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The association between osteoporosis and quality of life among older adults in Southern Iran: findings from the Bushehr Elderly Health Program

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Abstract

Background & objective Osteoporosis is a growing public health concern, particularly among the aging population. This study aimed to evaluate the association between osteoporosis and quality of life (QoL) in a sample of older adults.

Methods This cross-sectional study utilized data from all the participants of Bushehr Elderly Health program (BEHP), phase 2. QoL was assessed using the 12-Item Short Form Survey (SF-12 Questionnaire), and participants were classified as having osteoporosis or not based on the WHO diagnostic criteria. The physical (PCS) and mental (MCS) component summaries of QoL were estimated. The association between osteoporosis and QoL was evaluated separately for men and women, considering various health and lifestyle factors using linear regression analysis.

Results The study included 2,399 participants (average age 71.27 ± 7.36 years). 1,246 were women and 1,153 were men. Osteoporosis was present in 59% of women and 23% of men. Participants with osteoporosis had significantly lower PCS scores compared to those without osteoporosis (women: 38.1 vs. 40.2, $p < 0.001$; men: 44.3 vs. 45.8, p: 0.002). However, there was no statistically significant difference in MCS scores. Stratified by sex, osteoporosis was significantly associated with PCS in women [β = -2.14 (-3.13, -1.15)] and men [β = -1.53 (-2.52, -0.54)]. After accounting for relevant variables, the association remained significant in women [β=-0.95 (-1.87, -0.03)], but not in men [β=-0.63 (-1.55,0.28)].

Conclusion This study highlights the significant association between osteoporosis and the physical component of QoL in both older men and women, particularly among women. Further research and interventions focusing on enhancing physical QoL in individuals with osteoporosis are warranted to promote healthier aging.

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Keywords Osteoporosis, Bone mineral density, Quality of life, Elderly

Introduction

Osteoporosis, characterized by low bone mass, bone tissue deterioration, and disrupted bone microarchitecture, weakens bones and heightens fracture risk [1]. Often asymptomatic until fractures occur, it can lead to severe health complications and mortality. The prevalence of osteoporosis rises with aging populations and increased life expectancy [2], with global rates around 18% (23% in women, 12% in men) [3] and even higher prevalence in Iran among those aged 50 and above (38% in women, 25% in men) [4]. This condition can significantly impact an individual Quality of Life (QoL) which encompasses multiple dimensions, including physical, psychological, emotional, and social aspects [5]. Maintaining a high QoL is crucial as it influences overall health, happiness, and the ability to perform daily activities [6]. The elderly often experience a lower QoL due to various health problems and environmental factors that significantly impact their lives [7]. Compared to younger individuals, the elderly may experience feelings of concern and anxiety. The consequences of unforeseen negative events in the life of the elderly may lead to manifestations of depression, social isolation, reduced participation in leisure activities and reduced QoL [8]. Osteoporosis, on the other hand, can significantly diminish one's QoL. The condition may lead to persistent discomfort, limited mobility, and a heightened susceptibility to fractures. These complications may ultimately result in a loss of independence, self-reliance and autonomy for those affected, ultimately contributing to social isolation. Consequently, it is crucial to understand and address the relationship between osteoporosis and QoL, as both are vital health concerns for the elderly. By doing so, we can enhance the lives of individuals affected by osteoporosis [6, 9]. Research has established a link between osteoporosis and diminished QoL, particularly in the Health-Related QoL (HR-QoL) domain [10, 11].

Studies have shown that postmenopausal women with osteoporosis exhibit diminished HR-QoL across various dimensions compared to those with normal bone density, with fractures exacerbating this decline [10]. Similarly, men with osteoporosis demonstrate a reduction in HR-QoL, particularly in physical function, with fractures significantly impairing their QoL [11]. Higher Bone Mineral Density (BMD) levels in both men and women are linked to improved QoL, while the frequency of fractures and time elapsed since fracture have adverse effects [12]. The psychological impact of osteoporosis and fragility fractures encompasses anxiety, depression, social isolation, and a fear of falling. These factors may contribute to the reduced QoL experienced by individuals with this condition. Recognizing these complex effects is essential for creating comprehensive care strategies aimed at enhancing the well-being of those affected by osteoporosis [13].

