TÜBİTAK

ORIGINAL ARTICLE

Turk J Med Sci
2008; 38 (4): 329-333

E-mail: medsci@tubitak.gov.tr

Effect of Lactation on Bone Mineral Density Later in Life in Turkish Women*

Orhan AKSAKAL
Hakan AYTAN
Sabri CAVKAYTAR
Ömer Lütfi TAPISIZ
Tayfun GÜNGÖR
Bülent ÖZDAL
Leyla MOLLAMAHMUTOĞLU

Dr. Zekai Tahir Burak Women's Health Education and Research Hospital, Ankara -TURKEY

Aim: To investigate the probable effect of lactation on bone mineral density (BMD) later in life.

Materials and Methods: Eighty-seven premenopausal and 18 postmenopausal Turkish women were classified into four groups according to age. Age, height, weight, menopausal status, age at menopause (in postmenopausal women), years since menopause (in postmenopausal woman), parity and total lactation period were recorded. Lumbar spine BMD (L2-L4) was measured by dual-energy X-ray absorptiometry (DEXA). In each group, correlations of lactation with BMD were investigated using Pearson correlation test, and multiple regression analyses were used to determine the factors associated with BMD.

Results: No significant correlation was determined between total lactation period and BMD in any subgroup. This result did not change after adjusting for age, height, weight and parity.

Conclusions: Total lactation period does not seem to be a determinant of BMD later in life in Turkish women.

Key Words: Bone mineral density, lactation, dual-energy X-ray absorptiometry (DEXA)

Türk Kadınlarında Emzirmenin Hayatın İleriki Yıllarındaki Kemik Mineral Dansitometresi Üzerine Etkileri

Amaç: Emzirmenin hayatın ileriki yıllarındaki kemik mineral dansitometresi üzerine olası etkilerinin araştırılması.

Yöntem ve Gereç: Olgular 87 pre-menapozal ve 18 post-menapozal Türk kadınından oluşmakta idi. Yaşa göre olgular 4 gruba ayrıldılar. Yaş, boy, kilo, menapozal durum, menapoza girme yaşı ve menapozda geçirilen yıl (postmenapozal kadınlar için), parite ve total laktasyon periodları kaydedildi. Lumbal omurga kemik mineral dansitometri (KMD) (L2-L4) ölçümleri dual-enerji X-ray absorbtiometri (DEXA) cihazı ile yapıldı. Bütün gruplarda laktasyon ile KMD arasındaki ilişki Pearson Korelasyon Analizi kullanılarak incelendi. KMD ile ilişkili faktörleri belirlemede Çoklu Regresyon Analizi kullanıldı.

Bulgular: Bütün gruplarda total laktasyon periodu ile KMD arasında anlamlı bir ilişki saptanmadı. Bu sonuç yaş, boy, kilo ve parite gibi parametrelerin düzenlenmesi ile de değişmedi.

Sonuç: Total laktasyon periodu Türk kadınlarında hayatın ileriki yıllarındaki KMD için belirleyici bir etken olarak gözükmemektedir.

Anahtar Sözcükler: Kemik mineral dansitometresi, laktasyon, dual-enerji X-ray absorbtiometri (DEXA)

Received: October 01, 2007
Accepted: May 05, 2008

Correspondence
Ömer Lütfi TAPISIZ
Turan Güneş Bulvarı
Sedir Sitesi C2 Blok No: 6
06450 Or-An,
Ankara - TURKEY

omertapisiz@yahoo.com.tr

Introduction

Osteoporosis is an important health problem worldwide, characterized by low bone mass and micro-architectural deterioration of bone structure (1,2). Bone mineral density (BMD) is the best predictor for osteoporotic bone fractures. BMD is influenced by genetics, the environment, nutrition, physical exercise, diseases and drugs. Peak bone mass is the major determinant of BMD and is attained in the early thirties (3), the period of life in which pregnancy and lactation usually occur.

During pregnancy, mineralization of the fetal skeleton requires approximately 30 g calcium from maternal sources (4). Furthermore, abundant calcium is lost from the

* This study was presented as a poster presentation at the VIth International Congress of the Turkish-German Gynecological Association, Antalya, Turkey, 18-22 May 2005.

mother during lactation. These data suggest that BMD may change during and after pregnancy.

Although the exact role of pregnancy on BMD is currently under investigation, it has been shown that a 5% to 6% transitory bone mass reduction occurs after six months of lactation (5). However, there is controversy about the effects of lactation on BMD later in life. Some studies have shown an increase (6), others have suggested a decrease (7-9), and some even report no change (10,11).

