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Original article

Assessment of quality of life and its affecting factors in osteosarcopenic individuals in the Iranian older adult population: Bushehr Elderly Health (BEH) program

Amir Mohammad Vahdani [a], Mahnaz Sanjari [a], Noushin Fahimfar [a,*], Mahbube Ebrahimpur [b], Gita Shafiee [c], Kazem Khalagi [d], Mohammad Javad Mansourzadeh [a], Iraj Nabipour [e], Bagher Larijani [f], Afshin Ostovar [a]

[a] Osteoporosis Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran
[b] Elderly Health Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran
[c] Chronic Diseases Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran
[d] Obesity and Eating Habits Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran
[e] The Persian Gulf Marine Biotechnology Research Center, The Persian Gulf Biomedical Sciences Research Institute, Bushehr University of Medical Sciences, Bushehr, Iran
[f] Endocrinology and Metabolism Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

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ABSTRACT

Objectives: This cross-sectional study, conducted as part of the Bushehr Elderly Health program stage II in Bushehr, Iran, aimed to evaluate health-related quality of life (HR-QoL) in individuals aged ≥ 60 with osteosarcopenia, a condition characterized by the co-occurrence of osteopenia/osteoporosis and sarcopenia. Given the increasing elderly population worldwide, understanding the HR-QoL of this demographic is crucial, with osteosarcopenia being a significant factor.

Methods: The study enrolled 2369 participants aged ≥ 60 and collected demographic and anthropometric data. Various questionnaires, including the Short Form 12, Patient Health Questionnaire-9, Activities of Daily Living, and Instrumental Activities of Daily Living, were administered. Comparisons were made between individuals with and without osteosarcopenia. Regression models were employed to identify variables associated with HR-QoL in those with osteosarcopenia.

Results: Key findings revealed that 22.5% of participants had osteosarcopenia. Significantly different HR-QoL measures were observed between the 2 groups, especially in physical functioning and physical component summary scores. Male gender, advanced age, and chronic illnesses were linked to lower physical and mental HR-QoL scores among those with osteosarcopenia. In female participants, a history of fractures and physical disability were associated with reduced quality of life.

Conclusions: This study underscores the negative impact of osteosarcopenia on HR-QoL, particularly in male participants, with a focus on physical aspects. It also highlights age and chronic disease as contributing factors to diminished HR-QoL in individuals with osteosarcopenia. These findings emphasize the importance of addressing osteosarcopenia in the elderly population to improve their overall well-being.

1. Introduction

Osteosarcopenia is a geriatric syndrome defined by the concurrence of osteoporosis/osteopenia and sarcopenia. Osteoporosis/osteopenia is characterized by a reduced bone mineral density, and sarcopenia by a reduction in lean muscle mass, strength, or functional capacity; sarcopenia is also accompanied by a gradual increase in body fat [1,2]. Considering the rapidly rising portion of the older adult population and multiple studies linking both conditions with increased morbidity (including falling events, fractures, admission length and prevalence,

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* Corresponding author. No.10 Jalal–e-ale-Ahmad St., Chamran Hwy., P. O. Box 14117-13137, Tehran, Iran.
E-mail address: nfahimfar@Sina.tums.ac.ir (N. Fahimfar).

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balance disorders, etc.) and mortality in this age group [3–5], osteosarcopenia as an entity encompassing these 2 conditions (osteoporosis/osteopenia and sarcopenia) is receiving increasing attention and recognition.

Despite the large body of evidence on the prevalence, risk factors, and outcomes of both osteopenia/osteoporosis and sarcopenia, studies on osteosarcopenia and its implications are comparatively lacking [6]. Current studies on osteosarcopenia in multiple countries estimate its prevalence in a range of 12.5%–40% among different older adult populations [7], and a study in Iran in 2019 estimated the prevalence of osteosarcopenia at 30.6% and 29.5% among older adult women and men, respectively [8].

Health-related quality of life (HR-QoL) is an increasingly important metric in the assessment of the morbidity of various medical conditions, affected by a myriad of physiological, economic, social and cultural factors [9]. Studies link osteosarcopenia with the same sequels and complication as those seen in osteopenia/osteoporosis and sarcopenia, including falling events, fractures, weakness, reduced endurance, lowered height, balance disorders, posture changes and pathological spine curvatures, lower back pain and muscle spasms [10,11]; notably, the risk of serious complications such as falling events and fractures, especially of the hip joint, is considerably higher in individuals with osteosarcopenia than in those with osteopenia/osteoporosis or sarcopenia alone. Osteosarcopenia is also associated with malnutrition, peptic ulcer disease, inflammatory arthritis, and lowered mobility [12]. Clearly, osteosarcopenia should be considered a serious detriment to an individual's HR-QoL.

In this work, we analyze the overall HR-QoL levels and the factors affecting it in a large older adult population (aged over 60) living in Bushehr, Iran, utilizing baseline data from the second stage of the Bushehr Elderly Health (BEH) Program, which was initialized in 2015 [13].

