HEALTH BELIEF MODEL – MALE OSTEOPOROSIS: A CROSS-SECTIONAL STUDY

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SUMMARY

Objectives: The aim of this study is to examine the knowledge levels, beliefs, and self-efficacies of men regarding osteoporosis according to the health belief model.

Methods: Men aged 55 years and older were included in the study. After the descriptive characteristics of the participants were recorded, the Male Osteoporosis Knowledge Quiz, Osteoporosis Health Belief Scale, Osteoporosis Self-Efficacy Scale, and Osteoporosis Knowledge Test were administered to the participants face-to-face.

Results: A total of 435 men with an average age of 67.3 ± 0.4 years participated in the study. When the participants were categorized according to age subgroups, it was found that marital status ($p = 0.002$), economic status ($p = 0.016$), and education level ($p < 0.001$) differed with age. The results of the osteoporosis-specific measurement tools used in data collection also differed with age ($p < 0.05$). It was observed that men's levels of osteoporosis knowledge decreased with increasing age ($p < 0.05$). The lowest scores for the exercise benefits and health motivation subdimensions of the Osteoporosis Health Belief Scale and the Osteoporosis Self-Efficacy Scale were obtained from the subgroup that included the oldest participants ($p < 0.05$). The highest scores for the calcium barriers subdimension of the Osteoporosis Health Belief Scale were obtained from younger participants ($p = 0.036$). The level of osteoporosis knowledge showed a low-to-moderate correlation with each question of the Osteoporosis Health Belief Scale ($p < 0.05$). Age, education, associating the role of physiotherapy with primary-secondary treatment approaches, and health beliefs were the factors that affected the osteoporosis knowledge levels of the participating men ($p < 0.05$).

Conclusions: The knowledge of osteoporosis and preventive beliefs and behaviours of men need to be increased. Knowledge and perceptions of susceptibility to osteoporosis should be developed in men with appropriate education from an early age. We recommend that exercise and physiotherapy approaches should be utilized to a greater extent, especially for individuals in the at-risk age range.

Key words: male, osteoporosis, knowledge, health belief

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INTRODUCTION

Osteoporosis is an insidious disease that causes an increase in the risk of bone fractures as bone mineral density decreases with progressing age (1). Osteoporosis is often perceived as a disease prevalent among post-menopausal women (2). This is due to bone diameters being smaller in women, their peak bone mass being less, their sex hormones changing relatively earlier due to menopause, and their higher risk of falling (3). Therefore, among women, osteoporotic bone fractures are encountered at an earlier age (3). At the same time, it is predicted that the elderly population will increase as life expectancy at birth increases day by day; in parallel, osteoporosis and osteoporosis-related bone fractures will be encountered more often (4). In this context, while the estimated annual number of hip fractures in Turkey in 2009 was 24,000, this number is expected to reach 64,000 in 2025 (5). Worldwide estimations predict that the rate of hip fractures due to osteoporosis will increase by 89% in 2025 compared to 2000 (1).

The observed prevalence of osteoporosis in men over the age of 50 is 5–7% and the incidence of osteoporotic fractures in men is 39% (2, 3, 6). Osteoporotic hip fractures in men typically develop 10 years later than those seen in women (6, 7). The risk of fracture increasing with age is unsurprising, and it increases significantly after the age of 80 in men. This, in turn, leads to a high mortality rate among men following osteoporotic fractures (8).

A decrease of −2.5 standard deviation or more in bone mineral density compared to young adults as determined by bone mineral density measurements of the hip and/or vertebral regions using dual energy X-ray absorptiometry (DEXA) is a sufficient finding for the diagnosis of osteoporosis (8). In this context, all men above the age of 70 should have DEXA bone mineral density screening tests (6, 8). Moreover, men above the age of 50 who have secondary osteoporosis risks such as hypogonadism, hypercalciuria, nutritional deficits, a family history of fragility fractures, a family history of osteoporosis, long-term use of medications that negatively affect bone density, and smoking or alcohol use are recommended to undergo DEXA bone mineral density screening tests (6, 8). According to the results of a previous study, 16% of men between the ages of 50–69 and 46% of men over the age of 80 are diagnosed with osteoporosis following DEXA screening (9). However, it is also known that men often do not comply with screening tests for osteoporosis and many of them continue their

lives without diagnosis and treatment (10, 11). It is also known that health professionals may diagnose male osteoporosis later or experience problems in the implementation and continuity of planned osteoporosis treatments for male patients (12, 13).

