The Association between Short Inter-Pregnancy Interval and Postmenopausal Osteoporosis, Saudi Arabia, Taif City, 2019: A case-control study

Ameerah S. Bajaber (1)
Hashem Bukhary (3)
Afnan K. Sibyani (2)
Eid H. Alshahrani (4)
Tasneem H. Hassan (1)
Nojood A. Althomali (1)

(1) Medical intern, Taif university, Taif, Saudi Arabia
(2) Medical student, Taif university, Taif, Saudi Arabia
(3) Department of Surgery, Orthopedic Division, College of Medicine, Taif University, Taif, Kingdom of Saudi Arabia
(4) Medical intern, University of Bisha, Bisha, Saudi Arabia

Corresponding author:
Dr. Ameerah S. Bajaber
Medical intern, Taif university, Taif
Saudi Arabia
Tel.:0549766003
Email: ameera-09@hotmail.com

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Abstract

Background: Previous studies confirmed the relation between postmenopausal osteoporosis (PMOP) and short inter-pregnancy interval (IPI). Studies assessing this association in KSA are limited.

Objectives: This study aimed to assess the association and factors affecting the presence of osteoporosis among postmenopausal Saudi women.

Methods: A case-control study was done on cases diagnosed with PMOP who had DEXA scan report and cases of postmenopausal females without osteoporosis. Through a personal interview, a questionnaire was used to collect demographic data, height, weight, sports practice, previous bone fracture, smoking, medications used, breast-feeding numbers, interpregnancy intervals, age at menarche, age at menopause, age at first baby, number of deliveries, number of breastfeeding, and T-score and Z- score.

Results: Participants with at least one interpregnancy interval < one year had a significantly higher percentage of those belonging to cases. Cases had a significant higher mean number of inter-pregnancy interval less < one-year, lower T-score and lower Z-score compared to controls. A non-significant relationship was found between the cases and controls according to sports practice, BMI categories, previous bone fracture and smoking and family history of osteoporosis, age at menarche, age at menopause, age at first baby, number of deliveries, number of breastfeeding, and number of medications used.

Conclusion: Females in reproductive age should be educated about the importance of long IPI and the relation between short IPI on PMOP.

Key words: Association, inter-pregnancy, interval, postmenopausal, osteoporosis, Saudi Arabia.

Introduction

Osteoporosis is defined by the World Health Organization (WHO) as a bone mineral density (BMD) T-score less than -2.5 as measured by dual-emission x-ray absorptiometry (DXA).(1). Osteoporosis affects 30% of women and 12% of men at some point in their lifetimes.(2). In nine industrialized countries, in North America, Europe, Japan, and Australia, osteoporosis affects up to 49 million individuals and its prevalence at the total hip, or hip/spine ranged from 9 to 38 % for women and 1 to 8 % for men (3).

Many factors affect bone mineralsdensity; one of the most important factors is age; the risk gets higher at an age of more than 45 years or advanced age of menopause (4). A previous study confirmed the relation between osteoporosis, postmenopause and white women with previous smoking habit and lower schooling level (5,6). In addition, body fat is considered a protective factor as it has a role in raising the estrogen level in the blood, which can activate the osteoblasts. Thus those of low body weight have a higher risk of osteoporosis (7).

Prolonged breastfeeding is known to be associated with decreased bone mineral density and can affect bone metabolism and calcium hemostasis (8). Other studies have found that glucocorticoid therapy, rheumatoid arthritis, being nondiabetic or pre-diabetic, having a family history of osteoporosis, physical inactivity, and inadequate sun exposure increased the risk of having osteoporosis (9, 10). The risk of osteoporosis was also found to increase by 10% for each 1 year delay in the age of menarche (11). Women who had five or more abortions were found to have significantly lower spine BMD values compared to women who had no abortions or women who had one or two abortions (12).

In postmenopausal women, osteoporosis and osteopenia may be diagnosed based on BMD T scores measured by DXA, with or without the presence of a fragility fracture. Low BMD T scores predict future fractures in postmenopausal women (13). Young women with BMD Z scores below −2.0 should be categorized as having BMD that is “below expected range for age”, and those with Z scores above −2.0 should be categorized as having BMD that is “within the expected range for age” (14).

