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Thieme

An Evaluation of the Association of Reproductive History and Multiple Births during Adolescence with Postmenopausal Osteoporosis

Untersuchung über den Zusammenhang zwischen Reproduktionsgeschichte und mehrfachen Geburten in der Adoleszenz und postmenopausaler Osteoporose

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ABSTRACT

Introduction Osteoporosis is the most common metabolic bone disease characterized by low bone mass. Reproductive factors are known to affect bone mineral density (BMD). Calcium loss from maternal bone and decreased BMD have been observed especially during pregnancy and lactation, although this loss has been reported to recover within 6–12 months. There is no consensus on whether the effect of reproductive factors on the bone is positive or negative. The adolescent period is important for total bone mass, and total bone mass is significant in osteoporosis. The aim of this study was to investigate the effect of first gestational age, multiple births during adolescence, interpregnancy interval and reproductive history such as duration of breastfeeding on bone mineral density in postmenopausal women.

Materials and Methods BMD was measured in a total of 196 postmenopausal patients and in accordance with the results, analysis was made of three groups as normal, osteopenia and osteoporosis. Dual Energy X-Ray Absorptiometry (DEXA) was used to take the lumbar, femoral and total bone BMD measurements.

Results No statistically significant difference was determined between the groups in respect of total breastfeeding time ($p = 0.596$). It was detected that an increased interpregnancy interval decreased the risk of osteoporosis. In patients with osteoporosis, the mean interpregnancy interval was 1.4 ± 0.73 years, while it was longer in patients with osteopenia (1.92 ± 1.20) and normal BMD (2.45 ± 1.77) ($p = 0.005$). While no effect was determined of the first gestational age on BMD, in the univariate logistic regression analysis, multiple births in the adolescent period were seen to increase the risk of osteoporosis 6.833-fold ($p = 0.001$, $OR = 6.833$, 95% $CI = 2.131$–21.908; $p = 0.001$). The increase in the age of menopause was determined to decrease the risk of osteoporosis ($OR = 0.911$, 95% $CI = 0.843$–0.985; $p = 0.019$).

Conclusion Having frequent births throughout the whole reproductive age and having more than one child in adolescence has an adverse effect on postmenopausal bone mineral densities.

ZUSAMMENFASSUNG

Einleitung Die Osteoporose ist die am häufigsten vorkommende metabolische Knochenerkrankung. Kennzeichnend für die Erkrankung ist eine niedrige Knochendichte. Es ist bekannt, dass verschiedene Reproduktionsfaktoren Auswirkungen auf die Knochenmineraldichte (KMD) haben können. Ein Kalziumverlust zulasten des mütterlichen Skeletts sowie ein Rückgang an KMD wurden besonders während der Schwangerschaft und Stillzeit beobachtet, obwohl manchen Studien zufolge dieser Verlust innerhalb von 6–12 Monaten wiedergutgemacht wird. Es gibt keinen Konsens darüber, ob die Auswirkungen von Reproduktionsfaktoren auf die Knochen positiv oder negativ sind. Die Adoleszenz stellt eine wichtige Phase für die Gesamtknochendichte dar, und die Gesamtknochendichte spielt eine wesentliche Rolle bei der Entwicklung einer Osteoporose. Das Ziel dieser Studie war es, zu untersuchen, ob das Alter der Mutter bei der Geburt des 1. Kindes, mehrfache Geburten während der Adoleszenz, der Abstand zwischen den Geburten und die Reproduktionsgeschichte (z. B. die Dauer der Stillzeit) sich auf die Knochenmineraldichte von postmenopausalen Frauen auswirkt.

Material und Methoden Die KMD wurde bei 196 postmenopausalen Patientinnen gemessen. Basierend auf diese Messergebnisse wurden die Frauen in 3 Gruppen eingeteilt: normale KMD, Osteopenie und Osteoporose. KMD-Messungen im Lenden- und Oberschenkelbereich und zur Feststellung der Gesamtknochendichte wurden mithilfe der dualen Röntgenabsorptiometrie (DXA) durchgeführt.

