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Health-promoting lifestyle and quality of life in affected and unaffected menopausal women by primary osteoporosis

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Abstract:

BACKGROUND: Primary osteoporosis is a common complication of aging and menopause. The negative effects of osteoporosis in the coming years will increase by increasing life expectancy and population aging. The purpose of this research was to compare health-promoting lifestyle and quality of life in postmenopausal women with and without primary osteoporosis.

MATERIALS AND METHODS: This cross-sectional analytical research was conducted on 445 postmenopausal women aged 50–65 selected by simple random sampling in Tabriz health centers from September 2018 to July 2019. Data collection instruments included demographic, midwifery, anthropometric, health-promoting lifestyle profile II and menopausal quality-of-life questionnaire questionnaires, and serum test checklist (25-hydroxy vitamin D, complete blood count/diff, thyroid-stimulating hormone, fasting blood sugar, Calcium, and Phosphor). Dual-energy X-ray absorptiometry method was used to measure bone density. Data were analyzed using SPSS/23 through descriptive and inferential statistics such as Chi-square, independent *t*-test, Mann–Whitney, and multiple regression.

RESULTS: The mean score of lifestyle was 141.2 ± 21.9 in normal and 127.2 ± 25.4 in osteoporosis group, and differences were statistically significant in total score ($P < 0.001$) and all subdomains. The mean score of quality of life was 3.9 ± 1.2 in the normal and 4.5 ± 1.4 in the osteoporotic group. The differences were significant in total score ($P < 0.001$) and all subdomains except for sexual function subdomain ($P = 0.064$). Logistic regression adjusted for confounders indicated by one unit increase in total lifestyle score, the odds of primary osteoporosis reduced by 2.2% (adjusted odds ratio [0.95% confidence interval]: 0.978 [0.963–0.994], $P = 0.006$).

CONCLUSION: To prevent of primary osteoporosis and improve the quality of life of postmenopausal women, it seems that education and implementation of health-promoting lifestyle are essential. The research findings can be used to plan for health care in middle and old ages.

Keywords:

Lifestyle, menopause, primary osteoporosis, quality of life, senile osteoporosis

Introduction

Nowadays, 1 of 3 women over 50 years old (over breast cancer) and 1 of 5 men over 50 years old (over prostate cancer) are affected by osteoporosis.^[1] According to the World Health Organization criteria,

if the T-score is ≥ 1 , it illustrates a normal state; if T-score is between -1 and -2.5 , it illustrates osteopenia; and if t-score is ≤ -2.5 , it illustrates osteoporosis.^[2] It is a disabling condition resulted from bone loss and enhanced risk of bone fractures in osteoporosis, as well as pain and premature

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death.^[3] Increment of age is one of the most significant risk factors for osteoporosis.^[1]

Menopausal osteoporosis is the most common type of osteoporosis that is included in the group of primary osteoporosis. This condition not only enhances the risk of fractures but also affects the survival of postmenopausal women.^[4] Scientific studies have indicated that many lifestyle habits affect osteoporosis in postmenopausal women.^[5] Lifestyle corrections with emphasize on bone health-related habits have been recommended for postmenopausal women and consist of weight control, regular exercise, a well-balanced diet, limiting coffee and alcohol consumption, adequate Vitamin D and calcium intake, and avoiding tobacco use.^[6] Osteoporosis is considered as a lifestyle-related condition in developed countries.^[7]

Osteoporosis also has an adverse impact on the quality of life.^[8,9] This health disorder can have a profound effect on person's social and psychological functioning. Anxiety from living with a chronic disease results in depression, reduced ability to conduct social tasks, decreased independence for doing daily activities, and ultimately, decreased self-esteem and quality of life.^[10] Assessment of health-related quality of life is considered as an remarkable signs of clinical development in persons with osteoporosis and fractures.^[11]

As life expectancy increases, the negative impacts of osteoporosis will significantly increase in future years.^[12] Given that this disease requires planning for screening, treatment, and prevention, and based on a review of studies by the researcher, very few studies have examined the relationship between osteoporosis and health-promoting lifestyle and its subscales, whereas this study was conducted to compare the health-promoting lifestyle and quality of life of postmenopausal women with and without osteoporosis. Conducting this study can be of great help in future planning for the prevention of this disease.

Materials and Methods

Study design and participants

The present observational study was a cross-sectional analytical research that was conducted on 445 postmenopausal women aged 50–65, from September 2018 to July 2019, to compare the health-promoting lifestyle and quality of life in postmenopausal women with and without primary osteoporosis in Tabriz, Iran.