In the Kingdom of Saudi Arabia (KSA), a study was done in 2007 to determine the prevalence of osteoporosis among Saudi men and found a prevalence of osteopenia for the lumbar spine in the whole group of 35.7% (15). And among Saudi women, osteoporosis is considered as a physiologic process with a prevalence of 23% among Saudi women aged 50–70 years (16,17). A study done in 2019 assessed the association between systemic osteoporosis and periodontal diseases in Saudi postmenopausal women. The study found that osteoporosis was a risk factor for periodontal disease and seems to play a vital role in disease progression (18).

As studies assessing the association between short inter-pregnancy interval and postmenopausal osteoporosis in KSA are limited, this study aimed to assess the association and factors affecting the presence of osteoporosis among a sample of postmenopausal Saudi women, Taif city.

Methods

Study design and time frame: a case-control study was done between June 2019 to June 2020.

Study setting and participants: The inclusion criteria were Saudi and non-Saudi postmenopausal females living in the Taif city who came to ortho clinics already diagnosed with PMOP or who had DEXA scan report, and the excluding criteria were pre-menopausal females, nullipara postmenopausal women, males, not diagnosed PMOP, patients who are non-residents of the western region, and those who did not do DEXA scan. Data collection: the study was based on a pre-designed survey, then the questions were asked in an interview with postmenopausal females who visited ortho clinics. The questionnaire included a first part with items tomcollect demographic data; height, weight, education level, sports practice, previous bone fracture, and smoking. The second part included items on medications used, breastfeeding, interpregnancy intervals, age at menarche, age at menopause, age at first baby, number of deliveries, number of breastfeeding, T-score and Z- score. According to the participants’ responses to the questionnaire, they were classified into two groups, according to the presence of osteoporosis, as cases and controls.

Ethical consideration: Ethical approval was obtained from the deanship of Saudi females’ affairs before starting the work. During the research activities, each studied subject was informed about the study objectives stressing on the confidentiality of collected data and getting verbal and written consent from the subject to participate in the study.

Statistical analysis: Data were coded, tabulated and analyzed using (SPSS) version 25. Qualitative data were expressed as numbers and percentages, and Chi-squared test ($\chi 2$) was applied to test the relationship between variables. Quantitative data were expressed as mean and standard deviation (Mean ± SD), where Mann-Whitney was applied to test the relationship between variables. A P-value of <0.05 was considered as statistically significant.

Results

Sixty-two (62) postmenopausal women involved in our study, (96.8%) of the participants, were of Saudi nationality, 88.9% were from Taif city, 55.6% were illiterate, and 57.1% were satisfied with housework without practicing any exercises. Of the participants, 47.6% were obese, 22.2% had a previous bone fracture, and 3.2% were current smokers smoking one packet of cigarettes daily [Table 1].

Table 2 shows that 28.6% of the participants were taking Vitamin D and calcium, 93.7% had previous breastfeeding, and 50.8% had an inter-pregnancy interval of less than one year. The mean age, BMI, age at menarche, age at menopause, age at first baby, number of deliveries, number of breastfeeding, T-score and Z- score were 59.17 ± 8.1 years, 30.27 ± 4.82kg/m2, 13.11± 1.73 years, 50.17 ± 4.47 years, 20.85 ± 4.93 years, 7.42 ± 3.34 times, 1.67 ± 0.51 times, - 1.67 ± 172 and -0.94 ± 1.2 respectively. Figure 1 shows that 63.5% of the participants (cases) were diagnosed with osteoporosis, and 22% had a family history of it (Figure 2).

Table 3 illustrates that a non-significant relationship was found between the cases and controls according to their characteristics, sports practice, BMI categories, previous bone fracture and smoking and family history of osteoporosis (P> 0.05). In contrast, participants who had at least one interpregnancy interval of less than one year had a significant higher percentage of those belonging to cases (P<0.05) Figure 3.

