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State of bone mineral density in the female population of the Kyrgyz Republic

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Abstract. Osteoporosis is a progressive disease characterised by a decrease in bone mineral density, increasing bone fragility and risk of fractures. The study aimed to assess prevalence of osteoporosis and identify associated risk factors among postmenopausal women in Bishkek (Kyrgyz Republic). Study included 470 postmenopausal women who had lived in Bishkek (Kyrgyz Republic) for at least 5 years, including residents of Bishkek social care home (a residential care home for elderly). Age of participants ranged from 45 to 89 years, with a mean age of 60.1 ± 14.03 (95% CI 51.49-70.18). All participants were examined upon admission to Multidisciplinary Clinical Hospital No. 2 in Bishkek from July 2023 to August 2024. In postmenopausal women, prevalence of osteoporosis was 20.8%, osteopenic syndrome – 43.0% and normal bone mineral density – 36.2%. Thus, participants with a longer duration of menopause (more than 10 years) and concomitant type 2 diabetes mellitus had a higher prevalence of osteoporosis ($p < 0.05$). Furthermore, participants with a family history of symptoms associated with osteoporosis and bone fractures, as well as with personal history of bone fractures, also had higher prevalence of osteoporosis ($p < 0.05$). Smoking had a negative impact on bone health ($p < 0.026$). Overall prevalence of osteoporosis among postmenopausal women was 20.8%, and osteopenia was 43.0%. Raising awareness and encouraging lifestyle changes may help reduce risk and burden of osteoporosis among women in this age group

Keywords: bone mineral density; ultrasonic densitometry; osteoporosis; women; post-menopause

Introduction

Osteoporosis is a disease characterised by a decrease in bone mineral density (BMD), which leads to bone fragility and increased risk of fractures. Worldwide, osteoporosis causes approximately 8.9 million fractures

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annually, including 1.66 million hip fractures [1]. It is one of leading causes of disability and morbidity among ageing population worldwide, with increasing prevalence in both developed and developing regions. Despite global nature, osteoporosis remains underdiagnosed, undertreated, and underreported, especially in resource-limited settings where health systems often do not include bone health in routine care for women.

Osteoporosis is fourth most significant enemy of humans after cancer, cardiovascular disease and stroke, and prevalence increases with age, therefore one of major health problems in any country due to association with fractures [2]. T-score and Z-score indices are used to quantitatively assess bone mineral density. World Health Organisation (WHO) defines osteoporosis as a BMD that is 2.5 standard deviations (SD) or more below mean peak BMD. T-score shows changes in SD of human bone density relative to maximum BMD in healthy young people, and Z-score also shows changes in SD of human bone density relative to people of similar age, gender, and race. Accordingly, osteoporosis is defined as a T-score <-2.5, and osteopenia as a T-score between -1 and -2.5. Age, gender, race, genetics, low calcium intake, and physical activity all influence bone mass [3].

Menopause is one of most notable causes of osteoporosis. Postmenopausal women lose 3-5% of bone mass annually and are at risk of osteoporosis for 7 years after menopause. Cause of bone loss after menopause is a decrease in oestrogen production by ovaries. Menopausal osteoporosis is substantial as women spend a third of lives with reduced bone mass and increased risk of fractures, and rate of bone loss in first few years of menopause is high [4,5]. Fractures, disability and chronic pain are most common clinical consequences of osteoporosis. Fractures of pelvis, vertebrae and distal radius are most common osteoporotic fractures. These fractures not only cause morbidity but also increase probability of mortality. Mortality rate after a hip fracture in first year is 20% [6]. Screening for osteoporosis in the Kyrgyz Republic has only been actively conducted in last five years [7,8]. These studies addressed different age groups of women and men, including elderly and senile. However, osteoporosis in postmenopausal women remains largely unexplored. The study aimed to assess prevalence of osteoporosis and identify associated risk factors among postmenopausal women in Bishkek (Kyrgyz Republic).

Materials and Methods

Study included 470 postmenopausal women who had lived in Bishkek (Kyrgyz Republic) for at least five years, including residents of Bishkek social care home (a residential care home for elderly). Age of participants ranged from 45 to 89 years, with a mean age of 60.1 ± 14.03 (95% CI 51.49-70.18). All participants were examined upon admission to inpatient treatment at Multidisciplinary Clinical Hospital No. 2 in Bishkek, from July 2023 to August 2024. All women who did not consent to participate and who were under 45 years of age, as well as women with chronic liver failure, renal failure, malignant neoplasms, deafness, and mental illness, were excluded from study.