2. Methods

2.1. Study population

This cross-sectional study is pillared upon the basis of the BEH program, which has been run since 2013. The BEH program is a study attempting to determine the epidemiology of noncommunicable diseases and their risk factors in a representative older adult population living in Bushehr, Iran. In all, 3000 individuals of the older adult population of Bushehr were enrolled in phase I of the study, related to cardiovascular diseases and risk factors [14]. In phase II of the BEH, the prevalence of musculoskeletal disorders, cognitive impairments and their risk factors were studied in a sample of 2426 individuals of the older adult community-dwelling population of Bushehr in 2015–2016 which entered the follow-up stage of phase I. The rationale and methodology of this study are elaborated in a previous paper [13].

2.2. Ethics approval

This study was approved by the institutional review board of both the Endocrinology and Metabolism Research Institute (EMRI) and Bushehr University of Medical Sciences (IR.TUMS.EMRI.REC.1401.064) and followed the Declaration of Helsinki. All subjects agreed to participate in the study and provided written informed consent.

2.3. Data collection

Using valid questionnaires subjects were interviewed by trained interviewers about demographic status, general health, drug history and habitual history. All questionnaires used for this study were validated to local languages, as explained in the BEH protocol paper [13].

The height and weight of the participants were measured using a fixed stadiometer and a digital scale, with shoes removed and light clothing. Body mass index (BMI) was calculated via the weight (kg) divided by squared height (m^2) formula. Following 15 min in the sitting position and under suitable conditions, 2 measurements of systolic and diastolic blood pressure were taken of the right arm, and the mean of the 2 measurements was used as the participant's blood pressure.

Body composition was measured using dual X-ray absorptiometry (DXA, Discovery Wi, Hologic, Inc. Marlborough, MA, USA). Using this device, bone mineral density, fat mass and muscle mass were measured. Bone mineral density (BMD) of the lumbar spine (L1-L4) and total hip were measured in the correct position. Appendicular skeletal mass (ASM) for each participant was derived as the sum of upper and lower limb skeletal mass. The skeletal muscle mass index (SMI) was defined as ASM/height^2 (kg/m^2).

Health-related QoL was assessed in individuals both with and without osteosarcopenia using the 12-item Short Form Survey (SF-12), during private interviews with trained interviewers. The SF-12 questionnaire is a widely used tool for assessing self-reported HR-QoL; it contains 12 questions in 8 distinct domains, all related to an individual's HR-QoL: physical functioning (PF), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). Assessing an individual's response to the SF-12 questionnaire is a 3-stage process: first, the responses to each question are assessed; then, those responses are coalesced into the 8 distinct domains mentioned above; and finally physical and mental component summary (PCS and MCS, respectively) scores were obtained by aggregating the related domain scores [15].

PHQ-9 is the depression module in the Patient Health Questionnaire, scoring each of the 9 DSM IV criteria for depression as 0 for "not at all" to 3 for "nearly every day". It is a rapid tool for the detection of depression and has shown good reliability and validity [16,17].

"Chronic disease" was defined as a term encompassing rheumatoid arthritis, Parkinson's disease, chronic renal failure, osteoarthritis, chronic lung disease, cancer, liver failure, epilepsy, and Alzheimer's disease, among others. It was used as a self-reported categorical variable, recording the participants' provided medical history during interviews.

Activities of Daily Living (ADL) refers to activities regarding taking care of one's own body, whereas Instrumental Activities of Daily Living (IADL) refers to activities necessary for daily life at home and in the community, often requiring comparatively more complex interactions. IADL autonomy is important for "successful" aging [18]. These 2 metrics classify individuals as dependent or independent. The Barthel scale was used to assess the participants' ADL, scoring each individual on a scale of 1–100 using the Basic Activities of Living (BADL) questionnaire. Subjects with a score of < 95 were considered dependent, and those with a score of ≥ 95 were considered independent [19]. The Lawton scale was used to assess the participants' IADL, scoring them on a scale of 0 (low function, dependent) to 8 (high function, independent). Subjects with a score of < 8 on the Lawton scale were considered dependent, and those with a score of exactly 8 were considered independent [20,21].

2.4. Definition of terms

According to the World Health Organization, osteopenia and osteoporosis are delineated by a bone mineral density (BMD) T-score between -1 and -2.5 and less than 2.5, respectively, compared to healthy young adults of the same sex [22]. Sarcopenia is defined as low muscle strength and reduced muscle mass. Grip strength and gait speed were used as measures of muscle strength. The cutoff values for grip strength were $<$ 27 kg and $<$ 16 kg for men and women, respectively. The cutoff value for gait speed was < 0.8 m/s for both men and women. Reduced muscle mass was quantified via ASM/height^2, with cutoff values of < 7.0 kg/m^2 and $<$ 5.5 kg/m^2 for men and women, respectively [23–25]. The aforementioned cutoff values have been validated for the Iranian population [24]. Osteosarcopenia was thus assessed as the concurrence of sarcopenia and osteopenia/osteoporosis, via the criteria mentioned above.