Table 4 illustrates that cases had a significantly higher mean number of inter-pregnancy interval less than one-year, lower T-score and lower Z- score compared to controls (P=<0.05). On the other hand, a non-significant relationship was found between cases and controls according to their age, BMI, age at menarche, age at menopause, age at first baby, number of deliveries, number of breastfeeding, and number of medications used (P> 0.05).

Discussion

The present study found that postmenopausal females with osteoporosis (cases) had a significantly higher mean number of inter-pregnancy intervals (IPI) less than one year compared to the postmenopausal females without osteoporosis (controls). The association of IPI and postmenopausal osteoporosis has been observed before in two studies. One of those was done in 2015 and showed that IPI was lower in cases with osteoporosis in comparison to the controls group,(19) remarking that women who had 0–12 months interpregnancy interval have the highest risk for osteoporosis. The other study was done in 2019 and showed that increased IPI decreases the risk of osteoporosis (20). The previous study (20) also found that frequent births throughout the whole reproductive age and having more than one child in adolescence has an adverse effect on postmenopausal bone mineral densities.

Previous studies showed a decrease in bone mineral density and trabecular thickness due to pregnancy and lactation (21,22). A study was done in 2014 and showed an association between long periods of breastfeeding and vertebral fractures, supporting a role for lengthy lactation as a risk factor for osteoporotic fractures after menopause (23). Another one was done in 2016 and showed that prolonged breastfeeding was significantly associated with low BMD in the lumbar spine (24).

Bone mass loss associated with pregnancy and lactation is usually regained in the postpartum period. However, it is unknown whether the bone loss is completely recovered in women with shortened interpregnancy interval (IPI) (19).

In our study, a non-significant relationship was found between the cases and controls according to their BMI categories and smoking. This finding is in agreement with that revealed from a study done in Jorden (25). In contrast, other studies found that smoking was considered a significant factor (26,27). In addition, other studies revealed that women with low BMI are at increased risk of osteoporosis (28). Another study done in Brazil found that obese women had a lower prevalence of osteoporosis compared with those having normal weight and overweight women (29).

In our study, a non-significant relationship was found between the cases and controls according to the presence of a family history of osteoporosis. Many studies showed the opposite where a positive family history of osteoporosis in close relatives was significantly an independent risk factor for osteoporosis development (30,31).

In the present work, the same non-significant relationship was found between the cases and controls according to the age at menarche, age at menopause. Previous studies have found that osteoporosis was more prevalent among women having their menarche after the age of 13 years (30). This was explained by the fact that some women may forget or did not accurately recall the exact date of their menarche. (25,26). Other studies found that early loss of the menstrual cycle before 50 years was not a significant factor for osteoporosis in postmenopausal women (25).

Our study also revealed a non-significant relationship between the cases and controls according to the number of breastfeeding. The same result was observed in a study conducted on Chinese women in 2019 (32). This study found that breastfeeding and its duration was not associated with postmenopausal osteoporosis (32).

Also, a non-significant relationship was found between cases and controls according to sports practice, previous bone fracture, age at first baby, number of deliveries, and number of medications used. Previous studies found different results, where breastfeeding was significantly associated with low bone mineral density (BDM) and high risk of postmenopausal osteoporosis (PMOP) (24,33,34). Furthermore, an Italian study found that long periods of breastfeeding significantly increased the risk of osteoporotic fracture after menopause (23).

A strength of the present study is that research assessing the association between short IPI and postmenopausal osteoporosis in KSA is scarce and this study will help to understand this association that was proved in international studies with different populations.