Fractures, especially in the hip, vertebrae, and distal radius, result in physical pain, disability, reduced mobility, increased dependence, and diminished well-being [14, 15]. Slow recovery and incomplete rehabilitation may necessitate permanent nursing home care for many patients [16]. The global burden of low BMD is higher in women, but the attributed years of life lost, disability-adjusted life years (DALYs), and deaths are higher in men, with the largest discrepancy seen in Africa and the Eastern Mediterranean region [17]. Key risk factors for the burden include smoking [18], physical inactivity, diabetes, and low body mass index (BMI) [19] according to the highly cited papers in the field [20]. Notably, Iran has seen a significant increase in the age-standardized rate of DALYs attributed to musculoskeletal disorders over the past three decades [21].

Given the growing proportion of elderly individuals, the high prevalence of osteoporosis in this age group, and the diminished QoL often observed among the aged, there is a need for comprehensive research on these interrelated issues. However, studies examining the association between osteoporosis and QoL in the Middle East and Iranian contexts are limited. In this study, we aimed to conduct a comprehensive evaluation of the relationship between QoL and osteoporosis in a large, representative sample of elderly Iranian men and women. Our objectives included evaluating the various domains and components of QoL, exploring the correlation between physical and mental aspects of QoL and osteoporosis while considering multiple potential confounders. This would provide valuable insights for healthcare policy, resource allocation, and increasing awareness of the broader impacts of osteoporosis and underscores the significance of a multidisciplinary approach to osteoporosis management. By highlighting the association between osteoporosis and QoL considering the role of other variables like age, depression, and cognitive impairment, this study emphasizes the need for understanding how osteoporosis affects QoL. Improving awareness of this relationship could lead to better management strategies and interventions for the elderly, informing healthcare providers, policymakers, and caregivers.

Methods and material

Participants

The participants of the present cross-sectional study were selected from 2426 participants of the second phase

of the Bushehr Elderly Health Program (BEHP). BEHP is a population-based prospective cohort study initiated in 2013 in Bushehr, Iran, targeting individuals aged 60 and older to evaluate the prevalence of non-communicable diseases and their risk factors. Participants were selected through selected using a multistage cluster random sampling method. Its second phase (2015), aimed to investigate musculoskeletal diseases and cognitive impairments. Eligibility criteria mandated residency in Bushehr and excluded individuals with severe medical conditions or unwillingness to participate. Data collection involved validated questionnaires administered by trained personnel, ensuring informed consent was obtained from all participants. The questionnaire included some previously validated questionnaires [22–26]. Additional questions on demographics, medical history, and lifestyle behavior were validated in the original study [27]. Details regarding the design and methodologies of BEHP have been previously recorded [27, 28]. All the participants of the second stage of BEHP ($n=2426$) with available data on BMD and QoL ($n=2399$) were enrolled in the present cross-sectional study. The study utilized existing data including BMD results, laboratory tests, clinical parameters, and QoL data for each participant. Based on the consistent and systematic data collection efforts within the BEHP, and considering the objective nature of many exploratory variables, the incidence of missing data was either non-existent or less than 1% for most variables.

Measurements

Osteoporosis

BMD of the lumbar spine, total hip, and femoral neck was measured using Dual-energy X-ray absorptiometry (DXA Hologic Discovery WI (S/N 88102), Bedford, Virginia, United States of America) in a correct position by a trained operator [27]. Participants with a T-score of -2.5 or less in either site were considered osteoporotic, and others as non-osteoporotic [29]. In the present population, the age-standardized prevalence of osteoporosis is 24.6% in men and 62.7% in women as reported earlier [30].