Type 2 diabetes mellitus was diagnosed via a fasting blood sugar (FBS) value of ≥ 126 mg/dL, HbA1c ≥ 6.5%, or ascertained if the individual was on anti-diabetic medication. Hypertension was defined as having a systolic blood pressure of ≥ 140 mmHg or a diastolic blood pressure of ≥ 90 mmHg. Participants who smoked on a daily or occasional basis as well as those who used pipes were classified as current smokers.

2.5. Statistical analysis

Descriptive statistics were utilized to summarize the baseline characteristics of the study participants, including demographic information and medical history. For continuous variables, data were presented as means and standard deviations, while categorical variables were summarized using percentages.

Independent T-tests were used to compare quantitative variables among groups, and Pearson's chi-square tests were used to compare categorical variables. To identify potential factors affecting component summary scores, linear regression models were utilized. Initially, a simple regression model was run for each variable. Subsequently, variables demonstrating a significant correlation (P-value < 0.2) were included in a multiple regression model.

A threshold of 0.05 was selected to define statistical significance in all tests except the univariable regression model. All analyses were performed using STATA version 11 (StataCorp., Lakeway Drive, TX).

3. Results

Participants with missing values for osteosarcopenia were excluded; of the remaining 2369 participants, osteosarcopenia (N=528, 22.50%) was detected in 289 women (23.66%) and 239 (20.90%) men. Table 1 summarizes the baseline demographic characteristics for female and male participants. Age, BMI, years of schooling, and disability (IADL) showed statistically significant differences in subjects with and without osteosarcopenia in both sexes, as did depression (PHQ-9) and disability (ADL) in men (all P-values <0.05).

Figure 1 and 2 demonstrate the frequency distribution of the SF-12 questionnaire responses among women and men, respectively. Shades of green represent participants without osteosarcopenia, and shades of brown represent participants with osteosarcopenia. The responses of individuals with and without osteosarcopenia were compared using the Pearson's chi-square test, and the *p*-values for each question are shown. For women, only SF-2a ("Does your health limit you in moderate activities such as moving a table?") showed a statistically significant difference. For men, the responses to several questions (2a, 2b, 3a, 3b and 6b) were significantly different among individuals with and without osteosarcopenia.

Table 2 demonstrates the weighted average of women's and men's responses to each of the SF-12 survey questions, on a scale of 1 to 2-5, depending on the question. The response to question 2a was significantly different among women with and without osteosarcopenia; among men, the responses to questions 1, 2a, 2b, 3a, 3b and 6b were significantly different among individuals with and without osteosarcopenia.

Table 3 demonstrates the component scores of the SF-12 survey, on a standardized 50, 10 scale (ie, compared to the US general population with an average of 50 and a standard deviation of 10), along with the mental and physical component summary scores. Physical functioning (PF) was significantly different among women with and without osteosarcopenia; for men, physical functioning (PF), role physical (RP), general health (GH) and vitality (VT) scores were significantly different among participants with and without osteosarcopenia. The PCS scores among men with and without osteosarcopenia were significantly different.

Table 4 demonstrates the regression model for the different variables potentially correlated were quality of life (measured by the SF-12 PCS and MCS scores) in the osteosarcopenic portion of the study population (N = 528). In the multivariable regression model, sex, age, and depression yielded significant correlations for both PCS and MCS; hypertension, chronic disease, and disability (both ADL and IADL) yielded a significant correlation with PCS.

4. Discussion

In our study on 2369 participants of the older adult population, 22.5% of whom were osteosarcopenic, we found a significant correlation between osteosarcopenia and age, BMI, years of schooling and disability (ADL) in both men and women.

Waist circumference and BMI were among the variables that were significantly different among participants with and without

Table 1
Demographic characteristics of the participants by sex.