Table 1. Distribution of the participants according to their characters, sports practice, BMI categories, previous bone fracture and smoking

Variable	
Nationality	
Saudi	61 (96.8)
Non-Saudi	2(3.2)
City	
Taif	56 (88.9)
Makkah	7 (11.1)
Education	
Illiterate	35 (55.6)
Educated	28 (44.4)
Number of practicing walking or any sport/ week	
Bed ridden	6 (9.5)
I am satisfied with housework	36 (57.1)
< 3 times	14 (22.2)
≥ 3 times	7 (11.1)
BMI categories	
Underweight	1 (1.6)
Normal weight	9 (14.3)
Overweight	23 (36.5)
Obese	30 (47.6)
Previous bone fracture	
Yes	14 (22.2)
No	49 (77.8)
If yes, what was its site?	
hand	5 (7.9)
hip	4 (6.3)
leg	5 (7.9)
Current smoking	
Yes	2 (3.2)
No	61 (96.8)
Number of daily cigarette packets	
A packet/ day	2 (3.2)
Smoking duration	
10 years	1 (1.6)
20 years	1 (1.6)
Smoking duration (years)	15 ± 7

Table 2. Distribution of the participants according to medications used, breast feedings, interpregnancy intervals, age, BMI, age at menarche, age at menopause, age at first baby, number of deliveries, number of breast feedings, T-score and Z- score

Variable	No. (%)
Medication used	
DM medications	3(4.8)
NSAID and medication for HTN	1 (1.6)
Chemotherapy	1 (1.6)
Thyroid medications	1 (1.6)
Vitamin D	6 (9.5)
Vitamin D and calcium	18 (28.6)
Corticosteroid	2 (3.2)
Corticosteroid and Vitamin D	3 (4.8)
Corticosteroid and Vitamin D and calcium	4 (6.3)
Corticosteroid and DM medications	3 (4.8)
Heparin and DM medications	2 (3.2)
Heparin and Thyroid medications	1 (1.6)
Heparin and HTN medications	7 (11.1)
No medication taken	11 (17.5)
Number of medications used	1.67 ± 0.51
Previous breast feeding	
Yes	59 (93.7)
No	4 (6.3)
Number of breast feedings	6.22 ± 3.05
Inter-pregnancy interval less than one year	
Yes	32 (50.8)
No	31 (49.2)
Number of inter-pregnancy interval less than one year	3.25 ± 2.09
(Mean ±SD)	
Age	59.17 ± 8.1
BMI	30.27 ± 4.82
Age at menarche	13.11± 1.73
age at menopause	50.17 ± 4.47
Age at first baby	20.85 ± 4.93
Number of deliveries	7.42 ± 3.34
Number of breast feedings	1.67 ± 0.51
T-score	- 1.67 ± 172
Z- score	-0.94 ± 1.2

Figure 1. Percentage distribution of the participants according to being diagnosed with osteoporosis