In this study, we studied reproductive history and BMD of 87 premenopausal and 18 postmenopausal Turkish women. The purpose of this study was to ascertain whether lactation history is an independent risk factor for low BMD with possible inter-correlations (parity, weight, age and menopausal status).

Materials and Methods

Population

Fully informed consent was obtained from 87 premenopausal and 18 postmenopausal Turkish women aged 40-60 years old who were randomly recruited at Dr. Zekai Tahir Burak Women's Health Hospital, Ankara, between 2001 and 2002. All of the subjects were in good health according to medical evaluation. All postmenopausal women experienced natural menopause and no one had been treated with hormone replacement therapy (HRT). There was no history of alcohol intake, smoking or physical exercise. Subjects were classified into four subgroups in five-year increments as: group 1 (<40 years old) (n:33; 1 of whom was postmenopausal); group 2 (40-44 years old) (n:36; including 4 postmenopausal); group 3 (45-49 years old) (n:27; including 6 postmenopausal); and group 4 (>50 years old) (n:9; including 7 postmenopausal).

Methods

A questionnaire including age, height, weight, parity, total lactation period, menopausal status, age at menopause and years since menopause (YSM) was completed by all subjects. Subjects were weighed on an electric scale wearing minimal clothing. Height was measured to the nearest centimeter using a stadiometer. Total lactation period was described in total months for all combined pregnancies and parity was calculated as number of live births. Postmenopausal status was described as menstruation totally stopped for at least one year. Lumbar spine BMD (L2-L4) was measured by dual energy X-ray absorptiometry (DEXA) (QDR-4500SL, Hologic, Inc, MA, USA). This study protocol was approved by the ethical committee.

Statistical Analyses

SPSS version 10.0 was used for statistical analyses and a p value < 0.05 was assumed to be significant. Correlations between the variables were investigated using Pearson's correlation test and multiple regression analyses. On multiple regression analyses, the dependent variable was lumbar spine BMD, while independent variables were age, height, weight, parity, menopausal status, and age at menopause and YSM in postmenopausal women.

On multiple regression analyses, the strength of correlation between BMD and variables was assessed by a standard regression coefficient.

Results

Baseline characteristics and reproductive history including parity and total lactation period in each group are depicted in Table 1. The groups were similar with regard to BMD, height, weight, parity and total lactation period ($P > 0.05$ for all groups). Total lactation period was not statistically different between groups ($P > 0.05$), and mean parity was also similar ($P > 0.05$).

No correlations were determined between total lactation period and age ($r = 0.06$, $P = 0.513$), YSM ($r = -0.073$, $P = 0.773$), or lumbar BMD ($r = 0.047$, $P = 0.628$). However, height was found to have inverse ($r = -0.269$, $P = 0.05$) and parity and weight were found to have linear correlations ($r = 0.594$, $P < 0.001$; $r = 0.369$, $P < 0.001$, respectively) with total lactation period in all groups (Table 2).

Multiple regression analysis was used to determine the factors that were independently related with lumbar BMD. No factor was found to be independently correlated with lumbar BMD ($P > 0.05$) (Table 3).

Table 1. Baseline characteristics, parity, and total lactation period.

	<40 (years)° (n = 33)	40-44 (years)[1] (n = 36)	45-49 (years)[2] (n = 27)	>50 (years)[3] (n = 9)
Age (year)	37 ± 1.5	42.2 ± 1.7	47.3 ± 1.2	56 ± 4.2
BMD(g/cm)	0.57 ± 0.11	0.54 ± 0.10	0.59 ± 0.21	0.48 ± 0.09
Height (cm)	160 ± 2.4	159 ± 3.2	158 ± 3.9	161 ± 4.8
Weight (kg)	67.7 ± 11.4	69.1 ± 13.9	71.4 ± 13.3	69.3 ± 13.5
Parity	1.9 ± 1.2	2.2 ± 1.3	2.3 ± 1.4	2.4 ± 1.1
Total lactation period (month)	24.1 ± 19.7	22.8 ± 19.2	23.8 ± 19.6	25.3 ± 18.1
Age at menopause (year)	39	38.7 ± 4.5	46.3 ± 2.1	47.4 ± 3.9
Years since menopause	1.2	1.3 ± 0.7	2.1 ± 1.8	6.1 ± 3.5

Data are presented as mean ± standard deviation.
BMD: bone mineral density.
°one subject was postmenopausal
[1] four subjects were postmenopausal
[2] six subjects were postmenopausal
[3] seven subjects were postmenopausal

Table 2. Correlations of factors.