The study of osteoporosis through gender-based approaches has been a problem noted in both the literature and clinical practice. As a result of such approaches, data on male osteoporosis has remained relatively limited (14, 15). Considering this information, preparing an action plan to carry out studies to determine the level of knowledge that men have regarding osteoporosis and to eliminate information deficiencies, if any, is necessary. Various theories and models, and especially the health belief model, are often used to provide solutions to preventable public health problems such as osteoporosis and to develop educational programmes (16).

The aim of this study was to examine the knowledge levels, beliefs, and self-efficacies of men over the age of 55 living in Isparta province, Turkey, regarding osteoporosis according to the health belief model.

MATERIALS AND METHODS

Male patients who were not applying to our hospital for the diagnosis and/or treatment of osteoporosis (such as hyperopia, pharyngitis, hyperlipidaemia, hypertension, etc.) and men who were accompanying patients for any reason, aged ≥ 55 years, were included in the study. The participants' demographic data and their results for the Male Osteoporosis Knowledge Quiz, Osteoporosis Health Belief Scale, Osteoporosis Self-Efficacy Scale, and Osteoporosis Knowledge Test were recorded. Data collection was carried out face-to-face by a survey administrator trained in research and data collection tools.

Measurement Tools

Male Osteoporosis Knowledge Quiz: The Male Osteoporosis Knowledge Quiz, the validity of which was examined by Gaines et al., consists of 6 questions about osteoporosis specifically targeting men. Correct answers to the questions are scored with 1 point each, while 0 points are given for wrong answers. An "I don't know" option also exists in this quiz for those who do not know the answers to the questions. An increase in the total score obtained indicates an increase in the level of knowledge (17).

Osteoporosis Health Belief Scale: The Osteoporosis Health Belief Scale, which was developed by Kim et al., examines people's health beliefs regarding osteoporosis. The scale consists of a total of 42 questions and 7 subdimensions (18). A minimum of 6 points and a maximum of 30 points can be obtained from each subdimension, which are "susceptibility," "seriousness," "exercise benefits," "calcium benefits," "exercise barriers," "calcium barriers," and "health motivation." Total scores range from 42 to 210 points. The scale was previously adapted to the Turkish language (19). A high score positively affects the individual's health-protective and improving behaviours (19).

Osteoporosis Self-efficacy Scale: This scale, which was developed by Kim et al., evaluates individuals' self-efficacies regarding exercise and calcium intake (20). In this context, the scale consists of a total of 12 questions and 2 subdimensions, which are "exercise" and "calcium intake." A minimum of 0 points and a maximum of 600 points can be obtained from each subdimension. Total scores range from 0 to 1,200 points. The scale was previously adapted to the Turkish language (19). An increase in score indicates an increase in perceived confidence in taking calcium and exercising to prevent osteoporosis (19).

Osteoporosis Knowledge Test: The original version of this test, developed to measure osteoporosis-specific exercise and calcium knowledge, consists of 24 questions (20). The test can be scored with 2 separate dimensions, which are the Osteoporosis Physical Activity Knowledge Test (0–16 points) and Osteoporosis Calcium Knowledge Test (0–17 points). The scale was previously adapted to the Turkish language (19). Since it is stated in the Osteoporosis Knowledge Test that items specifically targeting women could be altered and only men were included in the present study, the 2nd and 7th questions of the original test were removed. The Osteoporosis Knowledge Test is scored between 0 and 24. The Osteoporosis Physical Activity Knowledge Test scores between 0 and 16. The Osteoporosis Calcium Knowledge Test is scored between 0 and 17. A high score means that the individual has a good level of osteoporosis knowledge (19).

Ethical Approval

This study was approved by the Ethics Committee of Suleyman Demirel University Health Sciences (23 February 2022, No. 55/1). Informed consent form was obtained from all men who participated in the research.

Power Analysis for Sample Size

Through the power analysis (confidence level 95%, precision rate 0.05) conducted to determine the sample size, it was found that at least 385 male participants were required for this study.

