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Ali Muslim Raza *, Aqsa Mansoor , Syeda Amber Zahra

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Prevalence of Sarcopenia and Its Related Clinical Factors in Postmenopausal Women with Type-1 Osteoporosis

Ali Muslim Raza *, Aqsa Mansoor and Syeda Amber Zehra

Department of Rehabilitation Sciences, Faculty of Medicine and Allied Health Sciences, The University of Faisalabad

* Correspondence: alimuslimraza1@gmail.com

Abstract: Background: Sarcopenia is a progressive muscle disorder characterized by muscle wasting, decreased strength, and a substantially elevated risk of developing severe and potentially life-threatening health complications. For decades, muscle wasting has been recognized as a clinical symptom in various severe diseases and conditions. However, with increasing life expectancy and an aging population, sarcopenia has emerged as a prominent age-related condition in primary care, significantly contributing to disability and mortality rates. **Aim and Objective:** Our goal was to elucidate the clinical characteristics associated with sarcopenia prevalence in postmenopausal women with type 1 osteoporosis. **Materials and Methods:** 370 postmenopausal osteoporosis patients who routinely visited the physiotherapy department at Ali Fatima Hospital were examined in this cross-sectional investigation. Mean age 64.59 ± 5.85 years, it was discovered that the patients' quality of life, postural stability, muscular strength, and balance were related to the existence of sarcopenia. **Conclusions:** In summary, among postmenopausal female patients with type 1 osteoporosis, the incidence of sarcopenia was relatively high (90.35%), affecting quality of life in 39.82% of patients, postural instability in 92.21% of patients, and balance in 39.92% of patients.

Keywords: Sarcopenia; Osteoporosis; Postmenopausal woman; QOL; Postural Instability

Introduction

Sarcopenia is a widespread, advancing condition that impacts skeletal muscles, resulting in reduced muscle bulk and performance, thereby heightening the risk of significant complications. It is widely recognized that a decline in muscle tissue and capability can present as symptoms in various major illnesses, such as cancer, endocrine disorders, rheumatologic diseases, and other systemic conditions. With the rise in life expectancy, sarcopenia is increasingly seen in general practice as an age-related issue, contributing to higher mortality and disability rates. Various international research organizations have created definitions, screening techniques, and diagnostic standards for sarcopenia [1].

The term "sarcopenia" was first introduced in the 1990s. In a 1997 essay, Irwin H. Rosenberg discusses its origins and contemporary importance, highlighting a lecture he gave at a symposium called "Sarcopenia: Diagnosis and Mechanisms" on April 17, 1996, in Washington, DC. The word "sarcopenia" is derived from the Greek words "sarx" (meaning "flesh") and "penia" (meaning "loss") [2].

Sarcopenia is classified as "primary" (age) when age is the sole contributing factor. However, when additional variables are evident, it is categorized as "secondary". The EWGSOP describes three conceptual stages: "presarcopenia," "sarcopenia," and "severe sarcopenia." The "presarcopenia" stage involves a reduction in muscle mass without affecting strength or physical performance, detectable

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only through techniques that accurately measure muscle mass relative to populations. The "sarcopenia" stage is characterized by a loss of muscle tissue, decreased muscle strength, or reduced physical function. Severe sarcopenia is defined when there is a simultaneous presence of decreased muscle mass, reduced muscle strength, and impaired physical performance [3]. Sarcopenia associated with hospitalization, acute sarcopenia, and induced sarcopenia are not attributed to age. Instead, these conditions arise from factors such as activity levels, diet, or illness [4].

Sarcopenia may be caused by systemic illnesses, notably inflammatory conditions like cancer or organ failure. Physical inactivity, whether due to a sedentary lifestyle, immobility, or disability resulting from illness, can also contribute to sarcopenia. Furthermore, insufficient intake of protein or calories, which may arise from conditions like anorexia, malabsorption, restricted eating patterns, or inadequate access to nutritious foods, can play a role in the development of sarcopenia [5].

Sarcopenia is associated with several risk factors, including age, gender, and physical activity levels. Resistance exercise is particularly effective in mitigating the skeletal muscle loss associated with aging. Additionally, sarcopenia is linked to major co-morbidities such as osteoporosis, insulin resistance, type 2 diabetes, and obesity [6]. Sarcopenia has been linked to increased risks of cardiovascular disease, mortality, physical disability, and metabolic dysfunction. It often coexists with obesity, leading to a condition known as sarcopenic obesity. This condition primarily affects older individuals who have elevated body fat percentages alongside reduced muscle mass, strength, or quality. Consequently, there appears to be a significant correlation between obesity, metabolic disorders, cardiovascular disease, and mortality in individuals with sarcopenia [7].