	Women (N = 1221)			Men (N = 1148)		
	Without Osteosarcopenia	With Osteosarcopenia	P-value [b]	Without Osteosarcopenia	With Osteosarcopenia	P-value[b]
	N = 932	N = 289		N = 909	N = 239	
Continuous variables[a]						
Age	68.16 ± 5.75 (67.79–68.53)	72.01 ± 6.87 (71.22–72.81)	**<0.001**	68.09 ± 5.21 (67.75–68.43)	74.84 ± 7.62 (73.87–75.81)	**<0.001**
BMI	30.12 ± 4.75 (29.81–30.42)	23.82 ± 3.06 (23.46–24.17)	**<0.001**	26.83 ± 3.94 (26.57–27.09)	23.98 ± 3.32 (23.56–24.41)	**<0.001**
Years of Schooling	2 (0–6)	0 (0–4)	**<0.001**	7 (4-12)	5 (0–8)	**<0.001**
Waist circumference	103.25 ± 11.29 (102.52–103.98)	90.16 ± 10.26 (88.97–91.35)	**<0.001**	98.38 ± 11.03 (97.66–99.09)	92.15 ± 10.38 (90.83–93.48)	**<0.001**
Categorical variables, N (%)						
Married	588 (63.09)	144 (49.83)	**<0.001**	880 (96.81)	217 (90.79)	**<0.001**
Diabetes mellitus	330 (35.45)	96 (33.45)	0.53	250 (27.62)	72 (30.13)	0.44
Current smoking	161 (17.27)	64 (22.15)	0.06	209 (22.99)	58 (24.27)	0.67
Hypertension	713 (76.50)	202 (69.90)	**0.02**	646 (71.15)	165 (69.04)	0.52
Chronic disease	204 (21.89)	59 (20.42)	0.59	95 (10.45)	29 (12.13)	0.45
Depression	196 (21.21)	64 (22.64)	0.65	44 (4.87)	20 (8.37)	**0.036**
Disabled (ADL)	293 (32.02)	92 (32.74)	0.82	99 (11.09)	52 (21.85)	**<0.001**
Disabled (IADL)	585 (66.10)	208 (77.61)	**<0.001**	302 (38.18)	110 (59.14)	**<0.001**
Fracture History	171 (18.45)	67 (28.15)	0.07	45 (4.97)	15 (6.28)	0.41

BMI, body mass index; ADL, activities of daily living; IADL, instrumental activities of daily living.

[a] Variables with a normal distribution are reported as mean ± SD (95% CI), and variables without a normal distribution are reported as median (25-75th percentile).

[b] Independent T-test and Mann-Whitney's test were used for comparing continuous variables with and without a normal distribution, respectively. Pearson's χ test was used for comparing categorical variables.