A structured questionnaire was used to collect data (age, education, marital status, abortions, breastfeeding, smoking/ever using tobacco). This questionnaire included characteristics of menstruation (age at menarche, duration, age at menopause and duration of menopause); personal and family history related to osteoporosis (symptoms of osteoporosis in the family, history of bone fractures in the family and personally in the patient); clinical and laboratory data (body mass index, kg/m^2) and physical activity. In addition, the questionnaire included questions about chronic diseases, including the most common chronic diseases of a non-infectious nature. Bone tissue condition was assessed using quantitative ultrasound scanning (QUS), which uses ultrasound waves to assess bone mineral density and structure and can detect osteopenia and osteoporosis, especially in peripheral areas (heel, wrist, forearm).

This study used a portable ultrasound device from the South Korean manufacturer OsteoSys – SONOST-3000 (OsteoSys Co., Ltd, Seoul, Korea). Every day, after turning on the equipment and before starting data collection, quality control tests were performed using a standard phantom in accordance with the manufacturer's protocol, which helped to avoid errors in the results. All measurements were taken by one researcher during one working day, at the same temperature in the research room. Right heel bone was selected for study. Statistical processing of research results was conducted using SPSS program, version 16.0 for Windows. Relative values were calculated. Student's T-test was used to calculate reliability of the differences in mean values of results obtained. Differences were considered significant when probability reached $p < 0.05$. Study was conducted following requirements of Helsinki Declaration [9]. Study was approved by an independent bioethics committee at Kyrgyz State Medical Academy named after I.K. Akhunbaev (protocol No. 15 of 21 February 2023).

Results

In this study, 54.7% of participants were aged under 60. Half of the participants (51.9%) had only primary education. 90.4% of participants were married, and 37.7% had six or more children. Approximately one-tenth of the participants (11.3%) had a history of more than two abortions, 79.2% reported that they had breastfed their children, and 14.5% continue to smoke at present (Table 1).

Average age of menopause onset among study participants was 14.07 ± 1.73 years. Average duration of menstrual cycle among the study participants was

42.31 ± 4.11 years. Age of menopause onset in 77.7% of study participants was after 45 years of age, and duration of menopause at time of inclusion exceeded 10 years in 46.8% of participants (Table 2).

Table 1. Key characteristics of study participants

Variables	Absolute number	Percentage	P
Age group (years): ■ <60 ■ ≥60	 247 223	 52.55 47.44	=0.327
Education: ■ primary ■ secondary ■ higher	 122 198 150	 25.9 42.1 31.9	<0.023
Family status: ■ married ■ divorced or widowed ■ not married	 271 63 136	 57.7 13.4 28.9	<0.017
Kids: ■ 2 or fewer ■ -3-5 ■ 6 or more	 41 325 104	 8.7 69.1 22.1	<0.02
Abortions: ■ none ■ 1-2 ■ >2	 421 33 16	 89.6 7.0 3.4	<0.021
Breastfeeding: ■ yes ■ no	 453 17	 96.4 3.6	<0.013
Smoking history: ■ yes ■ no	 11 459	 15.7 84.3	<0.001

Note: p < 0.05 – reliable when comparing the results obtained
Source: compiled by the authors

Table 2. Characteristics of the menstrual cycle of study participants

Variables	n (%)
Age at first menstruation (years), mean ± standard deviation	14.07 ± 1.73
Duration of menstruation (years), mean ± standard deviation	42.31 ± 4.11
Age at onset of menopause (years): ■ before 45 years ■ after 45 years	 105 (22.3) 365 (77.7)
Duration of menopause (years): ■ ≤5 ■ 6-10 ■ >10	 143 (30.4) 107 (22.7) 220 (46.8)

Source: compiled by the authors

Almost half of participants (44.9%) were overweight, and 59.1% of participants were taking statins. 60% of patients suffered from arterial hypertension, and 10.2% had type 2 diabetes mellitus. Family history of osteoporosis symptoms was present in 25.3% of participants, and a family history of bone fractures was present in 18.9% (Table 3).

Ultrasound densitometry data were also analysed. According to proposed diagnostic criteria for osteoporosis, which are based on a decrease in bone mineral density, a T-score of -1.0 and above indicates normal BMD values; a T-score of -1.0 to -2.5 was considered "osteopenic syndrome"; and a T-score of -2.5 and below in presence of one or more fractures was considered osteoporosis. Thus, average T- and Z-criteria values within the normal range (-0.387 and -0.318, respectively) were observed in 170 patients; average T-criteria (-1.511) and Z-criteria (-1.605) values, which corresponded to osteopenia, were observed in 202 patients. Lastly, average values of T- and Z-criteria (2.4 and -2.5, respectively) confirmed osteoporosis in 98 patients (Table 4).