Aging is accelerating globally, especially among those over 60. By 2050, the percentage of people over 60 worldwide is expected to increase significantly, rising from 10% to 16% [8]. Between 1990 and 2010, the population over 60 increased by 75.1%, and by 2025, it is predicted to have doubled to 11% [9]. In 1985, the global population consisted of about 9 percent elderly women [10]. By 2015, the number of senior females in Europe had increased by less than 40% [11]. Musculoskeletal problems among the elderly vary by age, geography, and personal circumstances. These issues are prevalent globally but exhibit significant differences between countries. In 2017, musculoskeletal diseases imposed a significant burden, with an estimated 1.3 billion prevalent cases and 138.7 million disability-adjusted life years (DALYs). Age-standardized death rates were reported at 1,720 per 100,000 individuals. Since 1990, there has been a slight decrease in age-standardized prevalence (-1.6 percent) and DALY rates (-3.5 percent) [12].

Sarcopenia becomes more prevalent with age, affecting approximately 14% of individuals aged 65 to under 70, and about 53% of those over 80. According to published definitions, sarcopenia's prevalence ranges from 5% to 14% among people aged 61 to 71, and from 12% to 52% in those aged 80 and above. In the year 2000, there were 600 million adults aged over 60 worldwide. By 2050, the global population is expected to be reached two billion, up from 1.2 billion in 2025. Currently, sarcopenia affects more than 50 million people, with projections indicating that this number will be surpassed by 200 million in the next 40 years based on standard prevalence estimates [13].

The hormonal changes during menopause adversely affect women's musculoskeletal health, heightening their vulnerability to health issues during midlife and beyond. Conditions like osteoporosis, osteoarthritis, and sarcopenia, which involve reduced muscle mass and function, are all associated with estrogen deficiency typical of menopause [14]. Reduced estrogen levels also contribute to decreases in both bone density and muscle strength [15]. As the global population ages, the prevalence of osteoporosis is on the rise. Complications from osteoporosis can lead to significant social and financial burdens, underscoring the importance of early identification. While other imaging modalities allow for the quantification of bone loss, assessment of fracture presence, and study of bone quality, conventional radiography enables semi-qualitative and qualitative evaluation of osteoporosis. In efforts to detect osteoporosis early, advanced imaging techniques such as high-resolution MRI and micro-CT are being utilized [16].

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Materials and Method

This cross-sectional study was conducted at Ali Fatima hospital, Lahore. We enrolled 370 postmenopausal women aged between 55 to 75 years who had been diagnosed with osteoporosis Patients with other types of osteoporosis (i.e., osteoporosis caused by malignant tumors, steroids, hyperthyroidism, and metabolic diseases) were excluded. We also excluded patients with reduced postural stability due to specific diseases, such as cardiovascular disease and vestibular nerve disorders. The study was conducted from 12 February to 5 July 2024, as the frequency of regular visits to Ali Fatima hospital, Lahore, physiotherapy department is generally three months for osteoporosis patients. The inclusion criteria were female sex, age between 55 to 75 years, and ability to fill a self-descriptive questionnaire.

The Chair Stand Test: The Chair Stand test, which involves repeatedly standing up from a seated position within a specified time frame, was utilized to gauge lower body strength and endurance [17].

The EuroQol-5D (EQ-5D) questionnaire was used to evaluate patients' health-related quality of life (QOL) at Jinnah Hospital, Mayo Hospital, and Ali Fatima Hospital. The EuroQoL Group developed this questionnaire, which provides a comprehensive assessment of health-related QOL in several domains, such as mobility, regular activities, self-care, pain/discomfort, and anxiety/depression. There are three degrees of difficulty for each dimension: no issues, moderate problems, and severe problems. Each level is denoted by a distinct five-digit code that represents the person's current state of health. A code such as 1-2-2-3-3, for example, denotes no functional limitations, moderate difficulties with self-management and daily tasks, and significant difficulties with pain/discomfort and anxiety/depression. These five-digit codes are added together to get the EQ-5D index score, which is a value between 5 and 15 that gives a general idea of the patient's overall.

The Berg Balance Scale: This scale is a popular instrument for assessing balance in elderly people and people with balance problems. It comprises of a set of exercises designed to evaluate a person's ability to stay balanced while engaging in a variety of functional motions, including sitting, standing, reaching, and turning [18].