Quality of life

The 12-Item Short Form Survey (SF-12 questionnaire, abbreviated SF-36) was utilized to assess 8 dimensions of QoL in the participants, encompassing both physical and mental components. Physical assessments were conducted to gauge the Physical Component Summary (PCS) of QoL, involving evaluations of mobility, strength, and flexibility. Emotional assessments were carried out using the SF-12 Questionnaire to measure the Mental Component Summary (MCS) of QoL, where participants rated their happiness, satisfaction, and overall well-being on a scale of 1 to 10. Social assessments included evaluations of social support, loneliness, and engagement in social activities, with participants providing insights into their social networks, frequency of social interactions, and feelings of loneliness [31]. Previous research in Iran has examined the reliability and validity of the SF-12 questionnaire, revealing reported Cronbach alpha values of 0.89 for the physical component summary and 0.90 for the mental component summary. Furthermore, it demonstrated excellent discriminatory ability in distinguishing between patient subgroups based on demographic and clinical variables [32].

Other variables

The Patient Health Questionnaire-9 (PHQ-9 questionnaire) [33] was used to diagnose depressive disorders. This diagnostic tool has been validated for use in the Iranian population [26]. Participants who scored between 8 and 27 were classified as having depression [34]. Individuals were categorized as having cognitive impairment if they exhibited impaired performance on either the Categorical Verbal Fluency Test (CFT) or the Mini-Cog assessment [27]. Individuals with fasting blood sugar≥126 mg/dl or HbA1c≥6.5% or a documented history of diabetes coupled with the use of antidiabetic medications were categorized as diabetics [35]. The presence of Hypertension (HTN) was confirmed if any of the following conditions were met: a documented history of HTN coupled with the use of antihypertensive medications, a systolic blood pressure (SBP) reading equal to or exceeding 140 mmHg, or a diastolic blood pressure (DBP) reading equal to or exceeding 90 mmHg [36]. Participants were categorized as either nonsmokers or current smokers based on their smoking habits. The physical activity level was evaluated using a validated self-report questionnaire [37]. It was calculated by dividing the total daily energy expenditure by the basal energy expenditure. We used a cutoff value of 1.6 to categorize individuals into two distinct groups based on their physical activity levels: inactive (comprising sedentary and low active individuals) and active (encompassing those classified as active and very active) [38].

Statistical analysis

We stratified the participants by sex. Characteristics and QoL domains with a normal distribution based on the Shapiro-Wilk normality test and Q-Q plot, are reported as mean±standard deviation, while those without normal distribution are presented as median (interquartile range, IQR). Categorical data are presented by frequencies (percentages). Differences among osteoporotic and non-osteoporotic individuals, stratified by sex, were assessed using an independent two-sample T-test, Mann-Whitney U test, or Pearson chi2 tests as indicated. Mean differences and 95% confidence intervals (95%CI) were

estimated for the SF12 domains and the PCS and MCS scores. We examined the association between osteoporosis and PCS and MCS using univariable and multivariable linear regression analysis. PCS and MCS scores were used as the dependent variables. The models used for the regression analysis include: *Model 1*, the crude unadjusted model; *Model 2*, the reduced model adjusted for age as the most important variable, and *Model 3*, the full model adjusted for age, sex, BMI, Medicare supplement insurance, diabetes, HTN, Rheumatoid arthritis, depression, cognitive impairment, physical activity, education, smoking, fracture history>45 years, fear of falling and falling in a recent year as the explanatory variables.

Regarding the assumptions underlying the linear regression models, the plots of the standardized residuals against each of the predictor variables did not indicate a clear departure from linearity. Also, the results of White's test and the Breusch-Pagan tests did not show evidence of heteroscedasticity. Additionally, kdensity, qnorm, and pnorm showed the residuals are close to a normal distribution. We also checked for multicollinearity using a variance inflation factor cut-off of 10. All analyses were performed using the STATA 17.0 statistical software. P-value<0.05 was considered as statistical significance.