Statistical Analysis

The analyses of this study were conducted using IBM SPSS Statistics 23 (IBM Corp., Armonk, NY, USA). Skewness-Kurtosis and Shapiro-Wilk tests were used to examine the compliance of the data with normal distribution. First, descriptive statistical analyses were performed. The Kruskal-Wallis test and Monte Carlo corrected chi-square test were used to analyse differences in the parameters evaluated according to age groups. The Dunn-Bonferroni test was used to determine the groups that showed differences according to the Kruskal-Wallis test. The correlations of the results obtained from the measurement tools to be evaluated according to the health belief model were examined by Spearman's correlation test. Multiple linear regression analysis with the backward elimination method was used to determine the factors affecting the Male Osteoporosis Knowledge Quiz scores. A statistically significant rate of $p < 0.05$ was considered, and $r = 0.20–0.39$ was evaluated as a weak correlation, $r = 0.40–0.59$ as a moderate correlation, $r = 0.60–0.79$ as a high correlation, and $r = 0.80–1,00$ as a very high correlation. Data were presented as frequency (n), rate (%), and median ± standard error.

Table 1. *Descriptive characteristics of participants (N = 435)*

	All n = 435 n (%)	Group 55–59 n = 83 n (%)	Group 60–64 n = 113 n (%)	Group 65–69 n = 91 n (%)	Group 70–74 n = 62 n (%)	Group 75–79 n = 30 n (%)	Group 80–84 n = 33 n (%)	Group over 85 n = 23 n (%)	p-value
Age (years), mean (SD)	67.3 (0.4)	57.2 (0.2)[a]	61.9 (0.1)[b]	66.8 (0.2)[c]	71.7 (0.2)[d]	76.8 (0.5)[e]	81.8 (0.3)[f]	87.4 (0.5)[g]	<0.001*
Body mass index (kg/m^2), mean (SD)	26.8 (0.2)	27.0 (0.4)	26.2 (0.3)	26.7 (0.3)	26.6 (0.5)	26.9 (0.8)	27.3 (0.6)	29.5 (1.4)	0.198
Marital status									
Married	296 (68.0)	64 (77.1)[a]	82 (72.6)[a]	67 (73.6)[a]	39 (62.9)[a,b]	20 (66.7)[a,b]	16 (48.5)[a,b]	8 (34.8)[b]	0.002*