The Romberg Test: An individual's ability to remain balanced while standing still with their feet together and their eyes closed is assessed using the Romberg test. This test can identify anomalies in sensory or proprioceptive function that may impact postural stability. It depends on proprioception and vestibular input to maintain balance [19].

Results

The characteristics of the study participants are summarized in Table 1. A total of 370 women aged between 55 to 75 years (mean age: 64.59 years) were recruited.

Table 1. Characteristics of the study population (n = 370), Marital status, Diagnose of Osteoporosis, DEXA scan, DEXA score.

		Mean	Range	Standard Deviation	Frequency	Percentage
Participant Age (years)		65	25	6		
Marital Status	Married				359	97.0%
	Unmarried				11	3.0%
Age of Menopause (years)		48	10	3		
Diagnose of Osteoporosis	Yes				337	91.1%
	No				33	8.9%
DEXA scan	Yes				342	92.4%
	No				28	7.6%

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DEXA score	-1 to +1				0	0.0%
	-1 to +2.5				14	3.8%
	< 2.5				337	91.1%
	No Scan				19	5.1%

Table 2. Chair Stand Test, Quality of life, Berg Balance Scale, Romberg Test.

		Frequency	Percentage
Chair Stand Test	+ve	334	90.3%
	-ve	36	9.7%
Quality of Life	Severe Problem	147	39.7%
	Moderate Problem	208	56.2%
	Slight Problem	15	4.1%
	No Problem	0	0.0%
	Extreme Problem	0	0.0%
Berg balance Scale	Low Fall Risk	0	0.0%
	Medium Fall Risk	228	61.6%
	High Fall Risk	142	38.4%
Romberg Test	+ve	340	91.9%
	-ve	30	8.1%

Table 3. DEXA Scan and Chair stand test cross tabulation.

DEXA scan * Chair Stand Test Cross tabulation				
Count				
		Chair Stand Test		
		+ve	-ve	Total
DEXA scan	Yes	309	33	342
	No	25	3	28
Total		334	36	370

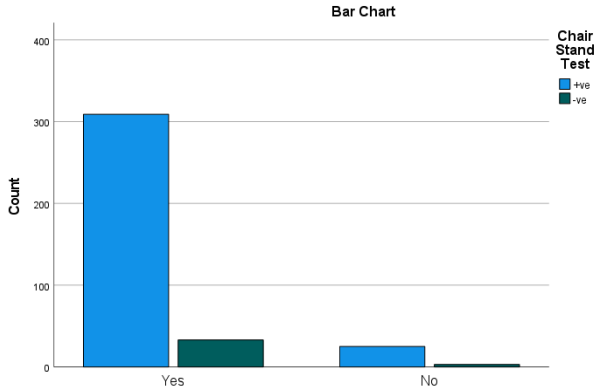

Figure 1. DEXA Scan and Chair stand test. **Result:** The results of the correlation analysis between DEXA scan and Chair Stand Test revealed that 342 participants had osteoporosis, while 309

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participants tested positive for sarcopenia. Notably, the results indicated that approximately 90.35% of the participants (309 out of 342) had sarcopenia.

Table 4. Quality of Life * Chair Stand Test Cross tabulation.

Quality of Life * Chair Stand Test Cross tabulation				
Count				
		Chair Stand Test		Total
		+ve	-ve	
Quality of Life	Severe Problem	133	14	147
	Moderate Problem	188	20	208
	Slight Problem	13	2	15
Total		334	36	370

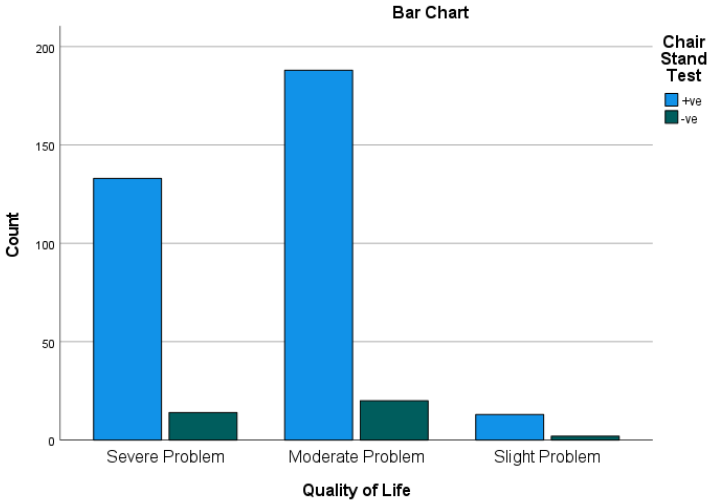

Figure 4. Quality of Life * Chair Stand Test Cross tabulation. **Result:** The results of the correlation analysis between Quality of life and Chair Stand Test revealed that 133 participants had severe problem Notably, the results indicated that approximately 39.82% of the participants (133 out of 334) had affect the quality of life.