The sample size was considered based on a similar study^[13] using G-Power software; version 3.1.2 (Franz Faul, Universitat Kiel, Germany) by the formula of estimating the difference of two independent means

based on the quality of life variable and the highest standard deviation (SD) in the subdomains of quality of life, $M_1 = 39.50$ (mean score in patients with osteoporosis), $M_2 = 67.85$ (mean score in nonosteoporosis patients), $SD_1 = 79.43$, and $SD_2 = 41.39$. Finally, the sample size was calculated as much as 106 people considering $\alpha = 0.05$ and power = 90%, and the final sample size was as much as 117 people for each group given 10% loss.

$$n = \frac{\left(z_{1-\frac{\alpha}{2}} + z_{1-\beta} \right)^2 (s_1^2 + s_2^2)}{(m_1 - m_2)^2}$$

$$n = \frac{10.5(79.5^2 + 41.4^2)}{28.4^2} = 106$$

General inclusion criteria included menopausal women in a range of 50–65 years old resident of Tabriz without menstruation for at least 12 consecutive months, ability to communicate verbally when answering questions, access to centers, and nonoccurrence of menopause before 40 years old.

Exclusion criteria included bone diseases other than osteoporosis, hereditary diseases (hemophilia, thalassemia, and hemochromatosis) according to the patient's statement, diseases of the internal glands tested and approved by an endocrinologist, digestive, taking medicine affecting bone metabolism, hypocalcemia and Vitamin D <20ng/ml, body mass index (BMI) <18.5, and menopause occurrence before 40 years old.

Sampling

After confirmation of this study by the ethics committee (IR.TBZMED.REC.1397.929) and getting the required permissions, the list and contact number of 850 women in a range of 50–65 years old were selected from 87 health centers of Tabriz city using simple randomized sampling system. Seven hundred and thirty of them were eligible for the study during the telephone interview and after giving a brief description of the research purpose and method. About 194 people were excluded during the in-person checkup and evaluation by the inclusion and exclusion criteria checklist. After explaining the optional participation of individuals in the study, emphasizing the confidentiality of their information and obtaining the signed informed consent form, 10 ml of blood samples was taken from the remaining 536 to perform complete blood count (CBC)/diff, calcium, phosphorus, alkaline phosphatase (ALP), thyroid stimulating hormone (TSH), creatinine (Cr), fasting blood glucose (FBS), and Vitamin D tests to differentiate primary osteoporosis from secondary osteoporosis and then was sent to

the laboratory. Blood samples were analyzed and interpreted by an expert at the Nutrition Research Laboratory, and the final diagnosis of osteoporosis and differentiation of the primary type of secondary was made by an endocrinologist. According to the results of the tests, 74 patients were identified with secondary osteoporosis. Furthermore, 17 people were excluded due to unwillingness to participate. Finally, 445 patients completed demographic, midwifery, anthropometric, lifestyle, and quality-of-life questionnaires [Figure 1]. After the necessary coordination, they were referred to the Bone Density Department of Sina Hospital to bone mineral density (BMD) examination by dual-energy X-ray absorptiometry (DEXA) in total hip area. According to the reports of densitometry tests, 142 people were normal, 109 people were osteoporotic, and 194 people had osteopenia. Total women in the normal and osteoporotic groups were entered to this study.

Possible confounding variables were controlled as follows: a number of variables were excluded as outlined above before entering the study. A number of variables such as age and sex were matched by the researcher based on the selected group or category (50–65 years women). Other socioeconomic variables were assessed through a questionnaire. Then, they were statistically adjusted if there were differences between the two groups.

Measurements

The data collection instruments were a checklist for inclusion and exclusion criteria, demographic, midwifery, and anthropometric characteristic questionnaires, health-promoting lifestyle profile (HPLP-II) and menopausal quality-of-life questionnaire (MENQOL), serum testing checklist (25-hydroxy Vitamin D, CBC/diff, Cr, calcium, phosphorus, FBS, ALP, and TSH), and