Table 3. Clinical characteristics and family history of study participants

Variables	Absolute number	Percentage	Value p
BMI (kg/m²):			
■ low	47	10.0	<0.015
■ normal	151	32.1	
■ overweight	211	44.9	
■ obesity	61	13.0	
Physical activity:			
■ yes	143	30.4	<0.021
■ no	327	69.6	
Diabetes:			
■ yes	48	10.2	<0.001
■ no	422	89.8	
Hypertension:			
■ yes	282	60.0	<0.024
■ no	188	40.0	
Calcium intake (mg/day):			
■ not consumed	318	67.7	<0.002
■ <600	83	17.7	
■ 600-1,000	42	8.9	
■ >1,000	27	5.7	
Use of statins:			
■ yes	278	59.1	<0.042
■ no	192	40.9	
Use of vitamin D3:			
■ yes	277	58.9	<0.044
■ no	193	41.1	
Vitamin D3 level (ng/ml):			
■ norm	88	18.7	<0.021
■ insufficient	225	47.9	
■ deficiency	157	33.4	
Family history related to symptoms of osteoporosis:			<0.022
■ yes	119	25.3	
■ no	351	74.7	
Family history of fractures due to bone fragility:			<0.017
■ yes	89	18.9	
■ no	381	81.1	
History of fractures due to bone fragility:			<0.04
■ yes	71	15.1	
■ no	399	84.9	

Note: $p < 0.05$ – reliable when comparing the results obtained
Source: compiled by the authors

Table 4. Prevalence of osteoporosis and osteopenia among study participants according to ultrasound bone densitometry

Prevalence	Absolute count	Percentage
Norm	170	36.2
Osteopenia	202	43.0
Osteoporosis	98	20.8

Source: compiled by the authors

To confirm results obtained by ultrasonic densitometry, patients with osteoporosis underwent dual-energy X-ray absorptiometry (DXA), which is considered an accurate, rapid, and non-invasive method for diagnosing bone density (osteodensitometry), which uses low-dose X-rays to determine mineral composition of bones. DXA performed on 67 (70.4%) of 98 patients in femoral neck (hip joint) and lumbar spine (vertebrae L1-L4) confirmed osteoporosis in all patients. Table 5 below shows only those variables that are significantly associated with osteoporosis. Thus, in study participants with a longer duration of menopause, namely more than 10 years, and with concomitant type 2 diabetes mellitus, prevalence of osteoporosis was significantly higher ($p < 0.05$).

Table 5. Relationship between the prevalence of osteoporosis and various characteristics of study participants

Variables	Osteoporosis (n = 98), n (%)	Norm (n = 372), n (%)	Value p
Age group (years): ■ <60, n=247 ■ ≥60, n=223	 33 (13.4) 65 (29.1)	 214 (86.6) 158 (70.9)	<0.017
Smoking history: ■ yes, n=11 ■ no, n=459	 7 (63.6) 91 (19.8)	 4 (36.4) 368 (80.2)	<0.002
Physical activity: ■ yes, n=143 ■ no, n=327	 21 (14.7) 77 (23.5)	 122 (85.3) 250 (76.5)	<0.019
Age at onset of menopause (years): ■ before 45 years, n=105 ■ after 45 years, n=365	 12 (11.4) 86 (23.6)	 93 (88.6) 279 (76.4)	<0.021
Duration of menopause (years): ■ ≤5, n=143 ■ 6-10, n=107 ■ >10, n=220	 15 (10.5) 17 (15.9) 66 (30.0)	 128 (89.5) 90 (84.1) 154 (70.0)	<0.013
Diabetes: ■ yes, n=48 ■ no, n=422	 43 (89.6) 55 (13.0)	 5 (10.4) 367 (87.0)	<0.001
Family history related to symptoms of osteoporosis: ■ yes, n=119 ■ no, n=351	 56 (47.1) 42 (12.0)	 63 (52.9) 309 (88.0)	<0.002
Family history of fractures due to bone fragility: ■ yes, n=89 ■ no, n=381	 30 (33.7) 68 (17.8)	 59 (66.3) 313 (82.2)	<0.027
History of fractures associated with brittle bones: ■ yes, n=71 ■ no, n=399	 20 (28.2) 78 (19.5)	 51 (71.8) 321 (80.5)	<0.033

Note: $p < 0.05$ – reliable when comparing the results obtained
Source: compiled by the authors

A high prevalence of osteoporosis was observed among study participants who had a family history of disease ($p < 0.05$) and among those who had a history of bone fractures ($p < 0.05$).

Discussion

Postmenopausal osteoporosis is a common public health problem, although it is often neglected. It is characterised by low bone mass, which leads to increased bone fragility in postmenopausal women [6]. Several scientific studies have shown that many lifestyle factors contribute to the decline in bone mineral density and the development of osteoporosis in postmenopausal women [4]. Risk factors for postmenopausal osteoporosis vary by region and have been well studied in Caucasian and Asian women [4,5,10]. Risk factors in African American women are similar to those in their Caucasian counterparts [10].