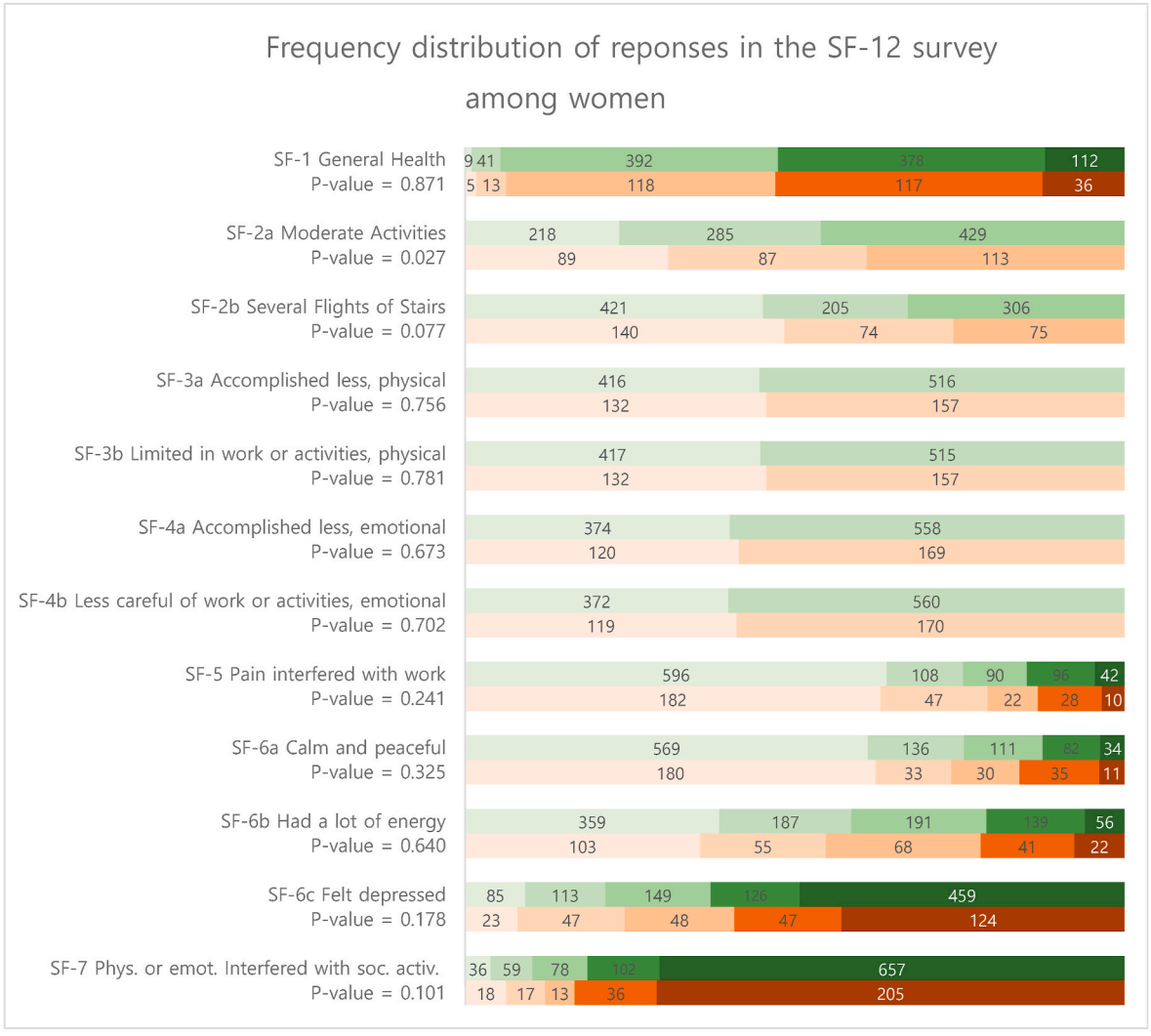


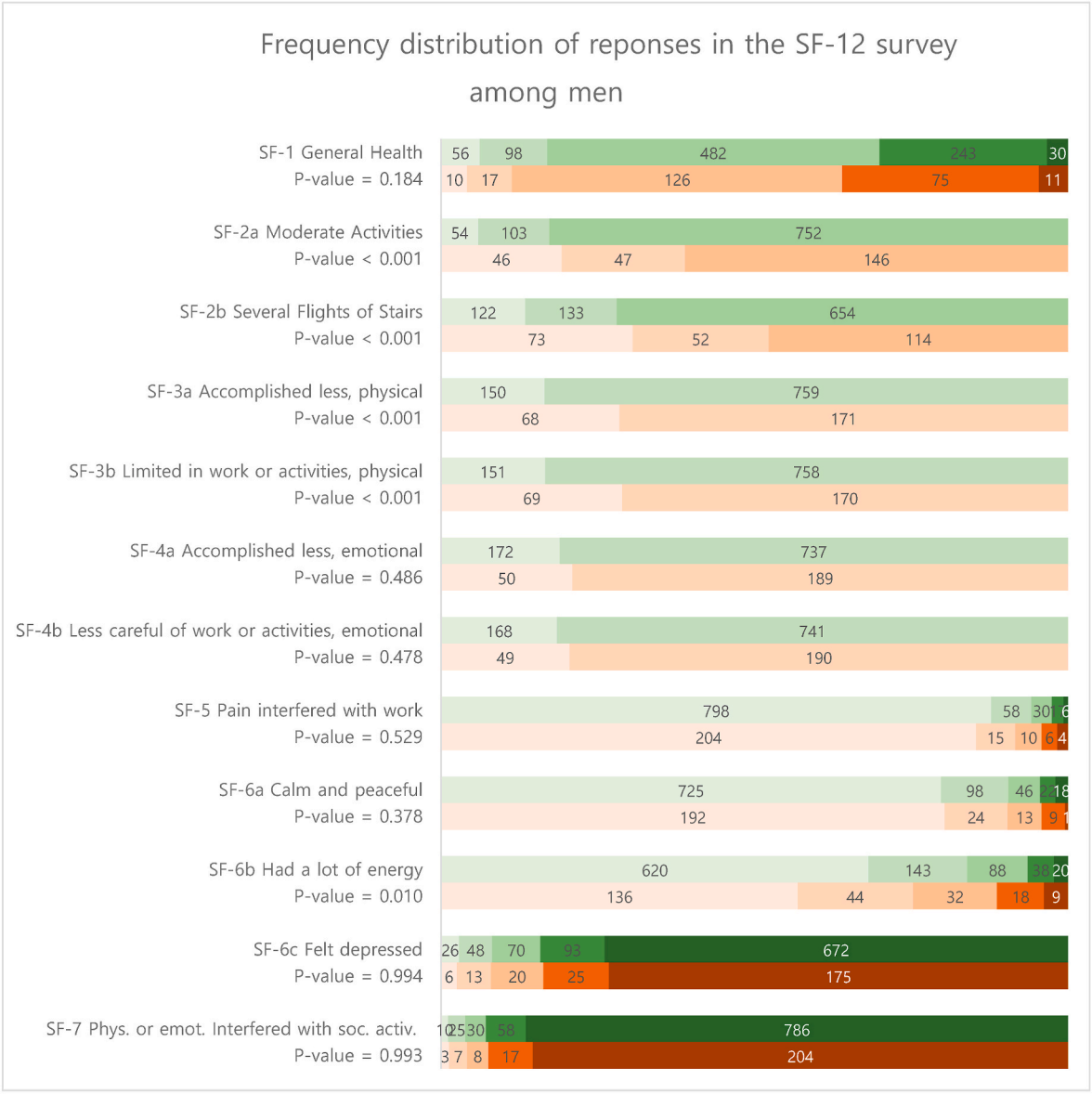
Fig. 1. The frequency distribution of the Short Form 12-item (SF-12) questionnaire responses among women. Shades of green represent participants without osteosarcopenia, and shades of brown represent participants with osteosarcopenia.

osteosarcopenia. Notably, osteosarcopenic obesity syndrome is among the prominent complications of osteosarcopenia in recent studies, and is defined as the simultaneous deterioration of bone and muscle tissue and the accumulation of extra fat tissue. The identification of this triad as related entities is among the recent trends in endocrinology, and their co-development is a current theory under investigation [26].