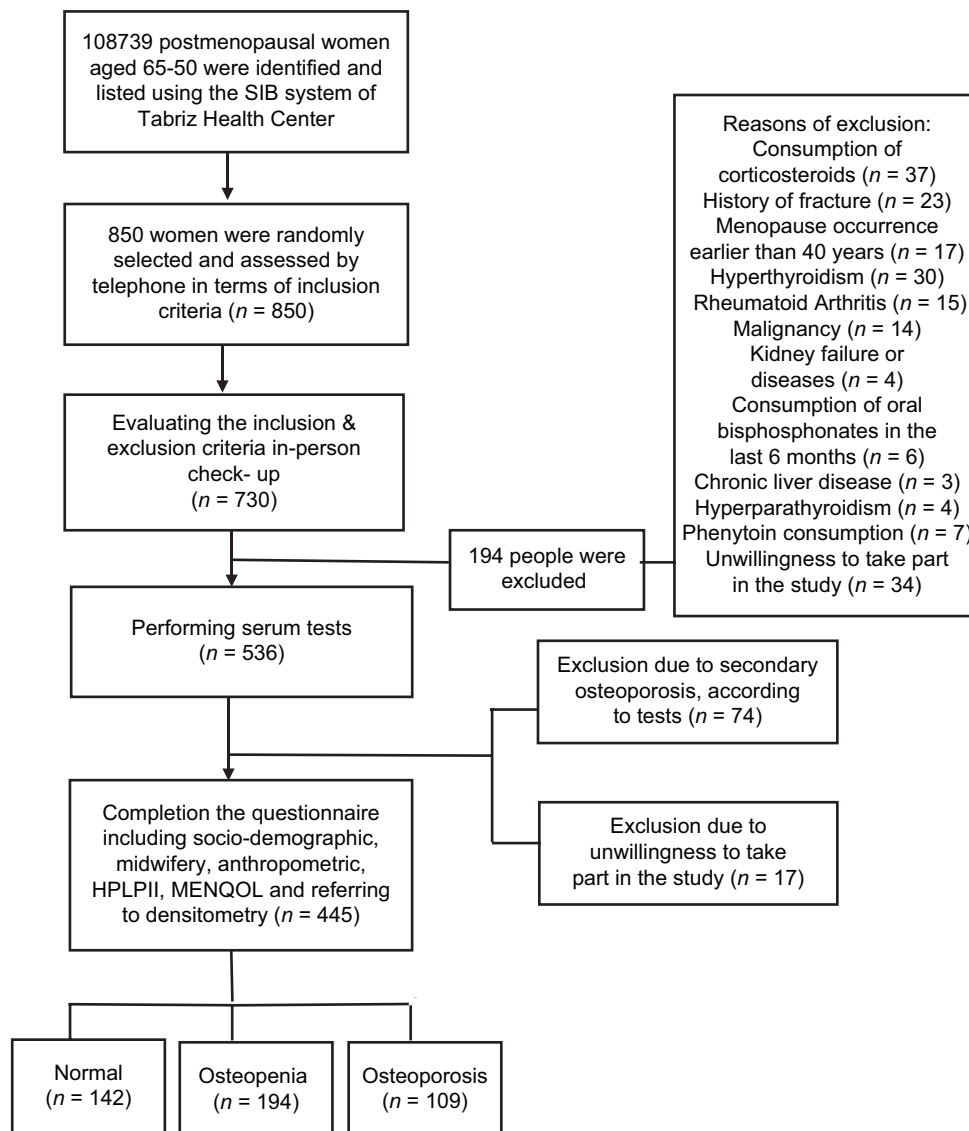


Figure 1: Flowchart of study

DEXA method for measuring the bone density. Content and face validity were used to determine the validity of the demographic, midwifery, and anthropometric questionnaires.

Total hip BMD data were measured by Hologic QDR 4500W (S/N 50266) dual-energy X-ray densitometer in Tabriz hospital.

The MENQOL questionnaire was designed in Toronto, Canada, and has four vasomotor, psychosocial, physical, and sexual subdomains.^[14] The minimum average score is 1 and the maximum is 8. Higher scores indicate poorer quality of life.^[15] The application of this questionnaire is easy and it was developed to apply in a sample of women between 47 and 62 years of age. This useful tool has become a valid and universal measure of quality of life in postmenopausal women's studies.^[16,17] The MENQOL questionnaire has also been used in a descriptive study in Iran.^[18]

In this study, Cronbach's alpha coefficient was as much as 0.890 for the MENQOL questionnaire and the intraclass correlation coefficient (ICC) using 2-week test-retest method on 20 subjects was 0.88 (0.87–0.91). Cronbach's alpha coefficients for each of the vasomotor, psychosocial, physical, and sexual subdomains were as much as 0.790, 0.756, 0.826, and 0.794, respectively.

The HPLP-II questionnaire was designed to investigate health-promoting behaviors.^[19] The health-promoting lifestyle questionnaire contains 52 items in 6 areas of health responsibility, spiritual growth, physical activity, interpersonal relations, nutrition, and stress management. The answers are based on the 4-point Likert scale including never (score 1), sometimes (score 2), often (score 3), and always (score 4). Therefore, the minimum score of this tool is 52 and the maximum score is 208. Higher scores indicate a healthier lifestyle.^[20] This instrument has also been used in Iran.^[21]

In this study, Cronbach's alpha coefficient was as much as 0.924 for HPLP-II questionnaire. The ICC with a 2-week test-retest method on 20 subjects was as much as 0.91 (0.89–0.93). Moreover, the Cronbach's alpha coefficients for each of the subscales of physical activity, nutrition, spiritual growth, interpersonal relationships, stress management, and health responsibility were 0.783, 0.642, 0.804, 0.716, 0.717, and 0.779, respectively.

Data analyses

Data related to questionnaires and densitometry were imported into SPSS Version 23 (IBM SPSS Statistics, IBM Corporation, Chicago, IL) after data collection. The distribution of data was determined by measures of central tendency (skewness, kurtosis, and SD).

Chi-square, independent *t*-test, and Mann–Whitney tests were used for the data analysis. Multiple logistic regression test was used to investigate the relationship between total lifestyle scores and its subdomains with bone density in normal and osteoporotic groups by adjusting for confounding factors. The test was adjusted for possible confounding factors including age, menopausal age, marital status, education level, family income, housing status, (BMI), type of supplementation, and family history of fractures due to osteoporosis. Variables with $P < 0.1$ were entered into the model. The Hosmer–Lemeshow test was used to test the fit of the model.