A range of studies have been conducted in the Kyrgyz Republic concerning a specific category of patients. According to F.E. Imanalieva *et al.* [7], prevalence of osteoporosis in different age groups was 3% in 20-29 age group, 5% in 30-39 age group, 10% in 40-49 age group, 15% in 50-59 age group, 19% in 60-69 age group, 23% in 70-79 age group, and 31% in 80+ age group. A study of prevalence of osteoporosis in older age groups by T.J. Tagaev *et al.* [8] demonstrated that in middle age group (40-59 years), osteoporosis was 23.4%, in older people (60-74 years) it was 38.6%, and in elderly group (75-90 years) it was 51.2%. Results indicated a high prevalence of osteoporosis with age, especially in women. However, there are no data on prevalence of osteopenia, osteoporosis, and risk factors for postmenopausal osteoporosis in Kyrgyz women, whose lifestyle and environmental factors differ from those in West.

According to literature, prevalence of osteopenia and osteoporosis varied across different regions and countries. In a study by A. Bener & N.M. Saleh [11] among postmenopausal Qatari women, osteopenia and osteoporosis were found in 15.9% and 29.3% of women, respectively. In another study by R. Gupta *et al.* [12] conducted among 2,296 postmenopausal Kuwaiti women, prevalence of osteoporosis was 19.3%, and osteopenia was 45.6%. In a cross-sectional study

involving 3,359 Chinese postmenopausal women, osteoporosis was found in 9.65% and osteopenia in 27.09% of women [13]. Prevalence of osteoporosis among Canadian women aged 50 and older is 15.8% [14]. A similar study in Lagos (Nigeria) showed a prevalence of osteoporosis of 20.2% [15].

Prevalence of osteoporosis was high (20.8%) among postmenopausal women. Thus, high prevalence of osteoporosis in peri- and postmenopausal women is a substantial public health problem. A total of 18.9% of respondents reported a history of fractures due to bone fragility. In these populations, BMD and other risk factors can be used to identify high-risk patients, and since effective treatments are available, many of these fractures can be prevented. Implementation of WHO technical report, assessment of osteoporosis at primary health care level, and corresponding FRAX web tool are substantial steps towards improving identification of patients at high risk of fractures worldwide [16]. Osteoporosis risk assessment tool developed by S. Sharma & S. Khandelwal [17] may be effective in Kyrgyzstan, where they used a combination of a questionnaire and ultrasound measurement of BMD. In a study by S. Nikose *et al.* [18], a total of 3,532 female patients were examined. They noted that a significant proportion of study population had lower bone mineral density (BMD), indicating osteoporosis, and that this had a statistically significant correlation with their socio-economic status, literacy level and emotional support from their family. Although DEXA scanning is considered as gold standard for assessing BMD [19-21], it is considered inaccessible in many countries, including Kyrgyzstan, due to high cost and lack of appropriate equipment. Despite ongoing regional studies in Kyrgyz Republic recommending regular screening to identify this hidden epidemic, in practice, this is ineffective as many women are unaware of it due to low literacy rates and insufficient support from their families. Study noted that women eat last, eating what is left after husbands, children and mothers-in-law, if they live together. This practice is deeply ingrained in the culture, and despite repeated advice and counselling, it has been difficult to change. High prevalence of osteoporosis correlates inversely with increasing age, postmenopausal period, low level of education, frequent childbirth, low socioeconomic status, and poor nutrition. Even in developed countries, there is still no officially accepted policy of population screening to identify individuals with osteoporosis. Patients were identified using an individualised search strategy based on a history of distal radius or hip fracture or presence of significant clinical risk factors. Not all risk factors lead to fractures due to their association with low bone mineral density; they may independently increase the risk of fractures.

Conclusions

In this study, the overall prevalence of osteopenia and osteoporosis in postmenopausal women was 43.0% and 20.8%, respectively. The results of this study and previous studies clearly indicated an urgent need for collective efforts to address the growing problem of osteoporosis in postmenopausal women. A multifaceted approach is needed to combat this disease, including educational activities, lifestyle changes, and appropriate hormone treatment. Lifestyle changes include dietary measures and regular physical activity, such as morning and evening walks and doing household chores. Regular consumption of calcium-rich foods such as milk and dairy products, calcium tablets, vitamin D supplements, soy products and almonds is substantial for maintaining bone renewal. Through education and specific preventive measures, the importance of these factors for bone health should be emphasised from an early age.

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Conflict of Interest

None.

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