Ergebnisse Es gab keine statistisch signifikanten Unterschiede zwischen den Gruppen bezüglich der Gesamtdauer der Stillzeit (p = 0,596). Es stellte sich heraus, dass ein längerer Abstand zwischen Schwangerschaften das Risiko einer Osteoporose minderte. Bei Patientinnen mit Osteoporose betrug der durchschnittliche Abstand zwischen Schwangerschaften 1,4 ± 0,73 Jahre, während der durchschnittliche Abstand zwischen Schwangerschaften länger war bei Patientinnen mit Osteopenie (1,92 ± 1,20) bzw. bei Patientinnen mit normaler Knochendichte (2,45 ± 1,77) (p = 0,005). Obwohl das Alter der Mutter bei der Geburt ihres 1. Kindes statistisch gesehen keine Auswirkungen auf die KMD hatte, stellte sich in der univariaten logistischen Regressionsanalyse heraus, dass mehrere Geburten in der Adoleszenz das Risiko einer Osteoporose um das 6,833-Fache erhöhten (p = 0,001, OR: 6,833, 95%-KI: 2,131–21,908; p = 0,001). Ein späteres Alter beim Eintreten der Wechseljahre senkte das Risiko einer Osteoporose (OR: 0,911, 95%-KI: 0,843–0,985; p = 0,019).

Schlussfolgerung Häufige Geburten während des gebärfähigen Alters und mehr als 1 Kind während der Adoleszenz wirken sich negativ auf die Knochenmineraldichte bei postmenopausalen Frauen aus.

Introduction

Osteoporosis (OP) is the most common metabolic bone disease characterized by low bone mass. Osteoporotic fractures cause severe morbidity and mortality in women, and postmenopausal osteoporosis is an important public health problem [1]. Risk factors for osteoporosis (OP) are multifactorial. These include white race, female sex, low body mass index (BMI), occupation, socioeconomic status, family history, fracture history, diet, habits such as tea, coffee and smoking, sedentary lifestyle, and drugs with adverse effects on the bone [1, 2].

Reproductive factors are known to affect bone mineral density (BMD) [3 – 11]. Calcium loss from maternal bone and decreased BMD have been observed especially during pregnancy and lactation [4], although this loss has been reported to recover within 6–12 months [5]. There is no consensus on whether the effect of reproductive factors on the bone is positive or negative.

