ORIGINAL ARTICLE

Psychological state, quality of life, and body composition in postmenopausal women with osteoporosis in Lithuania

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Abstract

Summary The objective of this study was to determine body composition, physical activity, and psychological state in postmenopausal women with osteoporosis. Fat mass, lean mass, water mass, and basal metabolic rate are lower, self-reported physical activity and risk factors of fractures are higher, and cognitive functions were worse in osteoporotic patients than in controls. Significant correlations were found between physical activity and emotional state parameters.

Introduction This study aims to determine peculiarities of body composition, physical activity, risk factors predicting fractures, psychological state and quality of life, and possible relations between them in postmenopausal women with osteoporosis in Lithuania.

Methods Thirty-one postmenopausal women with osteoporosis and 29 healthy age- and sex-matched controls were included in the study. Profile of Mood State and Hospital Anxiety and Depression Scale were used for the assessment of emotional state. Trail Making Test and Digit Symbol Test of Wechsler Adult Intelligence Scale were used to evaluate cognitive functioning. Quality of life was evaluated using the World Health Organization Brief Quality of Life Questionnaire. Risk of fractures was assessed by the Risk Factors Predicting Questionnaire.

Results Fat mass (22.4 ± 4.7 vs. 40.6 ± 14.2 kg, $p < 0.001$), lean mass (37.3 ± 6.0 vs. 48.1 ± 7.6 kg, $p < 0.001$), water mass (31.6 ± 2.9 vs. 38.3 ± 5.3 kg, $p < 0.001$), and basal metabolic rate ($1,253 \pm 132$ vs. $1,456 \pm 126$ kcal, $p < 0.001$) were lower in osteoporotic patients than in controls. Self-reported physical activity (2.35 ± 0.6 vs. 1.69 ± 0.5, $p < 0.001$) and risk factors of fractures (5.9 ± 2.1 vs. 2.6 ± 2.4, $p < 0.001$) were higher in women with osteoporosis than in healthy age- and sex-matched controls (2.35 ± 0.6 vs. 69 ± 0.5, $p < 0.001$). Trail making A and B scores were higher in patients than in age- and sex-matched controls (55.8 ± 19.9 vs. 45.1 ± 19.9, $p = 0.07$ and 118.2 ± 34.6 vs. 92.8 ± 48.7, $p = 0.006$). Some significant correlations were detected between physical activity and emotional state and quality of life parameters.

Conclusion In postmenopausal women with osteoporosis, fat body mass, lean body mass, water body mass, basal metabolic rate, and waist-to-hip ratio are lower, physical activity and risk of fractures are higher, and cognitive functions are worse than in age- and sex-matched controls. Some psychological peculiarities could be related to physical activity in women with osteoporosis.

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Introduction

As the population of developed countries age, osteoporosis becomes a significant public health problem [1]. Osteoporosis is a systemic disease in which bone density is reduced, leading to the weakening of the skeleton and increased vulnerability to fractures [2]. It is a widespread disease affecting about 75 million people, mostly postmenopausal women. It is called "the silent disease" since there are very few associated symptoms; osteoporotic fractures are the chief clinical feature with an enormous burden on health-related quality of life and mortality [3].

At the beginning of the osteoporosis studies in Lithuania in 1991–1993, the rate of characteristic osteoporotic fractures in Kaunas region (580,000 inhabitants; 170,000 males and 350,500 females), Lithuania, was found to be 1.60–1.65% in males over 65 years old and 7.52–10.56% in females over 65 years old [4]. Bone mineral density (BMD) measurements for healthy Lithuanian females are not significantly different from the normative Caucasian female reference data both in terms of average values and degree of spread. The Lithuanian women show the expected gradual reduction of BMD with age, after peaking at 20–39. The BMD of Lithuanian women tends to mirror rates of loss established for US/European subjects [5].

Increased likelihood of fracture has often been expressed as relative risk or risk ratio, defined as the ratio of fracture occurrence among individuals with, versus without, a given risk factor. However, relative risk alone is inadequate to express actual outcome frequency. More informative than relative risk is an approach that estimates the absolute risk of an individual with a given constellation of factors [age, sex, body mass index (BMI), prior fracture, parental hip fracture, bone mass density, smoking, and so on]. Data from population-based studies of osteoporotic fractures subjects were used to produce multivariable osteoporotic fractures prediction questionnaire models [6].

Osteoporosis can reduce mobility and may be painful, which can limit everyday activities, can lead to increasing isolation, which has a negative impact upon self-esteem, causes depression, and affects emotional state and quality of life [7, 8]. Quality of life plays an increasingly important role in the evaluation of the impact of osteoporosis. Quality of life may be impaired through the physical disability and psychological and social handicaps resulting from fractures [8].