Single	139 (32.0)	19 (22.9)[a]	31 (27.4)[a]	24 (26.4)[a]	23 (37.1)[a,b]	10 (33.3)[a,b]	17 (51.5)[a,b]	15 (65.2)[b]	
Economic status									
Income < expense	108 (24.8)	13 (15.7)[a]	29 (25.7)[a,b]	21 (23.1)[a,b]	10 (16.1)[a,b]	13 (43.3)[b]	12 (36.4)[a,b]	10 (43.5)[a,b]	0.016*
Income = expense	266 (61.1)	55 (66.2)[a]	64 (56.6)[a]	56 (61.5)[a]	47 (75.8)[a]	16 (53.4)[a]	18 (54.5)[a]	10 (43.5)[a]	
Income > expense	61 (14.1)	15 (18.1)[a]	20 (17.7)[a]	14 (15.4)[a]	5 (8.1)[a]	1 (3.3)[a]	3 (9.1)[a]	3 (13.0)[a]	
Education level									
Illiterate	62 (14.3)	3 (3.6)[a]	8 (7.1)[a]	8 (8.8)[a,b]	9 (14.5)[a,b,c]	9 (30.0)[b,c,d]	12 (36.4)[c,d]	13 (56.5)[d]	<0.001*
Only literate	134 (30.7)	18 (21.7)[a]	27 (23.9)[a]	30 (33.0)[a]	23 (37.1)[a]	15 (50.0)[a]	16 (48.5)[a]	5 (21.7)[a]	
Middle school	66 (15.2)	13 (15.7)[a]	21 (18.6)[a]	15 (16.5)[a]	10 (16.1)[a]	2 (6.7)[a]	4 (12.1)[a]	1 (4.3)[a]	
High school	109 (25.1)	31 (37.3)[a]	33 (29.2)[a]	23 (25.2)[a,b]	14 (22.6)[a,b]	3 (10.0)[a,b]	1 (3.0)[b]	4 (17.4)[a,b]	
University	64 (14.7)	18 (21.7)[a]	24 (21.2)[a]	15 (16.5)[a]	6 (9.7)[a]	1 (3.3)[a]	0 (0.0)[a]	0 (0.0)[a]	
Regular medicament use	109 (25.1)	19 (22.9)	30 (26.5)	27 (29.7)	11 (17.7)	7 (23.3)	10 (30.3)	5 (21.7)	0.711
Participants who have heard the term osteoporosis	184 (42.3)	51 (61.4)[a]	58 (51.3)[a]	40 (44.0)[a,b]	24 (38.7)[a,b,c]	4 (13.3)[c]	4 (12.1)[c]	3 (13.0)[b,c]	<0.001*
Family history of osteoporosis	122 (28.0)	14 (16.9)	21 (18.6)	24 (26.4)	6 (9.7)	1 (3.3)	3 (9.1)	2 (8.7)	0.296
Awareness of bone mineral density test	98 (22.5)	27 (32.5)[a]	33 (29.2)[a]	24 (26.4)[a]	10 (16.1)[a,b]	0 (0.0)[b]	3 (9.1)[a,b]	1 (4.3)[a,b]	<0.001*
Participants who had a bone mineral density test	21 (4.8)	5 (6.0)	8 (7.1)	3 (3.3)	3 (4.8)	0 (0.0)	2 (6.1)	0 (0.0)	0.692
Participants aware of the role of physiotherapy in prevention and treatment of osteoporosis	211 (48.5)	32 (38.6)	62 (54.9)	50 (54.9)	29 (46.8)	12 (40.0)	16 (48.5)	10 (43.5)	0.263

