descriptive characteristics according to osteoporosis assets in multiparous group and laboratory values.

	Osteoporosis (−) ($n = 64$) Mean ± SD	Osteoporosis (+) ($n = 27$) Mean ± SD	*p*
Age (year)	57.33 ± 7.19	62.26 ± 8.37	0.006[a,b]
Weight (kg)	1.60 ± 0.05	1.55 ± 0.09	0.025[a,c]
Length (m)	81.67 ± 14.10	71.76 ± 11.59	0.002[a,b]
BMI (kg/cm^2)	31.77 ± 5.44	30.27 ± 7.51	0.289[a]
Number of pregnancy *(Median)*	7.27 ± 2.27 (7.00)	7.26 ± 2.12 (7.00)	0.901[d]
Number of live births *(Median)*	5.94 ± 1.89 (5.00)	6.30 ± 1.56 (6.00)	0.067[d]
The number of stillbirths *(Median)*	1.02 ± 1.29 (1.00)	0.85 ± 1.23 (0.00)	0.429[d]
Number of abortions *(Median)*	0.33 ± 0.82 (0.00)	0.04 ± 0.19 (0.00)	0.058[d]
Age at first birth (year)	18.89 ± 2.27	18.74 ± 2.84	0.790[a]
Age at last birthday (year)	35.20 ± 2.93	35.37 ± 3.86	0.822[a]
Duration of breastfeeding (month)	111.05 ± 64.35	104.00 ± 48.36	0.611[a]
Age at menarche (year)	13.70 ± 1.40	13.67 ± 1.36	0.921[a]
Menopause age (year)	46.27 ± 6.14	47.32 ± 5.26	0.754[a]
Duration of menopause *(Median)*	11.32 ± 8.05 (10.00)	16.07 ± 10.57 (17.00)	0.057[d]
Calcium	9.44 ± 0.44	9.40 ± 0.46	0.741[a]
Phosphorus	3.46 ± 0.44	3.42 ± 0.34	0.594[a]
Magnesium	2.22 ± 0.30	2.09 ± 0.21	0.049[a,c]
Alkaline phosphatase *(Median)*	80.68 ± 24.49 (79.00)	87.32 ± 44.85 (76.00)	0.575[d]
Parathyroid hormone (Median)	72.95 ± 36.23 (67.50)	82.28 ± 27.89 (87.00)	0.045[c,d]
Thyroid stimulating hormone *(Median)*	1.85 ± 1.06 (1.69)	1.58 ± 1.00 (1.58)	0.260[d]
Bone-specific alkaline phosphatase *(Median)*	18.37 ± 6.24 (16.50)	32.25 ± 33.06 (19.05)	0.357[d]
Osteocalcin *(Median)*	20.65 ± 7.51 (20.65)	24.47 ± 15.86 (21.70)	0.521[d]
Vitamin D3	20.05 ± 14.86 (14.35)	28.14 ± 22.27 (22.20)	0.043[c,d]
CTx *(Median)*	375.92 ± 167.57 (363.50)	399.21 ± 239.48 (343.50)	0.985[d]

[a] Student's *t* test.
[b] $p < 0.01$.
[c] $p < 0.05$.
[d] Mann–Whitney *U* test.

Table 5 – Logistic regression analysis of risk factors for osteoporosis in multiparous group.

	B	S.E.	p	Exp B	%95 CI	
					Lower	Upper
Duration of menopause	0.102	0.038	0.007[a]	1.108	1.028	1.194
Vitamin D3 level	0.032	0.017	0.056	1.033	0.999	1.068
Weight (kg)	1.2	0.501	0.017[b]	3.321	1.243	8.872

[a] $p < 0.01$.
[b] $p < 0.05$.