Results

Participants

A total of 2,399 people participated in the study. Almost 52% of the participants were women. The average±SD age was 69.1±6.3 years in women and 69.5±6.4 years in men. Participants with osteoporosis were older compared to healthy participants (70.8±6.9 vs. 68.3±5.7, $P<0.0001$). Clinical and demographic characteristics of participants in four groups based on disease (with or without osteoporosis) and gender (women or men) are shown in Table 1. Overall, individuals with osteoporosis were statistically significantly older, had lower BMI, and lower level of education compared with those without osteoporosis.

In terms of other statistically significant variables, women with osteoporosis had lower medical insurance coverage (52.8% compared to 58.6%), HTN (72.5% vs. 79.0%), diabetes (33.2% vs. 43.5%), and high levels of physical activity (19% vs. 27.4%) when compared to women without osteoporosis. Conversely depression (24% vs. 19%), cognitive impairment (71.5% vs. 62.5%), fractures after the age of 45 (32.5% vs. 19.6%), and a fear of falling (59.2% vs. 52.2%) wee more prevalent among women with osteoporosis compared to those without osteoporosis.

Among men with osteoporosis, HTN (65.6% vs. 72.1%), and diabetes (18.4% vs. 35%) were statistically significantly less prevalent, whereas depression (9% vs. 4.8%), rheumatoid arthritis (1.1% vs. 0.1%), smoking (34.6% vs. 19.9%), fracture history after age 45 years (26.3% vs. 15.8%), and fear of falling (29.3% vs. 23.2%) were more prevalent compared to men without osteoporosis.

QoL domains and components

Overall women had lower QoL scores in all areas compared to men regardless of their osteoporosis status. Besides, participants with osteoporosis had lower QoL

Table 1 Characteristics of the study population stratified by sex and osteoporosis status

Characteristics	Women (*N*=1246)		*P*-Value	Men (*N*=1153)		*P*-Value
	OP (*N*=731)	Non-OP(*N*=515)		OP (*N*=266)	Non-OP (*N*=887)	
Age, years	70.64±6.85	67.04±4.81	<0.001	71.27±7.36	69.02±6.06	<0.001
BMI, Kg/m2	27.37±5.24	30.62±4.87	<0.001	24.32±4.10	26.80±3.80	<0.001
Lumbar spine BMD	0.73±0.11	0.92±0.11	<0.001	0.80±0.11	1.04±0.14	<0.001
Total hip BMD	0.68±0.10	0.85±0.08	<0.001	0.79±0.09	0.98±0.12	<0.001
Femoral neck BMD	0.52±0.08	0.68±0.07	<0.001	0.59±0.08	0.77±0.11	<0.001
Medicare supplement insurance	386 (52.80)	302 (58.64)	0.041	163 (61.28)	581 (65.50)	0.207
HTN	530 (72.50)	407 (79.03)	0.009	175 (65.79)	640 (72.15)	0.046
Diabetes	243 (33.24)	224 (43.50)	<0.001	49 (18.42)	310 (34.95)	<0.001
Depression	173 (23.96)	98 (19.14)	0.044	24 (9.02)	42 (4.76)	0.009
Rheumatoid arthritis	28 (3.85)	15 (2.91)	0.375	3 (1.13)	1 (0.11)	0.014
Cognitive impairment	523 (71.55)	322 (62.52)	0.001	149 (56.02)	439 (49.49)	0.062
Physical activity, good	140 (19.15)	141 (27.38)	0.001	53 (19.92)	215 (24.24)	0.144
Current smoker	137 (18.74)	92 (17.86)	0.694	92 (34.59)	176 (19.84)	<0.001
Fracture history	238 (32.56)	101 (19.61)	<0.001	70 (26.32)	140 (15.78)	<0.001
Fear of falling	433 (59.23)	269 (52.23)	0.014	78 (29.32)	206 (23.22)	0.043
Falling in a recent year	109 (14.91)	69 (13.40)	0.452	23 (8.65)	57 (6.43)	0.211
Education, years	0 (0–5)	4 (0–6)	<0.001	6 (1–12)	6 (4–12)	<0.001