**p-value is significant at the 0.05 level. There is a difference between groups with different exponential letters.*

Table 2. *Results of osteoporosis-specific measurement tools (N = 435)*

	All n = 435 Mean (SD)	Group 55–59 n = 83 Mean (SD)	Group 60–64 n = 113 Mean (SD)	Group 65–69 n = 91 Mean (SD)	Group 70–74 n = 62 Mean (SD)	Group 75–79 n = 30 Mean (SD)	Group 80–84 n = 33 Mean (SD)	Group over 85 n = 23 Mean (SD)	p-value
MOKQ Score	1.5 (0.1)	2.1 (0.2)[a]	1.9 (0.2)[a,b]	1.6 (0.2)[a,b,c]	1.3 (0.2)[b,c]	1.0 (0.3)[c,d]	0.6 (0.2)[d,e]	0.3 (0.1)[e]	<0.001*
OHBS Total Score	136.9 (0.6)	137.6 (1.6)[a,b]	136.1 (1.3)[a,b]	134.6 (1.2)[a,b]	138.9 (1.4)[a,b]	139.5 (1.5)[a]	140.2 (1.3)[a]	133.5 (2.1)[b]	0.016*
OHBS Susceptibility Score	18.5 (0.2)	19.2 (0.4)	18.6 (0.3)	18.1 (0.4)	18.5 (0.3)	18.5 (0.4)	18.4 (0.3)	18.0 (0.6)	0.446
OHBS Seriousness Score	20.3 (0.2)	20.0 (0.5)	20.4 (0.4)	19.8 (0.5)	20.8 (0.5)	20.5 (0.6)	20.6 (0.6)	19.8 (0.7)	0.834
OHBS Exercise Benefits Score	22.6 (0.2)	22.9 (0.6)[a,b]	22.6 (0.4)[a,b]	22.9 (0.4)[a,b]	23.7 (0.4)[a]	22.0 (0.5)[a,b]	21.4 (0.5)[b,c]	19.7 (0.6)[c]	<0.001*
OHBS Calcium Benefits Score	15.2 (0.2)	13.7 (0.6)[a]	14.9 (0.4)[a,b]	14.8 (0.5)[a,b]	15.4 (0.6)[a,b]	16.8 (0.7)[b,c]	18.0 (0.6)[c]	16.1 (0.7)[b,c]	<0.001*
OHBS Exercise Barriers Score	16.0 (0.2)	14.8 (0.5)[a]	15.8 (0.3)[a,b]	15.4 (0.4)[a]	16.4 (0.5)[a,b,c]	17.5 (0.7)[b,c]	17.6 (0.7)[c]	17.8 (0.8)[c]	<0.001*
OHBS Calcium Barriers Score	22.5 (0.2)	23.8 (0.5)[a]	22.0 (0.4)[b]	21.8 (0.4)[b]	22.4 (0.5)[a,b]	22.5 (0.4)[a,b]	23.2 (0.4)[a,b]	21.8 (0.5)[b]	0.036*
OHBS Health Motivation Score	21.9 (0.2)	23.1 (0.5)[a]	21.8 (0.4)[a,b]	21.8 (0.4)[a,b]	21.7 (0.4)[a,b]	21.6 (0.6)[a,b]	21.0 (0.5)[b]	20.3 (0.5)[b]	0.006*
OSES Total Score	757.8 (11.2)	830.0 (24.2)[a]	812.2 (20.2)[a]	773.9 (24.9)[a]	737.6 (25.0)[a,b]	672.0 (39.7)[b,c]	617.0 (33.1)[c,d]	533.9 (55.6)[d]	<0.001*
OSES Exercise Score	358.8 (6.1)	399.0 (13.5)[a]	393.4 (10.5)[a,b]	367.3 (14.1)[a,b]	344.7 (14.6)[b,c]	313.7 (20.1)[c,d]	274.9 (18.6)[d,e]	228.3 (26.5)[e]	<0.001*
OSES Calcium Score	398.9 (5.9)	430.9 (12.5)[a]	418.9 (10.8)[a]	406.7 (13.2)[a,b]	392.9 (13.4)[a,b,c]	358.3 (22.4)[b,c]	342.1 (18.6)[c,d]	305.7 (31.6)[d]	<0.001*
OKT Total Score	8.1 (0.2)	9.8 (0.5)[a]	9.2 (0.4)[a,b]	8.0 (0.4)[b,c]	7.4 (0.5)[c,d]	6.2 (0.7)[d,e]	5.2 (0.5)[e,f]	4.4 (0.7)[f]	<0.001*
OKT Exercise Score	5.0 (0.2)	6.3 (0.3)[a]	5.7 (0.3)[a,b]	5.1 (0.3)[a,b]	4.5 (0.4)[b,c]	3.6 (0.6)[c,d]	3.0 (0.4)[d,e]	2.3 (0.5)[e]	<0.001*
OKT Calcium Score	5.7 (0.1)	6.8 (0.4)[a]	6.5 (0.3)[a,b]	5.3 (0.3)[b,c]	5.2 (0.3)[c]	4.6 (0.6)[c,d]	3.9 (0.4)[d]	3.8 (0.5)[d]	<0.001*

*MOKQ – Male Osteoporosis Knowledge Quiz; OHBS – Osteoporosis Health Belief Scale; OSES – Osteoporosis Self-Efficacy Scale; OKT – Osteoporosis Knowledge Test. *p-value is significant at the 0.05 level. There is a difference between groups with different exponential letters.*