Results

There were 142 people in the normal group with a mean age of 55.4 ± 3.8 years and 109 people in the osteoporosis group with a mean age of 58.2 ± 3.8 years, and this difference statistically was significant ($P < 0.001$). Moreover, the mean age of menopause was 49.3 ± 3.5 years in the normal group and 48.2 ± 4 years in the osteoporosis group ($P = 0.022$). The majority of married people were in the normal group and the majority of unmarried people were in the osteoporotic group ($P = 0.007$). There was a statistically significant difference between the two groups in terms of housing status, educational level, number of pregnancies, and number of lactation months ($P < 0.01$) so that osteoporotic women were less educated but had more pregnancies and lactation months compared to the normal group. The mean BMI was as much as 31.7 ± 5 in the normal group and 28.4 ± 3.7 in the osteoporosis group ($P < 0.001$). The proportion of normal and overweight people in the osteoporosis group was higher than the normal BMD group. Furthermore, more than half of the females with normal BMD were obese (65.2%), but only 31.8% of women in osteoporosis group were obese. This difference was statistically significant ($P < 0.001$) [Table 1].

The mean of total lifestyle scores was as much as 141.2 ± 21.9 in the normal group and 127.2 ± 25.4 in the osteoporosis group. According to an independent *t*-test, there was a statistically significant difference between total lifestyle scores and all its subdomains in the two groups ($P < 0.05$) [Table 2].

According to skewness, kurtosis, and SD, the scores of total quality of life and all of its subdomains except for sexual function subdomain had normal distribution in both normal and osteoporotic groups. The mean of total scores of quality of life was as much as 3.9 ± 1.2 in the normal group and 4.5 ± 1.4 in the osteoporotic group. According to the independent *t*-test, there was

Table 1: Demographic, midwifery, and anthropometric characteristics of women in normal and osteoporosis groups

Variable	Normal (n=142)	Osteoporosis (n=109)	Sum	P
Age (year), n (%)				
50-55	75 (54.3)	23 (21.5)	98 (40)	<0.001*
56-60	47 (34.1)	53 (49.5)	100 (40.8)	
61-65	16 (11.6)	31 (29)	47 (19.2)	
Mean±SD	55.4±3.8	58.2±3.8	56.6±4	<0.001†
Menopause age (year), mean±SD	49.3±3.5	48.2±4	48.8±3.7	0.022‡
Marital status, n (%)				
Single, widow, divorced	17 (12)	28 (25.7)	45 (17.9)	<0.007‡
Married	125 (88)	81 (74.3)	206 (82.1)	
Job, n (%)				
Housewife	122 (85.9)	100 (91.7)	222 (88)	0.168‡
Employed	20 (14.1)	9 (8.3)	29 (12)	
Family income, n (%)				
Adequate	35 (24.6)	20 (18.5)	55 (22)	0.083§
Relatively adequate	93 (65.5)	70 (64.8)	163 (65.2)	
Inadequate	14 (9.9)	18 (16.7)	32 (12.8)	
House statuses, n (%)				
Private	132 (93.6)	89 (81.7)	221 (88.8)	0.004‡
Rental or relatives house	9 (6.4)	20 (18.4)	28 (11.2)	
Education, n (%)				
Illiterate	25 (17.6)	36 (33)	61 (24.3)	<0.001§
Primary	44 (31)	44 (40.4)	88 (35.2)	
Secondary	23 (16.2)	11 (10.1)	34 (13.5)	
High school-diploma	34 (23.9)	13 (11.9)	47 (18.7)	
Academic	16 (11.3)	5 (4.6)	21 (8.3)	
Gravida, n (%)				
0-2	36 (25.5)	18 (16.5)	54 (21.6)	0.001*
3-4	68 (48.2)	40 (36.7)	108 (43.2)	
≥5	37 (26.2)	51 (46.8)	88 (35.2)	
Mean±SD	3.7±1.9	4.8±2.4	4.2±2.2	<0.001†
Lactation, n (%)				
Yes	128 (94.8)	101 (96.2)	229 (95.4)	0.186‡
No	7 (5.2)	4 (3.8)	11 (4.6)	
Lactation duration (months), mean±SD	53.9±34.4	67.7±40.9	60±38	0.006‡
Supplementation#, n (%)				
Yes	72 (50.7)	44 (40.4)	116 (46.2)	0.125‡
No	70 (49.3)	65 (56.6)	135 (53.8)	
Type of supplement, n (%)				
Vitamin D	31 (43.1)	15 (34.1)	46 (39.7)	0.074*
Calcium	16 (22.2)	12 (27.3)	28 (24.1)	
Vitamin D and calcium	25 (34.7)	17 (38.6)	42 (36.2)	
History of fracture in family due to osteoporosis, n (%)				
Yes	10 (7.1)	15 (13.9)	25 (10.1)	0.091‡
No	130 (92.9)	93 (86.1)	223 (89.9)	
BMI (kg/m ²), mean±SD	31.7±4.9	28.4±3.7	30.3±4.8	<0.001†
BMI classification, n (%)				
Under weight (<18.5)	-	-	-	<0.001*
Normal (18.5-24.99)	10 (7.0)	15 (13.8)	25 (10.1)	
Over weight (25-29.99)	39 (27.5)	60 (55.0)	97 (39.1)	
Obese (≥30)	93 (65.5)	34 (31.2)	126 (50.8)	