Continuous variables with normal distribution are presented as Mean ± SD and those without normal distribution as median (Q1–Q3); categorical variables are presented as number (percentages). The comparison between groups was performed by idependent two sample T–test, Mann–Whitney U test, and Pearson chi–square test, respectively

Table 2 Domains and components of QoL in the study population by sex and osteoporosis status

	Women (*N* = 1246)			Men (*N* = 1153)		
	OP (*N* = 731)	Non-OP(*N* = 515)	Mean difference (95% CI)	OP (*N* = 266)	Non-OP (*N* = 887)	Mean difference (95% CI)
Domains						
Physical Functioning	37.90 (13.46)	41.60 (12.69)	3.70 (2.22,5.18)**	47.61 (12.48)	50.02 (10.43)	2.41 (0.91,3.90)*
Role Physical	25.08 (4.60)	25.72 (4.53)	0.64 (0.12,1.16)*	27.45 (3.85)	27.85 (3.55)	0.39 (-0.10,0.89)
Bodily Pain	48.67 (12.98)	50.33 (11.55)	1.66 (0.26,3.06)*	54.53 (7.87)	55.20 (6.90)	0.67 (-0.30,1.65)
General Health	35.74 (10.50)	36.58 (10.29)	0.84 (-0.33,2,01)	40.37 (9.92)	42.07 (10.41)	1.70 (0.28,3.11)*
Vitality	53.68 (13.20)	55.68 (12.52)	1.99 (0.54,3.45)*	60.68 (11.20)	61.88 (10.03)	1.19 (-0.21,2.61)
Social Functioning	49.56 (12.11)	51.07 (10.59)	1.51 (0.21,2.81)*	52.88 (9.15)	54.15 (7.22)	1.26 (0.21,2.32)*
Role Emotional	17.74 (5.52)	18.39 (5.36)	0.65 (0.03,1.26)*	19.92 (4.71)	20.50 (4.29)	0.58 (-0.02,1.18)
Mental Health	51.66 (14.54)	53.08 (13.42)	1.41 (-0.17,3.00)	58.49 (10.36)	59.28 (9.42)	0.79 (-0.53,2.11)
Components						
PCS-12	38.07 (8.93)	40.22 (8.49)	2.14 (1.15,3.13)**	44.29 (7.85)	45.83 (7.02)	1.53 (0.54,2.52)*
MCS–12	43.76 (11.16)	44.50 (10.59)	0.74 (-0.49,1.97)	47.39 (8.39)	47.96 (7.67)	0.56 (-0.51,1.64)

Mean (SD) of the domains and components are presented. OP: osteoporosis; * P value <0.05; ** P value <0.001; PCS: Physical Component Summary; MCS: Mental Component Summary

Table 3 Association between osteoporosis and physical and mental components of QOL in the study population

	MCS–12		PCS-12	
	Women	Men	Women	Men
Model 1	-0.74 (-1.97,0.49)	-0.56 (-1.64,0.50)	**-2.14 (-3.13,-1.15)***	**-1.53 (-2.52,-0.54)***
Model 2	-0.99 (-2.27,0.29)	-0.84 (-1.92,0.23)	-0.75 (-1.74,0.23)	-0.85 (-1.82,0.10)
Model 3	-0.24 (-1.36,0.87)	0.07 (-0.95,1.10)	**-0.95 (-1.87,-0.03)***	-0.63 (-1.55,0.28)