Table 3. *Correlation of knowledge and health belief variables*

		1	2	2a	2b	2c	2d	2e	2f	2g	3	3a	3b	4	4a	4b
1 MOKQ	r	1	**0.201****	**0.232****	**0.131****	**0.235****	**−0.248****	**−0.184****	**0.165****	**0.357****	**0.312****	**0.322****	**0.266****	**0.445****	**0.420****	**0.397****
	p		< 0.001	< 0.001	0.006	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
2 OHBS Total	r		1	**0.430****	**0.539****	**0.483****	**0.273****	**0.223****	**0.430****	**0.501****	**0.107***	0.080	**0.106***	**0.217****	**0.218****	**0.215****
	p			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.026	0.096	0.026	< 0.001	< 0.001	< 0.001
2a OHBS Susceptibility	r			1	**0.234****	0.085	−0.007	−0.009	0.070	**0.176****	**0.121***	**0.146****	0.080	**0.131****	**0.159****	**0.113***
	p				< 0.001	0.078	0.884	0.850	0.145	< 0.001	0.012	0.002	0.095	0.006	0.001	0.018
2b OHBS Seriousness	r				1	**0.190****	**0.130****	−0.034	0.094	**0.146****	0.002	0.005	−0.016	**0.123***	**0.150****	**0.104***
	p					< 0.001	0.007	0.484	0.051	0.002	0.960	0.920	0.739	0.010	0.002	0.031
2c OHBS Exercise Benefits	r					1	**−0.236****	**−0.302****	**0.420****	**0.390****	**0.261****	**0.209****	**0.267****	**0.435****	**0.368****	**0.421****
	p						< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
2d OHBS Calcium Benefits	r						1	**0.372****	**−0.343****	**−0.190****	**−0.348****	**−0.309****	**−0.344****	**−0.211****	**−0.166****	**−0.217****
	p							< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
2e OHBS Exercise Barriers	r							1	**−0.171***	**−0.212****	**−0.235****	**−0.203****	**−0.241****	**−0.346****	**−0.278****	**−0.293****
	p								< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
2f OHBS Calcium Barriers	r								1	**0.370****	**0.260****	**0.167****	**0.308****	**0.195****	**0.134****	**0.242****
	p									< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	< 0.001
2g OHBS Health Motivation	r									1	**0.331****	**0.312****	**0.302****	**0.332****	**0.314****	**0.295****
	p										< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
3 OSES Total	r										1	**0.933****	**0.922****	**0.366****	**0.348****	**0.303****
	p											< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
3a OSES Exercise	r											1	**0.739****	**0.341****	**0.331****	**0.278****
	p												< 0.001	< 0.001	< 0.001	< 0.001
3b OSES Calcium	r												1	**0.354****	**0.331****	**0.301****
	p													< 0.001	< 0.001	< 0.001
4 OKT Total	r													1	**0.936****	**0.926****
	p														< 0.001	< 0.001
4a OKT Exercise	r														1	**0.826****
	p															< 0.001
4b OKT Calcium	r															1

*MOKQ – Male Osteoporosis Knowledge Quiz; OHBS – Osteoporosis Health Belief Scale; OSES – Osteoporosis Self-Efficacy Scale; OKT – Osteoporosis Knowledge Test. **correlation is significant at the 0.01 level (2-tailed); *correlation is significant at the 0.05 level (2-tailed).*

RESULTS

A total of 435 men with an average age of 67.3 ± 0.4 years participated in the study. Age grouping in the study was made by taking into consideration the level-up periods (mean 5 years) of the education system in our country (21). When the participants were categorized according to age subgroups, it was found that marital status ($p = 0.002$), economic status ($p = 0.016$), and education level ($p < 0.001$) differed with age (Table 1).

While all men participating in the study had similar rates of family history of osteoporosis ($p > 0.05$), the rates of familiarity with the term "osteoporosis" and awareness of bone mineral density screening were higher among younger men ($p < 0.001$). The level of knowledge about the role of physiotherapy in the prevention and treatment of osteoporosis was found to be similar across all age groups (Table 1).

It was determined that the results of the osteoporosis-specific measurement tools used for data collection also differed with age (Table 2). The total score obtained from the Male Osteoporosis Knowledge Quiz was low for all participants and all age subgroups, and these scores decreased more as age increased (Table 2).

The differences observed in the subdimensions of the Osteoporosis Health Belief Scale also varied according to age (Table 2). While the group that received the lowest score for the exercise benefits subdimension of the scale was group over 85, the group that received the lowest score for the exercise barriers subdimension was group 55–59. While the group that received the highest score for the calcium benefits subdimension of the scale was group 80–84, the group that received the highest score for the exercise barriers subdimension was group 55–59. While those who received the highest scores from the health motivation subdimension of the Osteoporosis Health Belief Scale were in the younger age group, those who received the lowest scores were in the oldest group (Table 2). Those who received the lowest scores for the exercise and calcium subdimensions of both the Osteoporosis Self-Efficacy Scale and the Osteoporosis Knowledge Quiz were the oldest participants (Table 2). The level of osteoporosis knowledge of these men had a low-to-moderate correlation with each question of the Osteoporosis Health Belief Scale (Table 3).