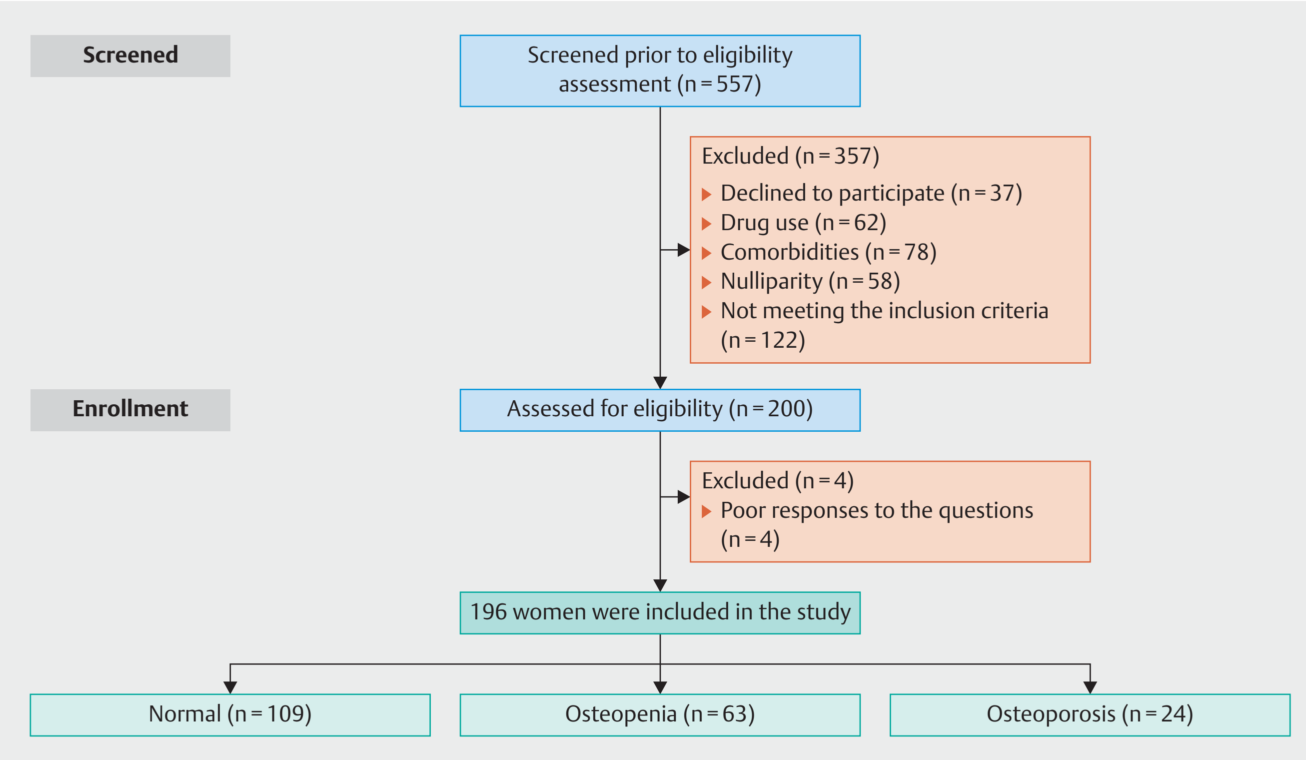
The term “adolescent” is often used synonymously with “teenager” and refers to the transition from childhood to adulthood, when there is not only physical development, but also sexual, and psychosocial development. According to the World Health Organization (WHO) definition, the adolescent period is between the ages of 10 and 19 years, with the period of 10–14 years considered as early adolescence and the period of 15 to 19 years, late adolescence [12]. The adolescent period is important for total bone mass, and total bone mass is significant in osteoporosis [6]. There are conflicting study results showing the effect on the bone of a single birth in adolescence, but there are no studies in literature which have investigated the effect of multiple pregnancies [3, 7]. The current study was planned from the hypothesis that two births during this period would have a greater effect on the bone compared to a single birth. Factors such as diet and lifestyle habits were questioned.

In this study, an investigation was made of the effect on bone density in the postmenopausal period of first gestational age, adolescent pregnancy, multiple births during this period, duration of lactation, interpregnancy intervals and dietary habits and lifestyle. It was aimed with this cross-sectional study to make a contribution to this issue which has not been clarified in literature.

Materials and Methods

Study design and patient population

This cross-sectional study was conducted at Düzce University Medical Faculty Training and Research Hospital between September 2017 and February 2018. Patients were included from those who underwent bone mineral density (BMD) testing as a requirement for the Gynecological Diseases and Obstetrics Polyclinic or for the Physical Therapy and Rehabilitation Polyclinic for any reason, with normal references values in blood tests, Ca and 25-OH D-vit, had delivered at least once, had been through a normal menopause and did not meet the exclusion criteria. Patients who



▶ **Fig. 1** The progress of all participants through the trial; flow diagram.

had not had menstrual bleeding for the previous 12 months were considered postmenopausal.

Patients were excluded if they were aged < 40 years, had cancer and had undergone chemoradiotherapy, thyroid or parathyroid surgery, were taking medication for parathyroid diseases, had uncontrolled thyroid disease, were taking medication for bone remodeling, had received hormone replacement therapy, had bone metabolism disease, were taking medicine (heparin, corticosteroid) which would affect bone, were surgically menopausal, or had any autoimmune disease such as rheumatoid arthritis. Patients were also excluded from the study due to causes of secondary osteoporosis such as chronic liver disease, type 1 diabetes, malabsorption, chronic malnutrition, and hypogonadism. Therefore, of the 256 patients initially reviewed, 31 were excluded due to nulliparity, 24 due to other diseases and medication and 5 as they did not wish to participate, and the study was completed with 196 patients (▶ **Fig. 1**).