Table 5. Romberg Test * Chair Stand Test Crosstabulation.

Romberg Test * Chair Stand Test Crosstabulation				
Count				
		Chair Stand Test		Total
		+ve	-ve	
Romberg Test	+ve	308	32	340
	-ve	26	4	30
Total		334	36	370

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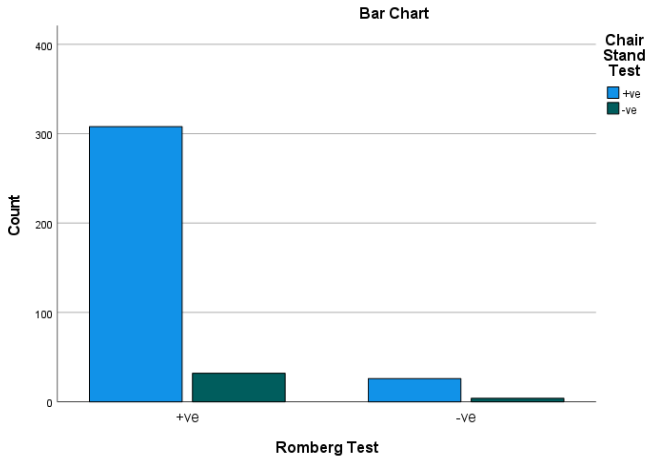

Figure 5. Romberg Test * Chair Stand Test Crosstabulation. **Result:** The results of the correlation analysis between Romberg test and Chair Stand Test revealed that 308 participants had postural instability. Notably, the results indicated that approximately 92.21% of the participants (308 out of 334) had postural instability.

Table 6. Berg balance Scale * Chair Stand Test Crosstabulation.

Berg balance Scale * Chair Stand Test Crosstabulation				
Count				
		Chair Stand Test		
		+ve	-ve	Total
Berg balance Scale	Medium Fall Risk	203	25	228
	High Fall Risk	131	11	142
Total		334	36	370

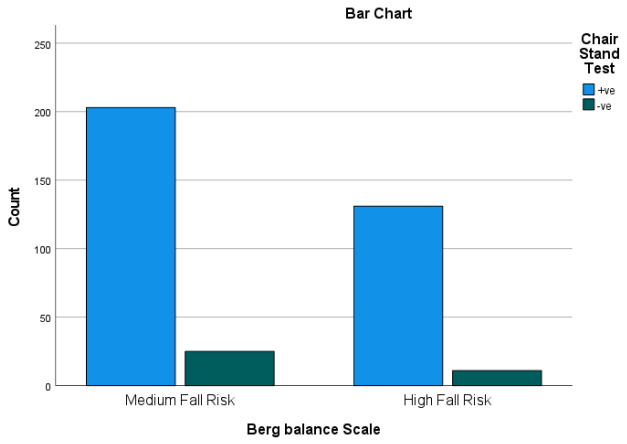

Figure 6. Berg balance Scale * Chair Stand Test Crosstabulation. **Result:** The results of the correlation analysis between Berg balance scale and Chair Stand Test revealed that 131 participants had high fall risk. Notably, the results indicated that approximately 39.22% of the participants (131 out of 334) had balance issues.

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Discussion

Research conducted at the physiotherapy department of the Ali Fatima Hospital in Lahore revealed that sarcopenia was often observed in postmenopausal women with osteoporosis and that it was linked to a history of falls, postural stability, nutrition, and quality of life. The primary cause of musculoskeletal deterioration and loss of functional ability in older adults is sarcopenia. The condition is characterised by a decrease in the amount and quality of skeletal muscle. The frequency of sarcopenia varies by age group [20].

The age range of our study was 55–75, with a mean age of 65. This is in line with other research on sarcopenic older adult populations. Akira Okayama et alstudy .'s from 2022 found sarcopenia in postmenopausal women in several randomly selected age groups. The mean age of the 61 patients was 77.6 ± 8.1 years [21].