*Chi-square, †Independent t-test, ‡Fisher's exact test, §Linear by linear, #Supplements containing Vitamin D and calcium. BMI=Body mass index, SD=Standard deviation

a statistically significant difference between the two groups in the quality of life and all of its subdomains

except sex subdomain ($P < 0.05$). There was no statistically significant difference between the two

groups regarding sexual function according to the Mann–Whitney U-test ($P > 0.05$) [Table 3].

According to the multiple logistic regression test by adjusting for confounding variables, one unit increase in the scores of nutrition (adjusted odds ratio [aOR] [0.95 confidence interval (CI)]: 0.889 [0.811–0.974], $P = 0.012$), spiritual growth (aOR [0.95 CI]: 0.927 [0.870–0.987], $P = 0.018$), interpersonal relations (aOR [0.95 CI]: 0.908 [0.848–0.972], $P = 0.006$), and health responsibility subdomains (aOR [0.95 CI]: 0.922 [0.865–0.982], $P = 0.012$) caused 11.1%, 7.3%, 9.2%, and 7.8% reduction, respectively, in the odds of osteoporosis development. However, there was no significant relationship between physical activity and stress management with osteoporosis ($P > 0.05$). Finally, one unit increase in the overall lifestyle score caused 2.2% reduction of developing osteoporosis (aOR [0.95 CI]: 0.978 [0.963–0.994], $P = 0.006$) [Table 4].

Discussion

In this study, there was a statistically significant difference between normal and osteoporotic groups in terms of total lifestyle score and all its subscales ($P < 0.05$) so that by one unit increase in total lifestyle score, the odds of primary osteoporosis reduced 2.2%. In the following, the results are discussed based on each of the six subdomains of health-promoting lifestyle.

1. Nutrition: Healthy nutrition is one of the several important components of lifestyle to maintain good bone health, but it is difficult to perceive the

- importance of healthy nutrition because its effects are subtle over long time periods.^[22] Although studies linking nutrition and bone mass focus more on calcium and Vitamin D, other nutrients such as magnesium, fluoride, and zinc are also important because of their specific role in bone composition.^[23] In this regard, the results of our study also showed that the women of normal group had healthier nutrition than those in osteoporosis group
2. Physical activity: Consistent with the results of the present study, the findings of one review study suggest that physical activity in postmenopausal women can prevent or even improve bone mass reduction, so women should consider exercise as a part of their daily routine^[24]
 3. Stress management: Although mental stress and osteoporosis occur through different mechanisms in the body, numerous studies suggest that there are many potential ways of linking the pathological response to stress and the development of bone disease. These pathways can include impairment of the hypothalamic–pituitary–adrenal axis; dysregulation of the inflammatory pathway, Insulin-like growth factor signaling, estrogen, serotonin, and gamma-aminobutyric acid.^[25] Therefore, stress management is particularly important for the elderly to improve their health promotion performance. Consistent with the results of this study, in another study, the results indicate a relationship between psychological stress and low BMD in postmenopausal women^[26]
 4. Interpersonal relations: It refers to the individual's status in terms of establishing and maintaining

Table 2: Comparison of health-promoting lifestyle scores and its subscales in postmenopausal women in the normal and osteoporosis groups

Subdomains of HPLP-II	Scores range	Mean±SD		P*
		Normal (n=142)	Osteoporosis (n=109)	
Nutrition	9-36	27.8±3.8	26 (4.5)	0.001
Spiritual growth	9-36	26±4.9	23.2 (6.2)	<0.001
Physical activity	8-32	15.8±5	14.3 (5)	0.022
Interpersonal relations	9-36	27.4±4.7	24.6 (5.4)	<0.001
Stress management	8-32	21.1±4.8	19.2 (5.1)	0.002
Self-health responsibility	9-36	23.2±5.9	20 (5.1)	<0.001
Total HPLP-II	52-208	141.2±21.9	127.2 (25.4)	<0.001

*Independent t-test. HPLP-II=Health-promoting lifestyle profile, SD=Standard deviation

Table 3: Comparison of menopause-related quality of life scores and its subscales in postmenopausal women in the normal and osteoporosis groups