The demographic data of the patients were obtained in one-to-one interviews. Detailed questions were asked in respect of age, height, weight, menarche age, first gestational age, number of births before the age of 20, the number of pregnancies and deliveries which completed six months, number of live births, birth dates, the shortest interpregnancy interval, breastfeeding times for each pregnancy, age of first breastfeeding, age of last breastfeeding, total breastfeeding time, marital status, level of income, education level, smoking, exercise habits, black tea consumption, caffeine intake, comorbid disease (DM, HT, hypothyroidism, asthma), current medication (iron supplements, Vitamin D, aspirin, thyroid hormone, glucocorticoid), weight gain during the last 30 years, the lifetime maximum weight, shortening of height, and surgical history (oophorectomy, hysterectomy, parathyroidectomy, etc.). The anamnesis was taken by a single physician.

The exercise limit was defined as 30 min/day of moderate intensity activity, and caffeine consumption was defined as 2 cups/day black tea and > 1 cup/day of coffee. Calcium consumption was calculated from the self-reported milk and dairy products intake.

The association of the number of births in the adolescent period was the primary focus of this study, so adolescent pregnancy history and total breastfeeding duration with the primary outcome of bone mineral density was analyzed taking interpregnancy intervals into consideration.

In all cases, bone mineral density (BMD) was measured with a GE/LUNAR DPX PRO DEXA device (Dual Energy X-Ray Absorptiometry). The BMD values of the patients were measured from the lumbar vertebrae (in the anterior position between L1–L4) and from the proximal femur (neck, trochanter and Ward's triangle), then the femur, lumbar and total BMD values and T scores were recorded. Osteoporosis was defined as a T score ≤ − 2.5, osteopenia as a T score from − 1.1 to − 2.4 and normal as a T score ≥ − 1.0. The lower of either the spine or the hip T-scores was used for classification according to the ISCD guidelines [13].

The age of 27 years was considered the age for complete peak-bone-mass [14]. Patients who gave birth at the age of 20 years and above were divided again into 2 subgroups of those who gave birth between the age of 20–27 years and those who gave birth aged > 27 years. The interpregnancy interval was calculated as the time between the month of birth and the date of the conception of the next pregnancy.

Power analysis

As a result of the power analysis, it was decided to include a total of 118 individuals in order to determine the statistical significance of a 0.8 unit difference (effect size 0.8) in terms of femoral neck and a 0.7 unit difference (effect size 0.7) in terms of lumbar spine between the groups in conditions of 90 % power and 5 % type 1 error. The power analysis was applied with PASS v.11 package software.

Statistical analysis

Continuous data were summarized as mean and standard deviation and categorical data as frequency and percentage. In the statistical evaluation of the data, the Independent Samples t-test was used in two group comparisons depending on the distribution pattern of data. One-way ANOVA or Kruskal-Wallis tests were used in comparisons of three or more groups. Associations between categorical variables were examined using the Pearson Chi-Square or Fisher's Exact tests. In the univariate analyzes, first, univariate logistic regression analysis was performed for each of the factors associated with osteoporosis and then the OR values were calculated using multivariate logistic regression analysis by taking all as the model. Statistical analyses were performed using SPSS v.22 packet software and the significance level was taken as 0.05.

Results

Demographic data

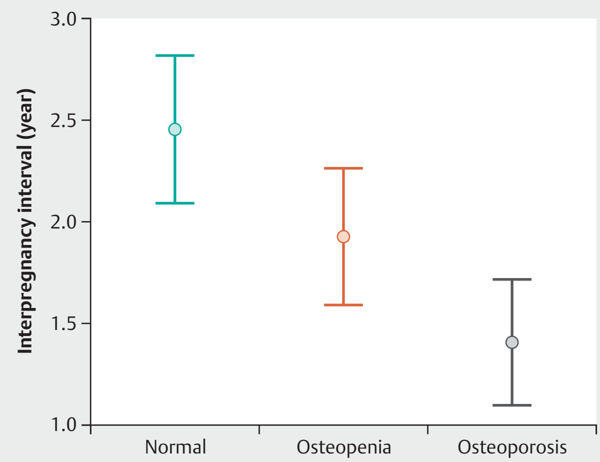
Demographic data according to BMD are shown in ▶ **Table 1**. When the total 196 postmenopausal patients were analyzed according to bone mineral densities, three groups were formed; 109 (55.6 %) as normal, 63 (32.1 %) as osteopenic and 24 (12.2 %) as osteoporotic. The mean age was 60.6 years and no difference was determined between the groups in respect of age (p = 0.931). The BMI values of the patients were statistically different, and the group with higher BMI was found to have better BMD (p = 0.001). There was no significant difference between the bone mineral density groups in terms of current monthly income, level of education, smoking, alcohol use, regular caffeine consumption, exercise, current consumption of milk and dairy products, menarche age and menopause duration (▶ **Table 1**). The menopause age was statistically significantly lower in the osteoporotic group compared to the normal group (p = 0.004). There was a significant difference in the rates of osteoporosis according to the style of dressing, and it was seen that 91.7 % of the patients who were diagnosed with osteoporosis wore the chador or traditional headscarf and 76.2 % of patients in the osteopenia group also wore the chador or traditional headscarf (p = 0.033).