Depressive symptoms are associated with increased risk of osteoporosis and new fractures even after controlling for other predictive factors [9]. Dual diagnosis of depression and osteoporosis may also mean worse health outcomes [10]. Perceived risk of osteoporosis may lead to decreased physical activity and hence actually decrease physical activity, change body composition, and increase the health-associated risk [11].

Osteoporosis can also cause both social consequences and psychological difficulties for patients with this disease: loss of social roles, failure in social reciprocity, social isolation, loneliness, depression, anxiety, reduced self-worth, and hopelessness. However, the causal direction of relationships between these factors and poor health is unclear. Since 1990, when the coexistence of osteoporosis and depression was first noted in observational studies [1], it is not clear whether osteoporosis can be seen as the causal factor of depression or depression as the outcome of osteoporosis [12]. Although causality is not clear, in addition to low BMI, role limitations due to poor emotional status and low physical functioning are related to low bone mineral content in postmenopausal women [13].

In the study of quality of life in Lithuanian women with osteoporosis, no significant differences were assessed between women with subclinical vertebral fractures and healthy women. Women with one subclinical vertebral fracture showed significantly worse results in pain, social function, and general health perception domains of quality of life [14].

Therefore, a lot is unclear in the relationship between physical status, psychological state, and quality of life, and a lot of data of research studies are quite controversial. But the results imply that, when we are concerned about osteoporosis, we should pay attention not only to the physical function but also to the psychological state of patients [13].

The objective of the study was to determine peculiarities of body composition, physical activity, osteoporotic fracture risk prediction, psychological state and quality of life, and possible relations between them in postmenopausal women with osteoporosis.

Patients and methods

All procedures were carried out with the adequate understanding and written consent of the subjects.

Thirty-one postmenopausal women (average age 69.3± 8.2 years) with osteoporosis (members of a disease-related club) and 29 healthy age- and sex-matched controls (average age 66.2±6.3 years) were included in the study. The inclusion of subjects was random.

Height was measured by stadiometer of international standard "Holtain Limited, Crymic Dyteg" (UK) and weight by electronic weights "Soehnle" (UK). Body composition was evaluated by means of a body composition monitoring unit Bodystat 1500 (UK).

Profile of Mood State (POMS) [15] and Hospital Anxiety and Depression Scale (HAD) [16] were used for the assessment of emotional state. The POMS questionnaire is a sensitive measure of mood. It measures POMS global score and several subscales: tension–anxiety, depression–dejection, anger–hostility, vigor–activity, fatigue–inertia, and confusion–bewilderment. A higher score represents a higher level of certain mood aspect.

Cognitive functioning (evaluation of psychomotor speed) was detected by use of Trail Making Test [17] and Digit Symbol Test of the Wechsler Adult Intelligence Scale [18]. Trail Making Test is a timed test in which the subject connects an altering sequence of numbers (trail making A) or numbers and letters (trail making B) in ascending order. The score on the test, which is based on the time required to

complete the sequence, is a measure of executive function, attention, and visual scanning abilities. Digit Symbol Test is a test in which the subject repeats sequences of numbers in a given order. The score of the test is a number or repeated number sequences in forward order, backward order, and global score (sum of both of them). The test shows attention abilities and psychomotor speed.

Quality of life was evaluated by means of the World Health Organization Brief Quality of Life Questionnaire [19]. It evaluates general satisfaction with health-related quality of life of the subject.

Osteoporotic fracture risk was evaluated by Factors Predicting Osteoporotic Fractures Questionnaire [6], which evaluates risk of fractures according to bone mineral density, age, sex, smoking or not, and physical state of the subject. Physical activity was self-reported by the participants of the study and was evaluated as low, middle, or high.

Descriptive values are given as mean ± standard deviation. The differences between data of the researched group and the control group were compared using Mann–Whitney U test. Correlations were found by means of Pearson test. In all calculations, we considered p values <0.05 as significant and p values <0.09 as tendency.

Results

Table 1 shows the comparison of anthropometric and body composition data in osteoporotic postmenopausal women and sex- and age-matched controls. Body mass index and waist-to-hip ratio of women with osteoporosis were significantly lower than in the controls. Also, all evaluated body composition parameters were significantly lower in osteoporotic patients than in the controls: fat body mass, lean body mass, water body mass, and basal metabolic rate. Physical activity was self-reported by the participants of the

study themselves and was significantly higher in postmenopausal women with osteoporosis than in healthy age- and sex-matched controls. Risk of fractures was significantly higher in osteoporotic postmenopausal women than in healthy controls.

In Table 2, comparison of psychological data and quality of life between osteoporotic patients and healthy women is presented. Significant differences were observed in cognitive functioning but not in emotional state and quality of life. Trail making A and B scores were higher in patients with osteoporosis than in age- and sex-matched controls, showing worse cognitive functioning of osteoporotic women.