	Age		Height		Weight		Parity		Lactation period		YSM		BMD	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Age	-	-	0.03	0.69	0.14	0.14	0.16	0.09	0.06	0.51	0.53	0.02	-0.10	0.29
Height	0.03	0.69	-	-	0.19	0.05	-0.19	0.04	-0.27	0.005	0.09	0.72	-0.04	0.65
Weight	0.14	0.14	0.19	0.05	-	-	0.17	0.09	0.37	0.001	-0.02	0.9	0.04	0.69
Parity	0.16	0.09	-0.19	0.04	0.17	0.09	-	-	0.59	0.001	-0.51	0.03	0.08	0.40
Lactation period	0.06	0.51	-0.27	0.005	0.37	0.001	0.59	0.001	-	-	-0.07	0.77	0.05	0.63
YSM	0.53	0.02	0.09	0.72	-0.02	0.9	-0.51	0.03	-0.07	0.77	-	-	-0.23	0.36
BMD	-0.10	0.29	-0.04	0.65	0.04	0.69	0.08	0.40	0.05	0.63	-0.23	0.36	-	-

YSM: years since menopause; BMD: bone mineral density.

Table 3. Multiple regression analysis of lumbar spine BMD versus age, height, weight, parity, and total lactation period.

Dependent and independent variables	Standardized regression coefficient	t	p value
Lumbar spine BMD			
Age	-0.0027	-1.218	0.226
Height	-0.1076	-0.037	0.709
Weight	0.0006	0.500	0.617
Parity	0.0083	0.472	0.637
Total lactation period	-0.0003	-0.317	0.751

BMD: bone mineral density.

Discussion

In this study, we aimed to ascertain whether lactation history is an independent risk factor for low BMD with possible inter-correlations. We found that lactation, although an active metabolic state, does not appear to be associated with BMD later in life. Lack of an association between bone density and breast-feeding was also supported by earlier studies (12,13). Some investigators have found that lactation was associated with greater bone density (6); others found lower bone density with breast-feeding (7-9); and some have reported no change (10,11). Most of these studies involved premenopausal women; however, and the effect of lactation appears to be transient, with no effect on bone density postmenopause (14,15). These differences may depend on study design, number of subjects, follow-up period, statistics and sites of bone measured. Are the bone sites used in measurement important? For example, forearm BMD can not reflect total body mineral density (16). Age adjustment is also necessary to reveal the relationship between lactation and BMD. In this regard, we divided our subjects by age into four subgroups in five-year increments and measured lumbar spine BMD. We found no significant relationship between total lactation period and BMD. Marked changes in calcium metabolism occur during lactation (17), related to amount of breast-milk produced, diet, and duration of lactation. The decrease in BMD averages 4-6% during the first six months of lactation (18). During lactation, the women have a period of considerable hypo-estrogenemia, which negatively affects calcium and phosphate metabolism, as seen in amenorrhea (19), and is widely documented after menopause (20). During lactation, the return of ovarian function varies greatly, so that remarkable differences in bone mass might develop among individuals. Sowers et al. (21) reported that a 5% transitory bone loss occurs in women who breastfed at least six months. They explained this by an environment of low circulating estradiol, high circulating parathyroid hormone related protein and prolactin concentrations. However, women lactating for more than six months recover bone loss after lactation in extended periods (22). From this angle, the loss of bone mineral during lactating years must have been compensated for later in life so that lactation was not found to be an independent factor affecting bone density.

Bone metabolism is a dynamic process that is affected by various factors during different phases of life including race, ethnicity (23), familial resemblance (24), hormonal status, age at menarche, menstrual irregularities, oral contraceptive usage, pregnancy, lactation, dietary factors, physical activity, smoking, and alcohol consumption (25-27). These factors have different effects on BMD in different stages of life. Thus, effect of lactation on BMD may be masked by greater BMD determinants later in life such as age, menopause, change in diet, change in body size, and altered physical activity. A recent study consisting of 3476 women in the Netherlands found that only age at menopause and menarche have significant associations with BMD (28). Although none of our subjects had a history of alcohol consumption or smoking, we could not evaluate dietary habits (calcium intake) and physical activity in our subjects. This situation could be a limitation of our study.

Based on these results, we conclude that lactation does not seem to be a determinant of BMD later in life after adjusting for age, height, weight and parity. Lactation causes a loss of bone mineral due to hormonal environment; however, BMD is affected by many different factors, each having different influences on different stages of life, and this negative effect of lactation may be masked by greater BMD determinants during life.

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