Subdomains of MENQOL	Scores range	Normal (n=142)		Osteoporosis (n=109)		P
		Mean±SD	Median (Q25-Q75)	Mean±SD	Median (Q25-Q75)	
Vasomotor	1-8	4.4±2.1	4.3 (2.6-6)	5.3±2.1	5.7 (3.8-7)	0.001*
Psychosocial	1-8	3.6±1.5	3.4 (2.4-4.6)	4.2±1.7	4.3 (2.9-5.7)	0.004*
Physical	1-8	3.8±1.1	3.7 (4.6-3.1)	4.1±1.3	4.1 (3.2-5)	0.028*
Sexual	1-8	3.9±2.3	3.7 (1.3-5.8)	4.5±2.5	4.3 (2.3-6.7)	0.064†
Total MENQOL	1-8	3.9±1.2	3.9 (3-4.8)	4.5±1.4	4.4 (3.3-5.8)	<0.001*

*Independent t-test, †Mann-Whitney U. MENQOL=Menopause-specific quality of life, SD=Standard deviation

Table 4: Multiple logistic regression test to compare health-promoting lifestyle scores and its subdomains in postmenopausal women of normal and osteoporosis groups

Subdomains of HPLP-II	aOR (95% CI)	P*
Nutrition	0.889 (0.811-0.974)	0.012
Spiritual growth	0.927 (0.870-0.987)	0.018
Physical activity	0.975 (0.906-1.048)	0.492
Interpersonal relations	0.908 (0.848-0.972)	0.006
Stress management	0.936 (0.874-1.002)	0.056
Self-health responsibility	0.922 (0.865-0.982)	0.012
Total HPLP-II	0.978 (0.963-0.994)	0.006

*Multiple logistic regression adjusted for age, menopause age, marital status, education, family income, house status, BMI, type of supplement and history of fracture in family due to osteoporosis. Hosmer-Lemeshow test: $\chi^2=5.263$, $df=8$, $P=0.729$. OR=Odds ratio, aOR=Adjusted OR, BMI=Body mass index, HPLP-II=Health-promoting lifestyle profile II, CI=Confidence interval

relationships that provide social support and intimacy. This aspect is considered a strong predictor of quality of life.^[27] Consistent with the results of the present research, other studies also found that poor quality of social relationships in postmenopausal women may be correlated with decreased bone mass in them^[10,26]

5. Self-health responsibility: Personal responsibility for one's health and well-being and reduced risk of disease can increase the chance of living longer and healthier.^[28] Therefore, health responsibility is important for the health promotion of individuals
6. Spiritual growth: This is an important aspect of human health. Consistent with the result of our research, another study also supports the beneficial effect of spirituality on elderly people's health.^[29]

In contrast to the present study, one other study did not show a statistically significant difference between the normal and osteoporotic groups in the overall lifestyle score.^[10] The possible reason for the inconsistency of the results can be attributed to the quantitative ultrasonic bone density method in the Tsuboi study, which is different from the standard gold standardized bone density assay (DEXA) used in the present study.

The difference between normal and osteoporotic groups in terms of total lifestyle score and all its subscales was significant again even after adjustment based on age, menopausal age, marital status, education level, family income, house status, BMI, type of supplementation, and family history of fracture due to osteoporosis. Furthermore, in Tsuboi study after adjustment of the variables such as age, BMI, smoking, and the presence of hypertension and diabetes in their study, a statistically significant difference was found that was consistent with the results of our study after adjustment.^[10]

In this study, there was a statistically significant difference between normal and osteoporotic groups in terms of total

score of quality of life and all of its subscales ($P < 0.05$), except for sexual function subscale ($P > 0.05$), which indicates that the osteoporotic group had a poorer quality of life than the normal group. In the following, the results are discussed based on each of four subdomains of menopausal quality of life.

1. Vasomotor: According to the reports that are consistent with our results, postmenopausal women with osteoporosis have higher vasomotor symptoms than nonosteoporotic women. It has been shown that adrenergic activity of the sympathetic nervous system is a negative regulator of bone mass. Adrenergic signaling suppresses osteoblast reproduction and bone growth^[30]
2. Physical: Consistent with the results of the present research, the other research showed that osteoporosis and bone fracture have a profound effect on individuals' physical activity and daily activity, and this effect occurs through a cumulative impairment cycle. This cycle involves avoiding activity, reducing muscle mass, and decreasing motor capacity, which leads to a greater risk of fracture and a greater reduction in physical activity.^[31]
3. Psychosocial: The results of a systematic review^[32] showed that bone mass reduction is associated with depressive symptoms in postmenopausal women and we also achieved this result
4. Sexual: There was no statistically significant difference between the two groups regarding sexual function. It is noteworthy that in the present study, the percentage of respondents to the sexual function questions of the questionnaire was lower than other subdomains (about 90% in the normal group and about 76% in the osteoporosis group), and this may be due to separation or death of spouse, being single, unwillingness to answer such questions for cultural reasons, and lack of acceptance by participants. MENQOL questionnaire has been adapted with the Iranian language and culture. In this study, it was recommended to revise and even remove the sexual activity item in the Persian version of the quality-of-life questionnaire.^[15]

The negative impact of osteoporosis on quality of life has been shown in several studies in line with the results of the present study.^[13,33-35] However, other researchers found no statistically significant difference in any of the subdomains of quality of life and its total score between the two groups.^[36] This inconsistency of the results may be attributed to the comparison of quality of life in the two groups of osteoporosis and osteopenia (not normal) in their study.