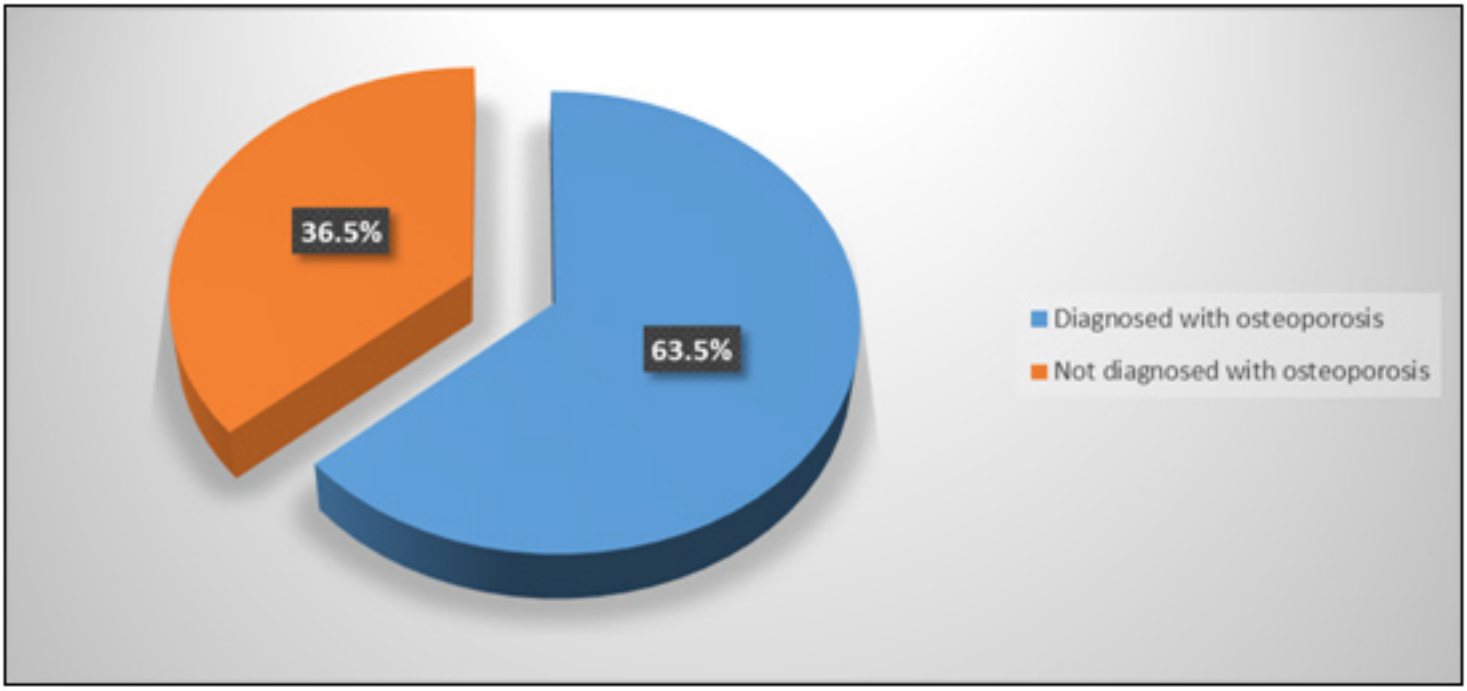


Figure 2. Percentage distribution of the participants according to family history of osteoporosis