find an association between parity and BMD in the hip, spine and radius in their study on 9699 women, after adjustments for other osteoporosis risk factors.[10] Lenora et al.[9] divided the patients into groups of those having no children ($n = 35$), those with 1–2 children ($n = 38$), 3–4 children ($n = 70$) and five and more children ($n = 67$) in their study on 210 postmenopausal women, and did not find a statistically significant difference between them in terms of lumbar and femoral BMD. The results of these two studies are similar to ours. There are also studies in the literature reporting a protective effect of parity against osteoporosis. Fox et al. have reported an increase in proximal radius density of 1.4% at every delivery.[18] Cure et al. have reported in their study in Columbia that multiparity is protective against osteoporosis in comparison with nulliparity. In their study they have found an approximately 2-fold increase in osteopenia, and a 4-fold increase in osteoporosis in nulliparous women in comparison with multiparous women.[11] There are also studies reporting negative effects of parity on bone mineral density. Gur et al.[12] have found lower BMD values in their study in Turkey at the spine and trochanter in women having given to five or more births in comparison with women with no deliveries or those with fewer deliveries. They have reported a correlation between the number of pregnancies and BMD at the trochanter, and Ward's triangle, but not with the BMD at the femoral neck. Pluskiewicz et al.[19] have evaluated bone mineral density in postmenopausal women with quantitative ultrasound at calcaneus and phalanges, and found lower z-scores in women with 3, 4, 5 and 6 deliveries in comparison with those with 1, 2 deliveries or no deliveries. Body weight and the duration of menopause were found to be factors that had an effect on bones in the regression analysis.

The differences in findings of different studies on the effects of parity on BMD may be due to differences in methodologies, sample sizes and level of development of the country that the study was conducted. Markers of bone turnover and osteoporosis risk factors such as physical activity level and calcium intake were not evaluated in many studies. Both groups were extensively evaluated in terms of risk factors of osteoporosis and adjustments were made according to osteoporosis risk factors of the groups. In the present study, no differences were detected in the BMDs of the two groups after adjustments for BMI levels were done in multiparous and nulliparous women with similar calcium intakes, physical activity levels and ages.

Demirtaş et al.[20] have reported that duration of menopause in multiparous women is an independent risk factor for osteoporosis. The duration of menopause was also found to be an independent risk factor in multiparous women in our study. Also, those with a body weight below 65 kg were found to be at risk for osteoporosis. It is well known that weight is protective against osteoporosis by exerting a mechanical load on the bone, and that women with a lower body weight are lose more bone.[21] In a study, the best predictor of low bone mineral density in women was found to be a low body weight. Women with a body weight lower than 66 kg was reported to be at risk for bone mineral density loss.[22] Similarly, a low body weight was found to increase the risk of osteoporosis in multiparous women in the present study.

Many studies have shown the presence of an association between the duration of lactation and bone mineral density. Okyay et al. have shown that lactation duration longer than 1 year per child creates a risk for osteoporosis.[14] Longer durations of lactation before peak bone age and especially before 27 years of age increase osteoporosis risk.[14] The studies that have shown an association between lactation and low BMD[23] have reported that the negative effect on BMD is reversed with the initiation of menstrual cycle.[24] Some authors have reported that prolonged duration of lactation may cause restoration of inadequate bone loss, and that this restoration may not be enough in the presence of very high parity, low socioeconomic level, inadequate calcium and vitamin intake.[23,25] Tsvetov et al.[26] have reported a negative effect of prolonged lactation on BMD and that this is most frequently seen in the vertebrae. We also found a negative correlation between lumbar BMD and the duration of lactation.

As far as we know, there is no study in the literature that has evaluated markers of bone turnover in multiparous and nulliparous women. The absence of a difference between the groups in ALP, osteocalcin, CTX supports the absence of a difference in bone mineral densities. Vitamin D was lower and PTH was higher in multiparous women in comparison to nulliparous women. Inadequate exposure of multiparous women to sunlight may be responsible for this condition.

The most important limitations of our study is its cross-sectional design, which was done at a single center with a limited sample size, and the data acquisition on the duration of lactation that entirely depended on self-reporting. A strong aspect of the present study is the evaluation of many risk factors that may have an effect on bone mineral density.

There is no difference between women who with five or more deliveries and women who had never given birth in terms of bone mineral density. Lumbar BMD shows a decrease in parallel with increasing durations of breast-feeding. In women with five or more deliveries duration of menopause and weight under 65 kg are found to be independent risk factors affecting osteoporosis.

Conflicts of interest

The authors declare no conflicts of interest.

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