Reproductive history

The reproductive histories of the patients are shown in ▶ **Table 2**. There was no difference in the first and last breastfeeding age of the patients (p = 0.761, p = 0.103). There was no statistically significant difference in the duration of total breastfeeding (p = 0.596).

It was observed that the onset of menopause at a later age decreased the risk of osteoporosis. In patients with osteoporosis, the mean menopausal age was 43.67 ± 6.36 years, while it was 45.25 ± 5.08 years in the osteopenic group and 47.18 ± 5.13 years in the normal group (p = 0.004). In the results of the univariate logistic regression analysis, the increase in menopausal age was seen to be associated with a decrease in the risk of osteoporosis (OR = 0.911, 95 % CI = 0.843–0.985; p = 0.019).

The increase in interpregnancy interval was found to decrease osteoporosis risk. The mean interpregnancy interval was 1.4 ± 0.73 years in patients with osteoporosis, whereas it was longer in patients with osteopenia (1.92 ± 1.20 years) and in the normal BMD group (2.45 ± 1.77 years) (p = 0.005). Each year increase in interpregnancy interval was determined to decrease the risk of osteoporosis 2-fold (OR = 0.490, 95 % CI = 0.288–0.835; p = 0.009). In the results of the multivariate analysis, it was seen that for each year increase in interpregnancy interval, there could be as much as a 2.6-fold decrease in osteoporosis risk (OR = 0.386, 95 % CI = 0.211–0.707; p = 0.002) (▶ **Table 3**, ▶ **Fig. 2**).



▶ **Fig. 2** Interpregnancy intervals for groups.

An older last breastfeeding age was not determined to be statistically significant, but it was seen to decrease the risk of osteoporosis. The mean age of the last breastfeeding was 28.58 ± 4.28 years in the patients with osteoporosis, 30.30 ± 5.29 years in the osteopenic group and 31.02 ± 5.05 years in the normal group. According to the univariate logistic regression analysis, the increase in the last breastfeeding age led to a decrease in the limit of the risk of osteoporosis (OR = 0.916, 95 % CI = 0.838–1.001; p = 0.054) and the multivariate analysis showed that this reduction was more noticeable (OR = 0.849, 95 % CI= 0.764–0.944; p = 0.002) (▶ **Table 3**).

The risk of osteoporosis was determined to increase with a history of more than one birth in late adolescence. None of the pa-

▶ **Table 1** Demographic data according to BMD.