In another study, this inconsistency is attributed to the lower sample size in each group (compared to the present study) and thus to less power of study.^[37]

Strengths of the study include high sample size, selection of individuals from different socioeconomic levels to increase the generalizability of results, use of random sampling to prevent bias in selection, and exclusion of patients with secondary osteoporosis from the study due to the lack of relationship between this type of osteoporosis and lifestyle.

According to our search in scientific databases, no previous study has been done to study all aspects of lifestyle as well as quality of life in osteoporotic postmenopausal women who have been randomly selected from all different parts of the city.

One of the limitations of this study is the inability of matching the groups in terms of age and BMI due to budget constraints, as well as the age limitation of 50–65 years for participants and the inability to examine postmenopausal women over 65 years old.

Conclusion

To prevent of primary osteoporosis and improve the quality of life of postmenopausal women, it seems that education and implementation of health-promoting lifestyle in the form of community-based care are essential. The research findings can be used to plan for health care in middle and old age, as well as to estimate the cost-effectiveness of health-care policies in the elderly. Further studies are recommended to examine women over 50 years old without age restriction or wider age range, as well as matching of groups in terms of important factors affecting osteoporosis such as age and BMI.

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Conflicts of interest

There are no conflicts of interest.

References

1. Foundation Io. Bone Health Organization around the Globe Mark World Osteoporosis Day. Available from: <https://www.iofbonehealth.org>. [Last accessed on 2018 Apr 12].
2. Bartl R. Epidemiology of Osteoporosis. 1st ed. Switzerland: Springer; 2017. p. 105-8.
3. Jakobsen A, Laurberg P, Vestergaard P, Andersen S. Clinical risk factors for osteoporosis are common among elderly people in Nuuk, Greenland. *Int J Circumpolar Health* 2013;72:19596.
4. Oka R, Ohira M, Suzuki S, Yoshida T, Koide H, Tanaka T, et al. Fracture risk assessment tool (FRAX) and for the diagnosis of osteoporosis in Japanese middle-aged and elderly women: Chiba bone survey. *J Endocr Soc* 2017;65:193-202.
5. Huitrón-Bravo G, Denova-Gutiérrez E, Talavera JO, Moran-Villota C, Tamayo J, Omaña-Covarrubias A, et al. Levels of serum estradiol and lifestyle factors related with bone mineral density in premenopausal Mexican women: A cross-sectional analysis. *BMC Musculoskelet Disord* 2016;17:437.
6. Oh EG, Yoo JY, Lee JE, Hyun SS, Ko IS, Chu SH. Effects of a three-month therapeutic lifestyle modification program to improve bone health in postmenopausal Korean women in a rural community: A randomized controlled trial. *Res Nurs Health* 2014;37:292-301.
7. Sotorník I. Osteoporosis – Epidemiology and pathogenesis. *Vnitr Lek* 2016;62 Suppl 6:84-7.
8. Urushihara H, Yoh K, Hamaya E, Taketsuna M, Tanaka K. Responsiveness of the Japanese osteoporosis quality of life questionnaire in women with postmenopausal osteoporosis. *Health Qual Life Outcomes* 2014;12:178.
9. Orimo H, Nakamura T, Hosoi T, Iki M, Uenishi K, Endo N, et al. Japanese 2011 guidelines for prevention and treatment of osteoporosis—executive summary. *Arch Osteoporos* 2012;7:3-20.
10. Tsuboi S, Hayakawa T, Kanda H, Fukushima T. The relationship between clustering health-promoting components of lifestyle and bone status among middle-aged women in a general population. *Environ Health Prev Med* 2009;14:292-8.
11. Madureira MM, Ciconelli RM, Pereira RM. Quality of life measurements in patients with osteoporosis and fractures. *Clinics (Sao Paulo)* 2012;67:1315-20.
12. Mehrabadi FE, Pakgozar M, Asadi S, Haghani H. Lifestyle of elderly people with osteoporosis and its related factors. *Iran J Ageing* 2017;12:132-45.
13. Shahmirzadi SE, Shojaeizadeh D, Azam K, Tol A. A survey on quality of life in the elderly with osteoporosis. *J Health Syst Res* 2013;8:1180-9.
14. Hilditch JR, Lewis J, Peter A, van Maris B, Ross A, Franssen E, et al. A menopause-specific quality of life questionnaire: Development and psychometric properties. *Maturitas* 1996;24:161-75.
15. Yazdkhasti M, Keshavarz M, Merghati KE, Hosseini F. The effect of structured educational program by supportgroup on menopause women's quality of life. *Iran J Med Educ* 2012;8:986-94.
16. Hilditch JR, Lewis JE, Ross AH, Peter A, van Maris B, Franssen E, et al. A comparison of the effects of oral conjugated equine estrogen and trans-dermal estradiol-17/I combined with an oral progestin on the quality of life in postmenopausal women. *Maturitas* 1996;24:177-84.
17. Kulasingam S, Moineddin R, Lewis JE, Tierney MC. The validity of the menopause specific quality of life questionnaire in older women. *Maturitas* 2008;60:239-43.
18. Ghazanfarpour M, Kaviani M, Rezaiee M, Ghaderi E, Zandvakili F. Cross cultural adaptation of the menopause specific questionnaire into the persian language. *Ann Med Health Sci Res* 2014;4:325-9.
19. Walker SN, Sechrist KR, Pender NJ. The health-promoting lifestyle profile: Development and psychometric characteristics. *Nurs Res* 1987;36:76-81.
20. Alzahrani SH, Malik AA, Bashawri J, Shaheen SA, Shaheen MM, Alsaib AA, et al. Health-promoting lifestyle profile and associated factors among medical students in a Saudi university. *SAGE Open Med* 2019;7:2050312119838426.
21. Tanjani PT, Azadbakht M, Garmaroudi G, Sahaf R, Fekrizadeh Z. Validity and reliability of health promoting lifestyle profile II in the Iranian elderly. *Int J Prev Med* 2016;7:74.
22. Weaver CM. Nutrition and bone health. *Oral Dis* 2017;23:412-5.