Linear regression analysis. MCS: Mental Component Summary; PCS: Physical Component Summary; Crude and Adjusted beta and 95% Confidence Intervals (CI) are presented. Model 1: Crude model; Model 2: adjusted by age; Model 3: adjusted by age, BMI, Medicare supplement insurance, diabetes, hypertension, rheumatoid arthritis, Depression, cognitive impairment, physical activity, Education, current smoking, fracture history >45 years, fear of falling, and falling in a recent year. * P value <0.05

compared to those without osteoporosis (Table 2). The difference was statistically significant for Physical Functioning [mean difference with 95% CI: 3.70 (2.22,5.18)], Role Physical (0.64 (0.12,1.16), Bodily Pain (1.66 (0.26,3.06), Vitality (1.99 (0.54,3.45), Social Functioning (1.51 (0.21,2.81), and Role Emotional (0.65 (0.03,1.26) in women, and Physical Functioning (2.41 (0.91,3.90), General Health (1.70 (0.28,3.11), and Social Functioning (1.26 (0.21,2.32) in men. The greatest difference was observed in the domain of Physical Functioning.

Regarding the physical and mental component summaries of QoL, men had significantly higher scores in both PCS and MCS compared to women in both osteoporosis [mean differences: 6.2 (5-7.4), 3.6 (2.1–5.1), respectively], and non-osteoporosis individuals [mean difference: 5.6 (4.8–6.4), 3.4 (2.5–4.4) respectively].

PCS was significantly lower in women with osteoporosis compared to women without osteoporosis (38.1 vs. 40.2, p value < 0.001). The same was observed in men (44.3 vs. 45.8, p value: 0.002). However, MCS was not statistically different between either men or women with osteoporosis and without osteoporosis.

Linear regression models

We examined the link between osteoporosis and the mental and physical aspects of QoL through linear regression analysis. Our findings revealed that osteoporosis was correlated with decreased PCS scores in both women [β = -2.14 (-3.13, -1.15)] and men [β = -1.53 (-2.52, -0.54)], as detailed in Table 3. After adjusting the analysis for age in Model 2, the association was not significant anymore. However, in the full model (Model 3) after accounting for all relevant variables, this association remained significant in women [β=-0.95 (-1.87, -0.03)], but not in men [β=-0.63 (-1.55,0.28)]. The association between osteoporosis and MCS was not significant in either sex.

Discussion

Considering the importance of osteoporosis and QoL in the aging population and the scarcity of data in our region, we evaluated the QoL among 2399 elderly individuals regarding their sex and osteoporosis status. We observed significantly diminished HR-QoL in several domains in women and men with osteoporosis compared to those without osteoporosis. The greatest difference was for physical functioning, vitality, bodily pain, and social functioning in women, and physical functioning, general health, and social functioning in men. Regarding the components of QoL, PCS but not MCS scores were significantly lower in individuals with osteoporosis. After adjusting for other covariates, osteoporosis was significantly associated with lower PCS in women but not men.

Women with osteoporosis had a significant decline in QoL, particularly in the domains of physical functioning, vitality, bodily pain, and social functioning. This decline may be attributed to the physical limitations and

discomfort caused by osteoporosis, which can impede daily activities and social interactions. Interestingly, general health and mental health domains did not show substantial differences between women with and without osteoporosis. Similarly, other recent studies have also reported that general health and mental health domains may not show substantial differences [39, 40]. According to a systematic review, while osteoporosis and fractures reduce HR-QoL, the differences in mental health status may not be significant [10]. This could potentially be due to societal normalization of the condition and individual coping strategies.