	Total (n = 196)	Normal (n = 109)	Osteopenia (n = 63)	Osteoporosis (n = 24)	p
Age (y)	60.6 ± 8.02	60.5 ± 8.77	60.8 ± 8.72	60.04 ± 7.87	0.931
BMI	32.9 ± 6.2	35.13 ± 6.18	30.12 ± 4.29	30.70 ± 6.88	**0.001**
Marital status					0.451
▪ Divorced/Widowed	34 (17.3 %)	16 (14.7 %)	14 (22.2 %)	4 (16.7 %)	
▪ Married	162 (82.7 %)	93 (85.3 %)	49 (77.8 %)-	20 (83.3 %)	
▪ Single	–	–	–	–	
Income levels					0.289
▪ Lowest	72 (36.7 %)	39 (35.8 %)	23 (36.5 %)	10 (41.7 %)	
▪ Medium-lowest	82 (41.8 %)	41 (37.6 %)	31 (49.2 %)	10 (41.7 %)	
▪ Medium-highest	36 (18.4 %)	26 (23.9 %)	6 (9.5 %)	4 (16.7 %)	
▪ Highest	6 (3.1 %)	3 (2.8 %)	3 (4.8 %)	0 (0.0 %)	
Education level					0.654
▪ Uneducated	44 (22.4 %)	24 (22.0 %)	13 (20.6 %)	7 (29.2 %)	
▪ Primary school	114 (58.2 %)	66 (60.6 %)	35 (55.6 %)	13 (54.2 %)	
▪ Secondary school	7 (3.6 %)	5 (4.6 %)	1 (1.6 %)	1 (4.2 %)	
▪ High school	20 (10.2 %)	9 (8.3 %)	8 (12.7 %)	3 (12.5 %)	
▪ University	11 (5.6 %)	5 (4.6 %)	6 (9.5 %)	0 (0.0 %)	
Smoking	42 (21.4 %)	23 (21.1 %)	14 (22.2 %)	5 (20.8 %)	0.982
Alcohol	2 (1.0 %)	1 (0.9 %)	0 (0.0 %)	1 (4.2 %)	0.333
Caffeine	160 (81.6 %)	90 (82.6 %)	52 (82.5 %)	18 (75.0 %)	0.670
Tea	140 (71.4 %)	81 (74.3 %)	44 (69.8 %)	15 (62.5 %)	0.482
Exercise	26 (13.3 %)	16 (14.7 %)	10 (15.9 %)	0 (0.0 %)	0.120
Dressing style					0.033
▪ Chador	3 (1.5 %)	0 (0.0 %)	2 (3.2 %)	1 (4.2 %)	
▪ Traditional headscarf	162 (82.7 %)	95 (87.2 %)	46 (73.0 %)	21 (87.5 %)	
▪ Not wearing a headscarf	31 (15.8 %)	14 (12.8 %)	15 (23.8 %)	2 (8.3 %)	
Sufficient calcium consumption	74 (37.8 %)	44 (40.4 %)	21 (33.3 %)	9 (37.5 %)	0.657
Height reduction	108 (55.1 %)	66 (60.6 %)	29 (46.0 %)	13 (54.2 %)	0.182
Parity (median [min–max])	3 (1–11)	3 (1–9)	3 (1–11)	3 (1–9)	0.763
Menarche age (y)	13.6 ± 1.54	13.56 ± 1.42	13.79 ± 1.69	13.96 ± 1.68	0.421
Menopause age (y)	46.13 ± 5.40	47.18 ± 5.13	45.25 ± 5.08	43.67 ± 6.36	0.004
Menopause duration (y)	14.46 ± 9.59	13.40 ± 9.38	15.57 ± 10.06	16.38 ± 9.04	0.210

Data are presented n (%) or as mean ± SD. Abbreviations: y: years; BMI: body mass index; SD: standard deviation

tients in this study gave birth more than twice in this period. Of the osteoporosis group with pregnancies in adolescence, 25 % had two deliveries. Univariate logistic regression analysis revealed that multiple births in the late adolescent period increased the risk of osteoporosis 6.833-fold (OR = 6.833, 95 % CI= 2.131–21.908; p = 0.001).

Discussion

The aim of this study was to examine the effects on bone mineral density in postmenopausal patients of parity, age at first pregnancy, the number of pregnancies and births in adolescence, the interpregnancy interval throughout the entire reproductive age, total breastfeeding period, menarche age, menopausal age and lifestyle habits.

The exclusion of many confounding factors, questioning of living conditions such as diet features, exercise, clothing, and income status can be considered to be the strengths of the study. The power of the study could have been reduced as the number of osteoporotic patients in the whole study group of patients was

▶ **Table 2** Reproductive history according to BMD.