Table 4. *Factors affecting Male Osteoporosis Knowledge Quiz Score*

Model	Unstandardized coefficients		Standardized coefficients	t	p-value	95% CI for B	
	B	Std. Error	Beta			Lower bound	Upper bound
Age	−0.021	0.008	−0.118	−2.613	0.009*	−0.037	−0.005
Education status	0.278	0.056	0.230	4.930	< 0.001*	0.167	0.388
Inability to correlate the role of physiotherapy in prevention and treatment of osteoporosis	−0.480	0.131	−0.152	−3.659	< 0.001*	−0.738	−0.222
OHBS Susceptibility Score	0.070	0.019	0.145	3.607	< 0.001*	0.032	0.108
OHBS Calcium Benefits Score	−0.032	0.014	−0.093	−2.257	0.024*	−0.059	−0.004
OHBS Health Motivation Score	0.061	0.017	0.146	3.509	< 0.001*	0.027	0.095
OKT Calcium Score	0.076	0.024	0.144	3.145	0.002*	0.028	0.123

*OHBS – Osteoporosis Health Belief Scale; OKT – Osteoporosis Knowledge Test. *p-value is significant at the 0.05 level.*

When the factors affecting osteoporosis knowledge levels were examined, it was determined that knowledge levels decreased as ages increased, but they increased as education levels increased. Knowledge levels were lower among those who did not associate the role of physiotherapy with the prevention and treatment of osteoporosis. It was also found that the scores obtained from the subdimensions of the Osteoporosis Health Belief Scale and Osteoporosis Knowledge Test were factors affecting knowledge levels (Table 4).

DISCUSSION

According to the data obtained in this study, the knowledge of osteoporosis is low among men. This becomes especially pronounced as age increases. While the level of knowledge about exercise benefits decreases as age increases, exercise barriers also increase with age. However, while the level of knowledge on the benefits of calcium intake is lower among younger men, calcium intake barriers are higher. The age group with the lowest health motivation was found to be the oldest age group. The level of knowledge and self-efficacy regarding both physical activity and calcium intake was found to be higher among younger men.

The increasing proportion of the elderly population and the increasing prevalence of osteoporosis in society makes osteoporosis a public health problem and interventions are necessities. In diseases such as osteoporosis that require primary prevention, it is not easy to change the stereotypical habits of individuals and societies (22). When theories and models regarding this issue in the literature are examined, it is seen that the health belief model is widely used in research and necessary action plans have been developed in accordance with this model (10, 23).

According to the health belief model, the adoption of behaviour to prevent a particular disease is based on the level of knowledge, susceptibility, and the seriousness of the subject. Accordingly, benefits and barriers related to that subject become prevalent and determine healthy behaviours and health motivations (16). When osteoporosis in particular is evaluated, the majority of scientific studies conducted to date have focused on women. As a result, knowledge, attitudes, and behaviours regarding osteoporosis have evolved among women to benefit their health (14). Although the number of such studies on this subject involving men is quite limited, knowledge about osteoporosis among men and their health beliefs, especially those in the highest risk group for this disease due to advanced age, should be improved in order to make transition to behavioural actions to prevent the disease (10, 14, 15).

In a study conducted with healthy Chinese men with an average age of 36.4 years, 52% of whom were university graduates, the results of the Facts on Osteoporosis Quiz and the Male Osteoporosis Knowledge Quiz were evaluated in order to determine their levels of osteoporosis knowledge. The participants' total average score for these tests was 10.8 points out of 20 points, and the osteoporosis knowledge levels of this sample, consisting of younger men with high levels of education, was found to be at an intermediate level (22). When the knowledge levels of men with an average age of 40.81 years, 76.6% of whom had a high school education or more, were evaluated by Tung, it was found that participants received an average of 10.8±3.5 points from the Osteoporosis Knowledge Test (24). According to statistics in our country, between 2008 and 2022, the proportion of literate males aged 6 and over in the population increased to 99.3% (25). Given that the level of education in our country has increased over time (25), it is natural that the level of education, especially in the older age group, is low and, in parallel, the level of knowledge is decreasing. Similar to the literature, age, education level, and health belief subdimension scores were factors that affected levels of knowledge in the present study.