Analysis of the SF-12 responses was performed in a 3-step process: individual question responses, domain scores and component summary scores.

While the response to several physical component questions was significantly different among men with and without osteosarcopenia, only one question yielded significantly different results among women with and without osteosarcopenia. The observed difference in men and women with regard to questions such as SF3-a ("Did you accomplish less than you would like due to your physical health?") and SF-3b ("Were you limited in the kind of work or other activities due to your physical health?") could be a consequence of various sociocultural factors affecting men and women's perceived expectations of their own activities in distinct ways.

In the domain section, more domain scores were again significantly different in men. Notably most of the domains yielding exclusively different scores among men with and without osteosarcopenia



Responses for each question, from left to right:

SF1: Excellent/Very good/Good/Fair/Poor

SF2a, SF2b: Limited a lot/Limited a little/Not limited at all

SF3a, SF3b: Yes/No

SF4a, SF4b: Yes/No

SF5: Not at all/A little bit/Moderately/Quite a bit/Extremely

SF6a, SF6b, SF6c: All of the time/Most of the time/A good bit of the time/Some of the time/A little bit of the time/None of the time

SF7: All of the time/Most of the time/A good bit of the time/Some of the time/A little bit of the time/None of the time

Fig. 2. The frequency distribution of the Short Form 12-item (SF-12) questionnaire responses among men. Shades of green represent participants without osteosarcopenia, and shades of brown represent participants with osteosarcopenia.

Table 2
Individual scores in the short form 12-item survey.

Women	Without Osteosarcopenia	With Osteosarcopenia	P-value[a]
	N = 932	N = 289	
1	3.58 ± 0.79 (3.53–3.63)	3.57 ± 0.83 (3.47–3.67)	0.87
2a	2.22 ± 0.80 (2.17–2.27)	2.08 ± 0.83 (1.98–2.17)	**0.008**
2b	1.87 ± 0.87 (1.82–1.93)	1.77 ± 0.83 (1.67–1.87)	0.08
3a	1.553 ± 0.497 (1.521–1.585)	1.543 ± 0.498 (1.485–1.601)	0.75
3b	1.552 ± 0.497 (1.520–1.584)	1.543 ± 0.498 (1.485–1.601)	0.78
4a	1.59 ± 0.49 (1.56–1.63)	1.58 ± 0.49 (1.52–1.62)	0.67
4b	1.60 ± 0.48 (1.56–1.63)	1.58 ± 0.49 (1.53–1.64)	0.70
5	1.79 ± 1.23 (1.71–1.87)	1.74 ± 1.15 (1.60–1.87)	0.50
6a	1.79 ± 1.17 (1.71–1.86)	1.83 ± 1.23 (1.69–1.98)	0.58
6b	2.29 ± 1.28 (2.21–2.38)	2.39 ± 1.30 (2.24–2.54)	0.28
6c	3.81 ± 1.38 (3.72–3.90)	3.69 ± 1.37 (3.54–3.85)	0.20
7	4.37 ± 1.11 (4.30–4.45)	4.35 ± 1.19 (4.22–4.49)	0.80
Men	N = 909	N = 239	
1	3.10 ± 0.86 (3.04–3.15)	3.25 ± 0.82 (3.04–3.35)	**0.016**
2a	2.27 ± 0.54 (2.73–2.80)	2.41 ± 0.79 (2.31–2.51)	**<0.001**
2b	2.58 ± 0.71 (2.53–2.63)	2.17 ± 0.86 (2.06–2.28)	**<0.001**
3a	1.83 ± 0.37 (1.81–1.85)	1.71 ± 0.45 (1.65–1.77)	**<0.001**
3b	1.83 ± 0.37 (1.80–1.85)	1.71 ± 0.45 (1.65–1.76)	**<0.001**
4a	1.81 ± 0.01 (1.78–1.83)	1.79 ± 0.40 (1.73–1.84)	0.48
4b	1.81 ± 0.38 (1.78–1.84)	1.79 ± 0.40 (1.74–1.84)	0.47
5	1.21 ± 0.65 (1.16–1.25)	1.28 ± 0.80 (1.18–1.39)	0.12
6a	1.36 ± 0.84 (1.30–1.41)	1.33 ± 0.78 (1.23–1.43)	0.71
6b	1.56 ± 0.97 (1.50–1.62)	1.82 ± 1.14 (1.68–1.97)	**<0.001**
6c	4.47 ± 1.03 (4.40–4.53)	4.46 ± 1.02 (4.33–4.59)	0.93
7	4.74 ± 0.74 (4.69–4.79)	4.72 ± 0.77 (4.62–4.82)	0.71

[a] Independent T-test was used to compare the averages of individuals with and without osteosarcopenia.

Table 3
Short form 12-item component scores among men and women.