Some significant correlations were detected (Table 3) between physical activity and emotional and quality of life parameters. Depression and anxiety correlated negatively and quality of life correlated positively with physical activity.

Discussion

The results of our study confirm that not only BMI, weight, and fat mass are lower in women with osteoporosis than in age- and sex-matched controls but also that lean body mass, water body mass, and waist-to-hip ratio are lower and self-reported physical activity is higher.

It is well known that bone mineral density increases with weight and body fat mass, and obesity has a protective effect against osteoporosis [20, 21]. Some studies indicate that both fat mass and lean mass affect bone density with different physiological and pathological conditions modulating this relationship [22]. Our study confirms that not only weight, BMI, and fat body mass but also lean body mass, water body mass, basal metabolic rate, and waist-to-hip ratio in postmenopausal women with osteoporosis are significantly lower than in age- and sex-matched controls.

The protective effect of higher body weight is explained by a combination of hormonal (peripheral aromatization of

Table 1 Anthropometric, body composition, physical activity, and osteoporotic fracture risk data in postmenopausal women with osteoporosis in comparison to age- and sex-matched controls

	Postmenopausal women with osteoporosis (n=31)	Age- and sex-matched controls (n=29)	p value (Mann–Whitney test)
Age (years)	69.3±8.2	66.2±6.3	NS
Height (cm)	158.5±6.5	159.2±4.6	NS
Weight (kg)	59.7±9.1	86.5±19.2	<0.001
Body mass index (kg/m^2)	23.7±3.1	34.2±7.5	<0.001
Fat body mass (kg)	22.4±4.7	40.6±14.2	<0.001
Lean body mass (kg)	37.3±6.0	48.1±7.6	<0.001
Water body mass (kg)	31.6±2.9	38.3±5.3	<0.001
Basal metabolic rate (kcal)	1253±132	1456±126	<0.001
Waist-to-hip ratio	0.82±0.45	0.86±0.64	0.01
Physical activity	2.35±0.6	1.69±0.5	<0.001
Risk of osteoporotic fractures	5.9±2.1	2.6±2.4	<0.001

NS not significant

Table 2 Psychological and quality of life data in postmenopausal women with osteoporosis in comparison to age- and sex-matched controls

	Postmenopausal women with osteoporosis (n=31)	Age- and sex-matched controls (n=29)	p value (Mann–Whitney test)
Cognitive functioning:			
Trail making A[a]	55.8±19.9	45.1±19.9	0.07
Trail making B[a]	118.2±34.6	92.8±48.7	0.006
Digit symbol, global score[b]	11.0±2.3	10.2±3.1	NS
Emotional state:			
HAD, depression[c]	5.7±3.4	5.1±2.6	NS
HAD, anxiety[c]	6.9±3.6	6.9±3.5	NS
POMS, global score[c]	25.9±31.6	21.9±22.1	NS
POMS, tension–anxiety[c]	7.7±6.3	6.7±5.3	NS
POMS, depression–dejection[c]	12.3±9.7	10.7±6.7	NS
POMS, anger–hostility[c]	8.2±7.2	6.7±6.3	NS
POMS, vigor–activity[d]	−15.2±4.3	−13.3±5.5	NS
POMS, fatigue–inertia[c]	8.6±5.4	7.4±3.9	NS
POMS, confusion–bewilderment[c]	4.6±4.4	3.5±3.6	NS
Quality of life, global score[e]	81.3±10.2	79.7±10.3	NS

NS not significant

[a] The higher score denotes worse cognitive functioning

[b] The higher score denotes better cognitive functioning

[c] The higher score denotes worse emotional state

[d] The higher score denotes better emotional state

[e] The higher score denotes better quality of life

androgens to estrogens in adipose tissue) and mechanical factors (on weight-bearing bone sites), but leptin also probably mediates fat and bone mass [20]. Leptin is an anorexigenic metabolic hormone that is secreted in proportion to fat mass [23] and decreases bone formation [24]. A strong positive correlation between fat mass and serum leptin concentrations has been reported [25].

In our study, results of cognitive functions are worse, risk factors predicting hip fractures are higher, but physical activity is also higher in women with osteoporosis. In addition, we found some correlations between physical activity and emotional state and quality of life scores.

There is convincing evidence that physical activity effectively slows bone loss in postmenopausal women in a dose-dependent manner. An inverse relationship between physical activity and the risk of hip fracture was detected [26]. Physical activity improves balance, co-ordination, muscle strength, and reaction time. All these traits increase the possibility to break a tendency to fall or to protect from the full impact of an actual fall by the arms [27, 28].