23. Ishimi Y. Osteoporosis and lifestyle. *J Nutr Sci Vitaminol (Tokyo)* 2015;61 Suppl: S139-41.
24. Segev D, Hellerstein D, Dunsky A. Physical activity-does it really increase bone density in postmenopausal women? A review of articles published between 2001-2016. *Curr Aging Sci* 2018;11:4-9.
25. Kelly RR, McDonald LT, Jensen NR, Sidles SJ, LaRue AC. Impacts of psychological stress on osteoporosis: Clinical implications and treatment interactions. *Front Psychiatry* 2019;10:200.
26. Follis SL, Bea J, Klimentidis Y, Hu C, Crandall CJ, Garcia DO, *et al.* Psychosocial stress and bone loss among postmenopausal women: Results from the Women's Health Initiative. *J Epidemiol Community Health* 2019;73:888-92.
27. Tol A, Tavassoli E, Shariferad GR, Shojaezadeh D. Health-promoting lifestyle and quality of life among undergraduate students at school of health, Isfahan University of medical sciences. *J Educ Health Promot* 2013;2:11.
28. Aung KT, Win CM, Maw HA. Health promoting behaviour of the elderly in Myanmar. *Sch J Applied Med Sci* 2017;5:131-8.
29. Rahimi A, Anoosheh M, Ahmadi F, Foroughan M. Exploring spirituality in Iranian healthy elderly people: A qualitative content analysis. *Iran J Nurs Midwifery Res* 2013;18:163-70.
30. Eimar H, Tamimi I, Murshed M, Tamimi F. Cholinergic regulation of bone. *J Musculoskelet Neuronal Interact* 2013;13:124-32.
31. Kerr C, Bottomley C, Shingler S, Giangregorio L, de Freitas HM, Patel C, *et al.* The importance of physical function to people with osteoporosis. *Osteoporosis Int* 2017;28:1597-607.
32. Mollard E, Bilek L, Waltman N. Emerging evidence on the link between depressive symptoms and bone loss in postmenopausal women. *Int J Womens Health* 2018;10:1-9.
33. Ciubean AD, Ungur RA, Irsay L, Ciortea VM, Borda IM, Onac I, *et al.* Health-related quality of life in Romanian postmenopausal women with osteoporosis and fragility fractures. *Clin Interv Aging* 2018;13:2465-72.
34. Mohammadbeigi A, Hassanzadeh J, Mohammadsalehi N, Nasimi B, Ranjbar-Omrani G. Impacts of osteoporosis on quality of life in elderly women. *Chronic Dis J* 2013;1:13-7.
35. Miyakoshi N, Kudo D, Hongo M, Kasukawa Y, Ishikawa Y, Shimada Y. Comparison of spinal alignment, muscular strength, and quality of life between women with postmenopausal osteoporosis and healthy volunteers. *Osteoporos Int* 2017;28:3153-60.
36. Dogu B, Sirzai H, Usen A, Yilmaz F, Kuran B. Comparison of body composition, nutritional status, functional status, and quality of life between osteoporotic and osteopenic postmenopausal women. *Medicina (Kaunas)* 2015;51:173-9.
37. Dallanezi G, Nahas EA, Freire BF, Nahas-Neto J, Corrente JE, Mazeto GM. Quality of life of women with low bone mass in postmenopause. *Rev Bras Ginecol Obstet* 2011;33:133-8.