	Total (n = 196)	Normal (n = 109)	Osteopenia (n = 63)	Osteoporosis (n = 24)	p
First breastfeeding age (y)	21.37 ± 3.87	21.56 ± 3.93	21.09 ± 4.17	21.29 ± 2.85	0.761
Last breastfeeding age (y)	30.46 ± 5.08	31.02 ± 5.05	30.30 ± 5.29	28.58 ± 4.28	0.103
Age of first pregnancy (y)	20.89 ± 3.98	21.06 ± 4.14	20.68 ± 4.11	20.75 ± 2.82	0.825
Age of first pregnancy (y)					0.936
▪ 14–19	82 (41.8 %)	45 (41.3 %)	27 (42.9 %)	10 (41.7 %)	
▪ 20–26	97 (49.5 %)	54 (49.5 %)	30 (47.6 %)	13 (54.2 %)	
▪ ≥ 27	17 (8.7 %)	10 (9.2 %)	6 (9.5 %)	1 (4.2 %)	
Adolescence pregnancy	82 (41.8 %)	45 (41.3 %)	27 (42.9 %)	10 (41.7 %)	0.980
Interpregnancy interval (y)	2.14 ± 1.54	2.45 ± 1.77	1.92 ± 1.20	1.40 ± 0.73	**0.005**
Interpregnancy interval (y; n = 169)					**0.020**
▪ < 1	26/169 (15.4 %)	10/94 (10.6 %)	10/51 (19.6 %)	6/24 (25.0 %)	
▪ 1–2	89/169 (52.7 %)	44/94 (46.8 %)	30/51 (58.8 %)	15/24 (62.5 %)	
▪ 2–3	29/169 (17.2 %)	21/94 (22.3 %)	5/51 (9.8 %)	3/24 (12.5 %)	
▪ > 3	25/169 (14.8 %)	19/94 (20.2 %)	6/51 (11.8 %)	0/24 (0.0 %)	
Repeated births during the adolescent period	14 (7.1 %)	2 (1.8 %)	6 (9.5 %)	6 (25.0 %)	**0.001**
Total duration of breastfeeding (m)	38.51 ± 33.73	37.52 ± 31.71	41.96 ± 40.17	34.38 ± 24.19	0.596
Total duration of breastfeeding (m)					0.689
▪ 0–6	33 (16.8 %)	21 (19.3 %)	11 (17.5 %)	1 (4.2 %)	
▪ 7–12	24 (12.2 %)	12 (11.0 %)	9 (14.3 %)	3 (12.5 %)	
▪ 13–24	34 (17.3 %)	21 (19.3 %)	7 (11.1 %)	6 (25.0 %)	
▪ 25–36	42 (21.4 %)	21 (19.3 %)	14 (22.2 %)	7 (29.2 %)	
▪ 37–48	16 (8.2 %)	8 (7.3 %)	6 (9.5 %)	2 (8.3 %)	
▪ ≥ 48	47 (24.0 %)	26 (23.9 %)	16 (25.4 %)	5 (20.8 %)	

Data are presented as n (%) or as mean ± SD. Abbreviations: m: months; y: years; BMI: body mass index; SD: standard deviation

▶ **Table 3** Logistic regression analysis for osteoporosis.

	Univariate		Multivariate	
	OR (95 % CI)	**p value**	**OR (95 % CI)**	**p value**
BMI	0.930 (0.864–1.002)	0.056	0.924 (0.855–0.998)	**0.045**
Menopause age	0.911 (0.843–0.985)	**0.019**	–	–
Interpregnancy interval	0.490 (0.288–0.835)	**0.009**	0.386 (0.211–0.707)	**0.002**
Last breastfeeding age	0.916 (0.838–1.001)	0.054	0.849 (0.764–0.944)	**0.002**
Repeated births during adolescence	6.833 (2.131–21.908)	**0.001**	–	–

low. Risk factors for osteoporosis are known to be smoking, income level, calcium consumption, and low levels of exercise and no significant differences thought to be connected to these factors were determined between the groups. In accordance with previous findings in literature, low BMI and modest Islamic clothing were found to increase the development of osteoporosis [15, 16]. Since the amount of breastfeeding can affect the bone as well as the duration of breastfeeding, the fact that the number of daily breastfeedings and duration were not considered could constitute a limitation of the study. Another limitation is that there was no evaluation of differences between single and multiple pregnancies. It is also possible that individuals do not give accurate information in the face-to-face interviews as they cannot recall such old events.