The majority of participants in our study were between the ages of 58 and 71, according to the standard deviation of six years, which is also in line with other studies [22].

According to our research, the menopausal mean age in our population was 49 years, with a 3-year standard deviation. This result is in line with earlier research that suggested the average menopausal age was around 46 years [23].The results of this investigation are consistent with other studies showing that osteoporosis and osteopenia are highly prevalent in comparable groups [24]. The majority of patients (90.8%) had DEXA values below 2.5, which is indicative of osteoporosis. This finding is in line with other research that found a significant incidence of osteoporosis in this age range [25]. Additionally, the percentage of patients with osteopenia (3.8%) is consistent with earlier findings [26].

The study's conclusions show that a vast majority of individuals—93.0 percent—did not have any comorbidities, whereas just 6.7% of participants did—having one or more. This implies that most of the subjects had minimal underlying medical issues and were generally in good health.

According to the findings of the Chair Stand Test, a sizable majority of participants (90.0 percent, n=334) had positive test results, suggesting insufficient functional ability and lower extremity strength. This implies that the majority of individuals lacked the functional ability and physical power necessary to get up from a sitting posture on their own.

However, a lesser percentage of subjects (10.0 percent, n=36) had negative test results, meaning that their lower extremity strength and functional ability were unaffected.

The results of this study are in line with earlier studies that have demonstrated lower extremity weakness and functional limits in older persons, which can have major effects on day-to-day functioning [27].

The EQ-5D quality of life assessment results show that among postmenopausal women with osteoporosis, there is a worrying prevalence of severe difficulties in at least one dimension. A considerable influence on their day-to-day life was shown by the almost 40% (39.6%) of individuals who reported having serious issues with their mobility, self-care, pain, regular activities, or sadness.

Furthermore, a majority of the participants (56.1%) reported experiencing moderate problems, suggesting a significant number of symptoms and functional limitations. The low percentage of respondents (4.0%) who expressed modest worries demonstrates how prevalent these issues are in this group of people. These results are in line with other studies that shown osteoporosis in postmenopausal women increases the likelihood of sarcopenia, a disorder marked by a gradual loss of muscular mass, strength, and function [28].

With 91.9 percent (340/370) of the subjects testing positive, the Romberg test findings show a high prevalence of positive results among the participants. On the other hand, 8.1 percent (30/370) of the subjects had negative Romberg test results, which suggests that their proprioception and balance are unharmed.

Most subjects showed deficits in proprioception and balance, which are essential for mobility, postural stability, and functional ability [19].

The high percentage of positive Romberg test findings is in line with other studies that have demonstrated the danger of balance and mobility problems in older persons with osteoporosis [19].

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The study's findings emphasise how crucial it is to identify and treat this population's balance and proprioception issues in order to stop falls and the damage they cause.

The Berg Balance Scale results show a worrisome prevalence of postural instability and fall risk among the participants, with 38.5 percent (142/370) and 61.5 percent (228/370) respectively categorised as moderate and medium fall risk. According to these results, a sizable fraction of participants may be at danger of falling, which can result in severe injuries and disabilities.

This is in line with other studies that have demonstrated that osteoporosis in older persons increases the risk of falls because of decreased muscular strength, mobility, and balance [29].

This research is subject to many limitations. In order to be included, postmenopausal women had to fulfil two requirements: they needed to be older (55–75 years old) and osteoporotic. As a result, women in various age groups might not be able to utilise the findings. Women who need walking assistance were included; however, women who were completely unable to walk or who had other concurrent diseases that may affect muscle mass or function (such as advanced cancer or end-stage renal illness) were excluded. Our study participants Each participant was chosen from the "Ali Fatima Hospital, Lahore" physiotherapy department.

This study has additional benefits. This large group includes over 370 elderly postmenopausal women who have Type-1 osteoporosis. By verifying each and every osteoporosis diagnosis using DEXA scan results, the high calibre of the osteoporosis data was guaranteed. This is the first investigation of the clinical traits linked to the incidence of sarcopenia in postmenopausal women with Type-1 osteoporosis. More studies of this sort will be required to ascertain the frequency of sarcopenia in postmenopausal women with Type-1 osteoporosis and the clinical characteristics linked to it in various age groups and research scenarios.

Conclusions

This study concluded that the prevalence of sarcopenia was 90.35% with affected quality of life in 39.82%, postural instability in 92.21% patients and balance in 39.92% patients respectively.

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