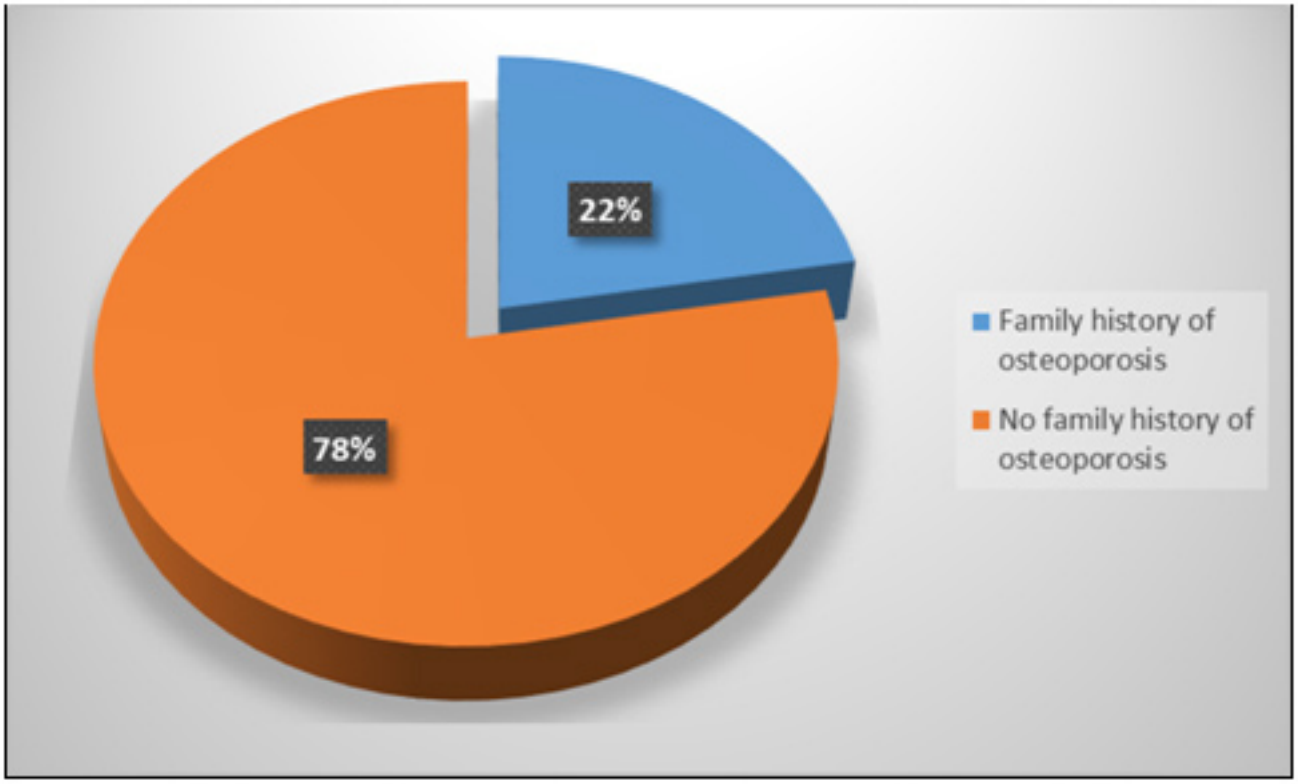
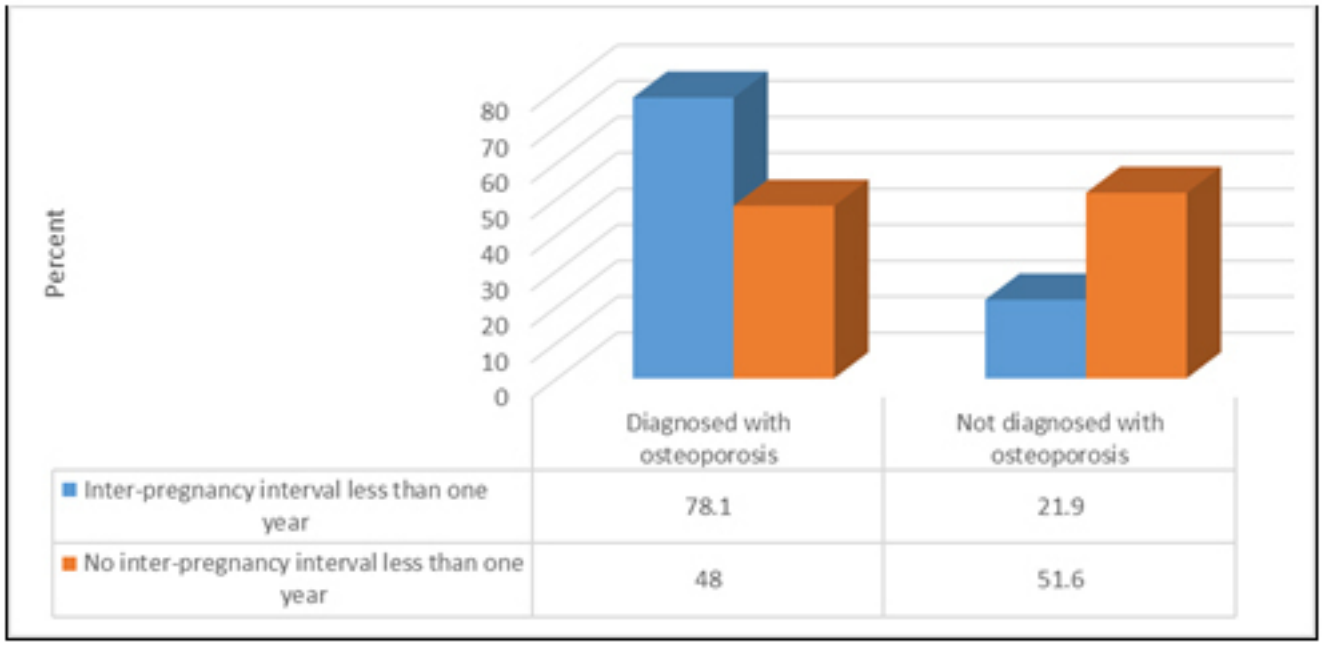