Women	Without Osteosarcopenia	With Osteosarcopenia	P-value[a]
	N = 932	N = 289	
PF (Physical Functioning)	40.17 ± 13.21 (39.32–41.02)	38.06 ± 13.19 (36.54–39.59)	**0.01**
RP (Role Physical)	25.41 ± 4.57 (25.12–25.71)	25.32 ± 4.59 (24.79–25.86)	0.76
BP (Bodily Pain)	49.30 ± 12.54 (48.50–50.11)	49.86 ± 11.81 (48.49–51.22)	0.50
GH (General Health)	36.15 ± 10.35 (35.48–36.81)	36.19 ± 10.64 (34.95–37.42)	0.95
VT (Vitality)	54.81 ± 12.88 (53.98–55.63)	53.87 ± 13.10 (52.35–55.39)	0.28
SF (Social Functioning)	50.29 ± 11.27 (49.56–51.01)	50.10 ± 12.05 (48.70–51.49)	0.80
RE (Role Emotional)	18.05 ± 5.45 (17.70–18.40)	17.90 ± 5.50 (17.26–18.54)	0.68
MH (Mental Health)	52.48 ± 13.98 (51.58–53.38)	51.50 ± 14.41 (49.83–53.17)	0.30
PCS	39.24 ± 8.80 (38.68–39.81)	38.72 ± 8.62 (37.72–39.72)	0.37
MCS	44.12 ± 10.82 (43.43–44.82)	43.75 ± 11.10 (42.47–45.04)	0.61
Men	N = 909	N = 239	
PF (Physical Functioning)	50.90 ± 9.79 (50.27–51.47)	44.35 ± 13.17 (42.67–46.03)	**<0.001**
RP (Role Physical)	28.01 ± 3.42 (27.78–28.23)	26.89 ± 4.16 (26.36–27.42)	**<0.001**
BP (Bodily Pain)	55.27 ± 6.64 (54.84–55.71)	54.50 ± 8.17 (53.45–55.54)	0.12
GH (General Health)	42.07 ± 10.33 (41.40–42.74)	40.30 ± 10.18 (39.00–41.59)	**0.018**
VT (Vitality)	62.19 ± 9.83 (61.55–62.83)	59.53 ± 11.55 (58.06–61.01)	**<0.001**
SF (Social Functioning)	53.97 ± 7.51 (53.49–54.46)	53.77 ± 7.79 (52.78–54.77)	0.71
RE (Role Emotional)	20.43 ± 4.34 (20.15–20.72)	20.21 ± 4.52 (19.63–20.79)	0.48
MH (Mental Health)	59.11 ± 9.69 (58.48–59.74)	59.21 ± 9.36 (58.01–60.40)	0.89
PCS	46.34 ± 6.61 (45.91–46.77)	42.43 ± 8.35 (41.37–43.50)	**<0.001**
MCS	47.64 ± 7.81 (47.14–48.15)	48.66 ± 7.81 (47.67–49.66)	0.07

PCS, physical component summary; MCS, mental component summary.
[a] Independent T-test was used to compare the average component scores of participants with and without osteosarcopenia.

(compared to women) were physical components, including role physical, general health and to a lesser extent vitality.

Component summary analysis was congruent with the former stages, as expected. Physical component summary (PCS) scores among men were the only case significantly affected by osteosarcopenia in the study population.

Univariable and multivariable linear regression models were used to look for potential variables correlated with the PCS and MCS scores. In the multivariable model, female sex, age, and depression were inversely correlated with both PCS and MCS in the osteosarcopenic participants. Depression being identified as a variable inversely related to the PCS and MCS scores is unsurprising, considering its reciprocal relation with almost all the aspects of HR-QoL. Interestingly, the difference in the prevalence of depression among men with and without osteosarcopenia was greater than the same difference among women with and without osteosarcopenia; this could lead to future studies investigating the causes of this difference. Depression and chronic diseases playing prominent roles in the HR-QoL of afflicted individuals is one of the important findings of the study, identifying these 2 as potential targets for potential future public health interventions designed to improve HR-QoL in the older adult population. The PCS score was also correlated with ADL and IADL, which is to be expected, given that the items of both scales encompass physical abilities.

Compared to previous studies which found the prevalence of osteosarcopenia to be much higher in community-dwelling women of age compared to men of the same demographic (up to 64.3%, and 8%–11%, respectively) [27], our study showed only a marginal difference between women and men (23% and 22%, respectively). To the best of our knowledge, a study designed to assess the QoL-related consequences of osteosarcopenia has not been conducted; most of the available literature is on either osteopenia/osteoporosis or sarcopenia, and mortality, fractures and falling events are the prominent sequels associated with osteosarcopenia [27].

The main strength of this study is taking advantage of a large sample of a community-dwelling population, and the novel nature of the questions it addresses, considering that osteosarcopenia is still a newly introduced syndrome and studies in several areas related to it are as of yet lacking.