In our study, results of cognitive functioning in post-menopausal women with osteoporosis were worse than in age- and sex-matched controls. Other studies show similar results. Women with osteoporosis were found to have poorer cognitive functioning and greater risk to cognitive deterioration [29]. Besides, women with more rapid hip-bone loss were more likely to develop cognitive decline than those who had lower rate of loss (or who gained bone mass) [30]. Cognition modified the association between BMI and hip fracture in a large cohort of older persons. Though underweight (BMI<22) individuals were at greater risk of hip fracture, the risk was greater among persons with lower results of performing cognitive functioning tests. Low cognition has been shown to compromise the adaptive and coping abilities of older adults to environmental demands or medical stressors. The lack of ability to adapt may translate into less physical activity, poor adherence to treatment regimen, and poor motivation to engage in healthy lifestyles. On the other hand, cognitively impaired older adults who maintain good mobility may reduce their risk of fractures [31].

Probably because of too small sample size or because of the quite active way of life of participants, we did not find significant differences in quality of life or emotional state of osteoporotic patients and healthy controls in contrast to data of other studies.

Health-related quality of life, assessed by generic and osteoporosis-specific instruments, is decreased in patients

Table 3 Significant correlations between physical activity and psychological data

Correlations between		r (Pearson test)	p value (Pearson test)
Physical activity	HAD, depression	−0.270	0.042
Physical activity	HAD, anxiety	−0.301	0.023
Physical activity	POMS, depression–dejection	−0.278	0.033
Physical activity	POMS, global score	−0.263	0.046
Physical activity	Quality of life, global score	0.269	0.041

with vertebral fractures due to osteoporosis as a function of the number of vertebral fractures, presence of comorbid conditions, and age [32]. A strong positive association was found between health-related quality of life and post-secondary education, a family history of osteoporosis, and working. Living in long-term care has the most marked negative effect on quality of life [33]. Although the quality of life does not correlate with bone mineral density, it is markedly influenced by the presence of vertebral fractures, especially recent ones [34, 35].

Women with osteoporosis have the greatest impairments in physical, psychological, and social aspects of quality of life [36].

The long-term physical, psychological, and social consequences affect quality of life, impair social and leisure activities, and may alter emotional status to the extent of causing depression [8].

Osteoporosis, as a chronic illness, influences interpersonal relationships [30]. Since, for many people, the first vertebral fracture occurs without impairment or pain, it usually has no psychosocial effect. When such symptoms as functional disability, pain, and deformity occur, psychosocial functioning diminishes [37].

In the social arena, these include social role loss (roles of the individual and family roles), failure in social reciprocity, and social isolation [38, 39].

The social outcomes often precede other consequential problems, including those in the psychological arena. The two primary psychological issues associated with osteoporosis are anxiety and depression [1].

Anxiety (feelings of apprehension and fear) is a normal emotion that occurs when people face an unknown or threatening situation. Many women experience severe anxiety when they are diagnosed with osteoporosis, especially when an atraumatic, but symptomatic, fracture leads to diagnosis [38]. In the context of osteoporosis, anxiety often leads patients to overexert themselves in making lifestyle changes so that, after a short while, they find themselves overwhelmed and unable to comply with most of the changes [1].

The relationship between osteoporosis and depression is a tantalizing one, yet no longitudinal studies have been conducted that allow researchers to make causal attribution or to really understand the potential interactive mechanisms of the diseases [1]. It was suggested that depression is associated with lower neuroendocrine function and, therefore, lower bone density [40]. In public health terms, both osteoporosis and depression are major problems. Combining them has the potential to create an even worse challenge for individuals [1]. Depressive symptoms were found to be associated with an increased rate of bone loss [41].

Oxidative stress is associated with the risk of osteoporosis [42]. Other risk factors for osteoporosis such as

smoking, hypertension, and diabetes mellitus are also associated with increased oxidative stress and free-radical levels [43].

The main limitation of our study was the relatively small sample size. Another limitation was not assaying hormonal and vitamin D levels in the blood of participants. In addition, we did not evaluate socioeconomic state, presence or absence of other chronic diseases, presence or absence of fractures, diet, and the use of supplements. These limitations are also our guidelines for further research works.

Although the study has some limitations, it revealed many topics in the biopsychological and health-related well-being situation of postmenopausal women with osteoporosis in Lithuania. These results could be important for all the health and social support system specialists giving treatment and support for their patients.

Throughout the last decade, researchers have made clear that not all of the consequences of osteoporosis are skeletal in nature. Focusing on the biopsychosocial nature of osteoporosis becomes more critical as the number of people with this diagnosis increases [1].

In conclusion, in postmenopausal women with osteoporosis of Lithuania, weight, BMI, fat body mass, lean body mass, water body mass, basal metabolic rate, and waist-to-hip ratio are lower, physical activity and risk of fractures are higher, and cognitive functions are worse than in age- and sex-matched controls. Some psychological peculiarities could be related to physical activity in women with osteoporosis, but it needs further investigation.

Conflicts of interest None.

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