Studies comparing gender-specific differences in osteoporosis knowledge are also present in the literature. Qi et al. evaluated the knowledge levels of Chinese participants living as immigrants in the USA who had a mean age of 64.08 ± 9.48 years, and 24.1% of whom were males. These participants were then educated on the subject. The Osteoporosis Knowledge Test results of these participants were initially in the range of 12.08–13.47 points, but the tested knowledge levels showed a significant increase after 2 weeks of education (26). Babatunde et al. evaluated the knowledge levels of elderly African-American participants with an average age of 70.2 years using the Osteoporosis Knowledge Test and calculated that the knowledge scores of the participants were in the range of 8.4–9.6. After a 6-week educational programme, significant increases in their levels of knowledge were observed (23). The originality of our study is that the information about male osteoporosis in our country is limited. In this context, a valuable

contribution to the literature has been presented. The osteoporosis knowledge levels of the men participating in our study were at a low-to-moderate level. This result was lower compared to the average scores presented in the literature. It is thought that this may be due to the relatively high average age of the men in our sample and their low education levels.

It is known that the prevention behaviours of individuals against disease increase as knowledge about the subject increases and they are influenced by health beliefs (27, 28). In another study in which female and male participants were evaluated together, it was found that osteoporosis health beliefs were positively correlated with physical activity and daily calcium intake. However, bone health as measured by DEXA was not related to knowledge, beliefs, or practices related to osteoporosis. It was emphasized that support for knowledge, health beliefs and health practices should be intensified, especially for men (29). In another study, it was found that awareness of osteoporosis-specific health practices, especially among young people, was low. Increases in osteoporosis knowledge levels caused increases in health beliefs and calcium intake together with decreases in coffee consumption (30). In this study, there was no difference in perceptions of susceptibility and seriousness in the health beliefs of participants of different ages. However, it would be expected to find higher levels of perceptions of susceptibility and seriousness regarding osteoporotic fractures among the older men in the high-risk age group. The main reason for these results observed in our study may be that the men in the high-risk age group had the lowest levels of knowledge about osteoporosis. A lack of information leads to a lack of awareness and, therefore, lower levels of perceived susceptibility and seriousness than expected. On the other hand, considering that osteoporosis is a permanent disease, men in the younger age group being susceptive to calcium intake barriers will experience a negative effect on bone quality at later ages. Men in the older age group not having enough knowledge about the benefits of exercise and experiencing barriers to exercise is another important finding. It is apparent that planning is needed in order to resolve this situation of lower levels of exercise for protection from hip fractures after falls, which are frequently observed in older age groups.

In addition to knowledge and beliefs about the relevant subject, self-efficacy is another necessary condition for the implementation of healthy lifestyle behaviours. In a study in which men were found to obtain moderate-to-high scores on both the exercise and calcium subdimensions of the Osteoporosis Self-Efficacy Scale, self-efficacy was correlated with younger age and the exercise benefits and exercise barriers subdimensions of health beliefs. It was also found that self-efficacy of calcium intake was positively correlated with health beliefs, health motivation, and exercise self-efficacy (22). In a mixed-model study conducted on this subject, it was found that higher Health Belief Scale scores correlated with self-efficacy (28). It was also determined that older individuals need more support in the area of self-efficacy.

For diseases with community screening test recommendations for risky age groups such as osteoporosis, awareness and interest in those tests are important factors in the success of the screening. Nayak et al. reported that elderly people in particular have various barriers to osteoporosis screening, including low perceptions of susceptibility, and they recommended that those barriers be overcome with education (31). In the present study, the susceptibility levels for bone mineral density screening among participants over the age of 70, who are an at-risk group recommended to undergo screening tests, were much lower than expected, as was their rate of taking the test. These results of this study are in line with the relevant literature.

This study is one of the rare studies to examine the knowledge and health beliefs of men in our country regarding osteoporosis, but it has some limitations including the cross-sectional design of the study, not examining the dimension of men's healthy behaviours against osteoporosis, and not determining the level of impact these factors have on objective bone health parameters.

CONCLUSIONS

In conclusion, knowledge of osteoporosis and prevention behaviours among men need to be intensified. Knowledge and perceptions of susceptibility to osteoporosis should be developed in men through education from younger ages. We recommend that exercise and physiotherapy approaches aimed at primary prevention, and especially lowering the risk of falling, should be utilized to a greater extent, especially for individuals in the at-risk age range. We also recommend that health professionals should not associate osteoporosis only with females and should not ignore males.

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Authors' Contributions

SE, TİP, ZB and FB – research design; TİP, ZB and FB – data collection; SE – data analysis; SE – manuscript with input from all authors. All authors approved the submitted version.

Conflicts of Interest

None declared

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