Also of note, is the dual nature of the syndromes affecting the individual afflicted with osteosarcopenia (both osteopenia/osteoporosis and sarcopenia), which could complicate how one might associate risk factors and consequences with a condition encompassing both of these. Furthermore, the cross-sectional design of this study prevents causal inferences based on the observed results.

Another limitation of the study is in its data collection procedure, considering older adults might not always provide reliable medical history data; furthermore, the variable 'chronic disease' used in the study encompasses several entities as a binary categorical variable, which prevents more precise analysis on comorbidities.

5. Conclusions

Osteosarcopenia is a widespread condition among men and women in the Iranian older adult population. Sex, age, and depression are associated with diminished HRQoL in affected individuals.

Table 4
Regression models for PCS and MCS in patients with osteosarcopenia.

	PCS				MCS			
	Univariable		Multivariable[a]		Univariable		Multivariable[a]	
	P-value	r [95% CI]	P-value	r [95% CI]	P-value	r [95% CI]	P-value	r [95% CI]
Sex	**<0.001**	**3.706 [2.245, 5.167]**	**0.019**	**1.941 [0.314, 3.567]**	**<0.001**	**4.909 [3.234, 6.585]**	**0.015**	**2.124 [0.414, 3.835]**
Age	**<0.001**	**−0.224 [−0.323, −0.12]**	**<0.001**	**−0.207 [−03.12, −0.101]**	**0.002**	**0.183 [0.067, 0.299]**	**0.015**	**0.133 [0.026, 0.240]**
Years of schooling	**0.001**	0.306 [0.134, 0.478]	0.737	−0.031 [−0.218, 0.154]	0.130	0.155 [−0.045, 0.356]	0.592	0.052 [−0.140, 0.245]
BMI	**0.195**	**−0.154 [−0.387, 0.079]**	0.132	−0.170 [−0.393, 0.051]	0.717	0.049 [−0.220, 0.320]	–	–
Diabetes mellitus	0.203	−1.037 [−2.634, 0.560]	–	–	0.139	−1.382 [−3.215, 0.450]	0.446	−0.621 [−2.221, 0.978]
Hypertension	**0.008**	**−2.180 [−3.788, −0.577]**	**0.033**	**−0.134 [−1.669, 1.401]**	0.318	−0.949 [−2.815, 0.916]	–	–
History of fractures	**0.039**	**−2.152 [−4.198, −0.105]**	0.239	−1.158 [−3.087, 0.770]	**0.021**	**−2.775 [−5.139, −0.411]**	0.298	–
Waist circumference	0.419	−0.029 [−0.101, 0.042]	–	–	0.816	0.009 [−0.073, 0.092]	–	–
Chronic disease	**<0.001**	**−4.561 [−6.520, -2.603]**	**<0.001**	**−2.050 [−3.934, -0.166]**	**0.036**	**−2.460 [−4.758, −0.163]**	0.991	−0.011 [−1.985, 1.961]
Disabled (IADL)	**<0.001**	**−5.847 [−7.521, −4.172]**	**<0.001**	**−2.907 [−4.515, −1.299]**	0.526	−0.647 [−2.655, 1.359]	–	–
Disabled (ADL)	**<0.001**	**−8.175 [−9.687, −6.662]**	**<0.001**	**−5.544 [−7.172, −3.916]**	0.999	−0.001 [−1.941, 1.939]	–	–
Depressed	**<0.001**	**−9.078 [−10.959, −7.196]**	**<0.001**	**−6.42 [−8.411, −4.442]**	**<0.001**	**−14.292 [−16.297, −12.286]**	**<0.001**	**−13.465 [−15.498, −11.432]**

PCS, physical component summary; MCS, mental component summary.
BMI, body mass index; ADL, activities of daily living; IADL, instrumental activities of daily living.
[a] Only the subset of variables with a p-value of <0.2 in the univariable regression models were used in the multivariable regression model.

CRediT author statement

Amir Mohammad Vahdani: Writing - Original Draft, Writing – Review & Editing, Visualization. **Mahnaz Sanjari**: Validation, Writing – Original Draft, Writing – Review & Editing. **Noushin Fahimfar**: Writing - Review & Editing, Formal analysis. **Mahbube Ebrahimpur**: Formal Analysis, Writing - Review & Editing. **Gita Shafee**: Investigation, Resources, Data Curation, Writing – Review & Editing. **Kazem Khalagi**: Formal Analysis, Writing – Review & Editing. **Mohammad Javad Mansourzadeh**: Investigation, Resources, Data Curation, Writing – Review & Editing. **Iraj Nabipour**: Investigation, Resources, Data Curation, Writing – Review & Editing. **Bagher Larijani**: Conceptualization, Writing – Review & Editing. **Afshin Ostovar**: Conceptualization, Writing – Review & Editing.

Availability

The data that support the findings of this study are available from Osteoporosis Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Osteoporosis Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran.

Conflicts of interest

The authors declare no competing interests.

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