Bone mineral densities may be affected by endocrine changes during pregnancy. In a large-scale study, it was found that the risk of postpartum hip fracture declined by 10 % in the following years [17]. Similar studies show that a greater number of births is protective against osteoporotic fracture risk [18, 19]. In a large-scale observational study investigating the effect of parity and breastfeeding on BMD in postmenopausal women, it was observed that parity and breastfeeding had no effect on bone density [6]. In this regard, the results of the current study support the studies in literature showing that parity has no effect on bone mineral density.

Since osteoblastic activity continues during adolescence, the effect of pregnancy in this period on bone mass may be different from that of pregnancy in later reproductive years. Adolescence is an important period for total bone mass formation and total bone mass is a determinant of osteoporosis. 90% of the total bone mass is achieved at the age of 18 and 99% at the age of 27 [20]. The issue of how the adolescent pregnancy history affects bone mineral densities in later life remains a matter of current debate. There are studies in literature showing varying results ranging from harmful effects to protective effects [3, 21, 22]. In one study, adolescent pregnancy was reported to be a predictor of postmenopausal osteoporosis and increase the risk 2.2-fold [21]. In another study, while no difference was found in the bone mineral densities of the lumbar region of adolescent pregnancy patients, bone mineral densities of the femur neck were found to be better than those of the control group [3]. In another study, it was suggested that pregnancy during adolescence may damage physiological processes and thus have harmful effects on peak bone mass [22]. In the current study, there was no significant difference in both the lumbar and femoral bone mineral densities of the patients who gave birth and those who did not give birth in the adolescent period. Patients who gave birth twice in adolescence were determined to have a 6.8 times higher risk of osteoporosis. This was a finding that showed that late adolescent pregnancy had a negative effect on bone mineral density. The difference between the single child and two children may be due to the small sample size.

Early onset of menopause has been shown to increase postmenopausal osteoporosis [9, 11] and the results of the current study are consistent with previous findings in literature.

The association between BMD and the duration of breastfeeding was investigated, and the results were seen to be as complex as the correlation between parity and late adolescent pregnancy. While the protective effect of breastfeeding on the lumbar vertebrae has been reported, it has been stated that every 6 months of breastfeeding reduced the risk of hip fracture by 13%, and as a result, the risk for hip fracture decreased as the duration of breastfeeding increased. However, in another study, it was shown that a six-month lactation period was accompanied by a loss of 5–7% in the spine and hip bone mass [23 – 25]. It was reported that even if calcium intake in the diet is sufficient during the lactation period, an important part of the calcium requirement is provided by the maternal skeleton, which is why long-term lactation causes more bone loss in the mother [26]. The frequency of postmenopausal osteoporosis was observed to be high in the group of patients who breastfed for over one year and whose first breastfeeding age was below 27 years [27]. In the same study, the protective effect of parity was mentioned. Similarly, in the current study, no relationship was found between the first breastfeeding age and postmenopausal osteoporosis. It has been reported that breastfeeding had no negative effect on peak bone mass or risk of hip fracture and that BMD values immediately returned to their previous values when breastfeeding was stopped [5, 14, 28, 29]. This improvement requires a certain interval between two pregnancies. The risk of osteoporosis in the postmenopausal period has been found to be higher in patients with an interpregnancy interval shorter than one year [30]. In the current study, in line with literature, a longer interpregnancy interval was found to result in a decrease in osteoporosis risk. No statistically significant difference was determined between the total breastfeeding period and BMD. In studies which have shown that the breastfeeding period has a positive effect on bone mineral density, this could be due to the association of the contraceptive effect of breastfeeding and the longer interpregnancy interval.

Conclusion

While no effect of breastfeeding on BMD was determined in this study, a shorter interpregnancy interval and having more than one child in late adolescence was seen to have a negative effect on bone mineral density in the postmenopausal period. The adolescent period is an important period for total bone mass formation and more than one pregnancy at this age can trigger postmenopausal osteoporosis. Postmenopausal bone density is multifactorial throughout the life of a woman, so there is conflicting information in literature. More prospective randomized studies are required to clarify this issue.

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Ethical approval

Written consent documents were obtained from all the patients who agreed to participate in the study. Before starting the study, approval was granted by the Ethics Committee of Duzce University Medical Faculty (2017/155). All procedures were carried out in line with the Helsinki Declaration.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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