Table 3. Relationship between tosteoporosis and participants' characteristics, sports practice, BMI categories, previous bone fracture and smoking and family history of osteoporosis

Variable	Cases No. (%)	controls No. (%)	χ2	p-value
Nationality				
Saudi	69 (63.9)	22 (36.1)	0.16	0.68
Non-Saudi	1 (50)	1 (50)		
City				
Taif	35 (62.5)	21 (37.5)	0.21	0.64
Makkah	5 (71.4)	2 (26.6)		
Education				
Illiterate	19 (54.3)	16 (75.7)	2.99	0.09
educated	21 (75)	7 (25)		
Number of practicing walking or any sport/ week				
Bed ridden	4 (66.7)	2 (33.3)	0.46	0.92
I am satisfied with housework	23 (63.9)	13 (36.1)		
< 3 times	8 (57.1)	6 (42.9)		
≥ 3 times	5 (71.4)	2 (28.6)		
BMI categories				
Underweight	1 (100)	0 (0.0)	2	0.57
Normal weight	7 (77.8)	2 (22.2)		
Overweight	15 (65.2)	8 (34.8)		
obese	17 (56.7)	13 (43.3)		
Previous bone fracture				
Yes	9 (64.3)	5 (35.7)	0.005	0.94
No	31 (63.3)	18 (36.7)		
Current smoking				
Yes	1 (50)	1 (50)	0.16	0.68
No	39 (63.9)	22 (36.1)		
Previous breast feeding				
Yes	37 (62.7)	22 (37.3)	0.24	0.62
No	3 (75)	1 (25)		
Family history of osteoporosis				
Yes	9 (64.3)	5 (35.7)	0.005	0.94
No	31 (63.3)	18 (36.7)		

Figure 3. Relationship between the cases and controls and the presence of interpregnancy interval less than one year



N.B.: ($\chi 2=6$, p-value=0.01)

Table 4. Relationship between osteoporosis and participants' age, BMI, age at menarche, age at menopause, age at first baby, number of deliveries, number of interpregnancy intervals less than one year, number of breast feedings, number of medications used, T-score and Z- score

Variable	Cases	controls	Test	P-value
	No. (%)	No. (%)		
Age	58.35 ±6.7	58.87 ±10.26	0.86*	0.381
BMI	29.5 ±4.86	31.62 ±4.54	1.7**	0.09
Age at menarche	13 ±1.3	13.3±2.32	0.19*	0.48
Age at menopause	50.93±3.6	48.87 ±5.53	1.65*	0.09
Age at first baby	21.37 ±4.77	19.95 ±5.19	1.15*	0.24
Number of deliveries	7.3 ±3.49	7.65 ±3.12	0.5*	0.61
Number of inter-pregnancy interval less than one year	3.65 ±1.49	2 ±0.53	2.71*	**0.007**
Number of breast feedings	6.08 ±3.26	6.45 ±2.72	0.47*	0.631
Number of medications used	1.6 ±0.55	1.78 ±0.41	1.34*	0.17
T-score	-2.26 ±1.65	-1.36 ±1.71	2.31*	**0.02**
Z- score	-1.56 ±0.67	-0.6 ±1.27	2.39*	**0.01**

N.B.: *Mann-Whitney test **Independent sample t-test

Limitations

The main limitation of this study is the national lockdown due to COVID-19 pandemic that affect the data collection and the sample size.

Conclusions

Participants with at least one interpregnancy interval less than one year had a significantly higher percentage of those belonging to cases. In addition, cases had a significant higher mean number of inter-pregnancy intervals less < one-year, lower T-score and lower Z- score compared to controls. A non-significant relationship was found between the cases and controls according to sports practice, BMI categories, previous bone fracture and smoking and family history of osteoporosis, age at menarche, age at menopause, age at first baby, number of deliveries, number of breast feedings, and number of medications used. Based on the results of the present study, health education campaigns should be done to educate all women in the reproductive age about the relationship between short IPI on PMOP.

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