We observed that men with osteoporosis had lower QoL scores in the domains of physical functioning, general health, and social functioning compared to men without osteoporosis. Decline in general health is more noticeable in men compared to women, emphasizing the distinct obstacles encountered by men with osteoporosis. This could be possibly due to the lower prevalence of osteoporosis in men, leading to reduced societal recognition and assistance. This lower incidence could lead to less societal awareness and understanding of the condition in men. This, in turn, may result in men feeling less prepared to manage their osteoporosis, contributing to a greater perceived negative impact on their QoL. Besides, secondary osteoporosis affects a higher percentage of men compared to postmenopausal women, with approximately two-thirds of men and around 30% of postmenopausal women experiencing this condition [41]. The causes are multifaceted, including hypogonadism, medications, and various medical conditions. Thus, men with osteoporosis often experience a more profound negative impact on their QoL, which may be partly attributed to the underlying causes of their condition. Our findings are consistent with a recent systematic review, reporting a poorer global HR-QoL and multiple dimensions of QoL in men with osteoporosis than men without osteoporosis [11]. A recent study has also shown that men with primary osteoporosis, especially those with severe osteoporosis, experience significantly impaired QoL in physical health domains. Fragility fractures were identified as a key factor contributing to lower scores, emphasizing the negative social implications of the disease. Additionally, bisphosphonates treatment was found to improve physical health domains in men with osteoporosis [12]. Furthermore, another study discovered that men with osteoporosis experienced significant limitations in QoL, particularly in the aspects of general health perception, mental function, and pain. Those with multiple fractures exhibited even lower QoL [42].

Our findings demonstrate a notable association between osteoporosis and reduced PCS scores, while no significant association was observed with MCS scores. After adjusting for several factors, the link between osteoporosis and lower PCS scores remained statistically significant only among women. Women generally have lower peak bone mass compared to men, and lifestyle factors like diet and physical activity can also influence bone health differently in each gender [43, 44]. This observation aligns with the existing literature. A systematic review highlighted a significant decline in QoL for postmenopausal women with osteoporosis, particularly affecting PCS scores more than MCS scores, especially in those with osteoporotic fractures [10]. Additionally, the study from the Canadian Multicentre Osteoporosis Study revealed a substantial reduction in HR-QoL for both men and women with osteoporosis, with women showing lower scores in physical health domains. Interestingly, mental health scores remained stable or improved, indicating that the physical aspects of osteoporosis have a more pronounced impact on QoL than the mental aspects over a 10-year period [45].

Strengths and limitations

This research provides valuable insights into the association between osteoporosis and different domains and components of QoL among elderly population and is one of the few studies in this regard in the area, supported by a sizable sample size. The analysis was adjusted for several confounding variables, strengthening the reliability of the findings. However, the cross-sectional design of the study precludes the establishment of causality, and the absence of longitudinal data restricts our understanding on the impact of the duration and progression of osteoporosis over time. Additionally, the research does not explore the effects of specific medications on QoL at this stage. Despite these limitations, the results offer potentially valuable information for healthcare providers, policymakers, and social workers, emphasizing the necessity for targeted interventions to improve the QoL of individuals with osteoporosis. The study's rationale and aim underscore the significance of assessing QoL within an aging population with the increasing incidence of osteoporosis, which is a growing public health concern.

Conclusions

In conclusion, this study sheds light on the significant association between osteoporosis and the physical component of QoL in both men and women. The findings reveal that individuals with osteoporosis, particularly women, experience lower physical QoL scores compared to those without osteoporosis. This underscores the importance of early detection and management of osteoporosis to improve the overall well-being and QoL, especially in aging populations. While the cross-sectional design limits causal conclusions and lacks longitudinal data, further research and interventions focusing on enhancing QoL in individuals with

osteoporosis, particularly addressing the physical aspects are warranted to promote healthier aging and well-being.

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Author contributions
YZ and NP are co-first authors. Study design: NP, NF; Study conduct: all authors; Data collection: AO, IN, BL; Statistical analysis: MH, NP, NF; Data interpretation: NP, NF, MH; Manuscript drafting: NP, YZ, AS, MH, NF; All authors read and approved the final manuscript.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from the Ethics Committees at the Endocrinology and Metabolism Research Institute of Tehran University of Medical Sciences and Bushehr University of Medical Sciences, marked with the ethical codes IR.TUMS.EMRI.REC.1394.0036 and B-91-14-2, respectively. Informed consent was obtained from all subjects.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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