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Effect of Brief Osteoporosis Education on Knowledge and Awareness in Elderly

Yaşlılarda Kısa Osteoporoz Eğitiminin Bilgi ve Farkındalığa Etkisi

ABSTRACT

Objective:

This study assessed the impact of a 20-minute osteoporosis education session on awareness and lifestyle changes in 76 elderly participants in senior day centers.

Material and Methods:

In this single-group interventional study, participants completed the Osteoporosis Knowledge Assessment Tool (OKAT) before and after the educational session. Also one month follow up was conducted with 41 participants, in which the primary focus was on OKAT score changes and secondary outcomes related to dietary calcium intake, exercise, and sun exposure.

Results:

The mean pre-education OKAT score was 9.76 (±3.40). It was higher in the highly-educated participants (p=0.04). The mean post-education OKAT score was 14.04 (±2.72), and the OKAT scores significantly improved following education (p<0.001). Scores decreased after 1 month (p=0.014) but were still higher than the pre-education scores (<0.001). After the education, a quarter of the participants embraced healthy habits, with dietary modifications being the most common, followed by increased physical activity and sun exposure (31.17%, 24.39%, and 24.39%, respectively).

Conclusion:

Education improved knowledge and awareness of osteoporosis in middle-aged and older adults, and this improvement lasted for a medium timeframe. This study showed that brief education led by a professional was beneficial for senior day center participants, and that these centers may be ideal places for preventive education.

Key Words:

Osteoporosis, Education, Senior centers, Lifestyle changes

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ÖZ

Amaç:

Bu çalışma, yaşlı merkezlerindeki 76 katılımcıda 20 dakikalık bir osteoporoz eğitim oturumunun farkındalık ve yaşam tarzı değişiklikleri üzerindeki etkisini değerlendirdi.

Gereç ve Yöntemler:

Bu tek gruplu girişimsel çalışmada katılımcılar eğitim oturumundan önce ve sonra Osteoporoz Bilgi Değerlendirme Aracını (OKAT) doldurdular. Kırk bir katılımcıyla 1 aylık takip de yapıldı, bu takipte birincil odak noktası OKAT skoru değişiklikleriydi ve ikincil sonuçlar diyet ile kalsiyum alımı, egzersiz ve güneşe maruz kalma ile ilgiliydi.

Bulgular:

Eğitim öncesi ortalama OKAT puanı 9,76 (±3.40) idi. Bu ortalama yüksek eğitimli katılımcılarda daha yüksekti (p=0.04). Eğitim sonrası ortalama OKAT puanı 14,04 (±2.72) olup, eğitim sonrasında OKAT puanlarında anlamlı iyileşme yaşandı (p<0.001). Puanlar 1 ay sonra azaldı (p=0.01) ancak hâlâ başlangıçtaki puanlardan yüksekti (<0.001). Eğitim müdahalesinden sonra, katılımcıların dörtte biri sağlıklı alışkanlıklar benimsedi; en yaygın olanı beslenme değişiklikleriydi, bunu artan fiziksel aktivite ve güneşlenme takip ediyordu (sırasıyla %31.17, %24.39 ve %24.39).

Sonuç:

Eğitim, orta yaşlı ve yaşlılarda osteoporoza ilişkin bilgi ve farkındalığı artırdı ve bu farkındalık orta bir zaman dilimi boyunca devam etti. Bu çalışma profesyonel tarafından yapılan kısa eğitimin yaşlı gündüz merkezlerinin katılımcıları için faydalı olduğunu ve bu merkezlerin önleyici eğitim için ideal yerler olabileceğini gösterdi.

Anahtar Kelimeler:

Osteoporoz, Eğitim, Yaşlı merkezleri, Yaşam tarzı değişiklikleri

INTRODUCTION

With an increase in the elderly population, osteoporosis has become a matter of concern. Globally, the prevalence of osteoporosis is 19.7%, and osteopenia affects 40.4% of the population (1). Among the elderly, osteoporosis has a worldwide prevalence of 21.7%, with the highest rate reported in Asia 24.3% (2). It causes more than 8.9 million fractures per year, resulting in fractures every three seconds (3). The global incidence of hip fractures is projected to increase significantly, with an expected 310% increase in men and 240 % increase in women by 2050 (4). The disability-adjusted life years lost in Europe due to osteoporosis surpass those of common cancers, except for lung cancer (5). The most significant demographic changes are anticipated in Asia, where the percentage of hip fractures is predicted to increase from 26% in 1990 to 45% in 2050, underscoring the urgent need for preventive strategies (4). A systematic review highlighted the unmet information needs of patients with osteoporosis, particularly regarding the nature of their condition, medications, self-management, and follow-up care (6). When educational interventions in older adults were reviewed, patients' understanding of osteoporosis significantly improved with all approaches including PowerPoint presentations with discussions, educational programs within classes, self-management courses, computerized support programs, and brush-up courses (7). In today's world, with the growing burden of osteoporosis and the fractures it can cause, information of middle-aged and elderly individuals about this condition is very critical.

Senior centers, which are crucial community hubs for the elderly, offer environments for health information. Typically, people attend these centers for socialization, recreational activities, and daily life support. Pardasani and Berkman investigated attendance patterns and the perceived benefits of participation in senior centers in New York City. Of the 597 senior center members, the majority attended the centers approximately three days a week. Nearly all members (96.3%) reported various benefits, including socialization, educational programs, activities, companionship, meals, and improved mental and physical well-being (8). Osteoporosis information sessions can be effectively organized in senior centers, offering an ideal setting for group education and awareness of this condition.

Based on practical experience and feedback from students, it is generally recommended that lectures should not exceed 20 minutes in length (9). According to one study, analysis of student concentration during lectures indicated that the optimal lecture duration may be around 30 minutes rather than the conventional 60 minutes, as student concentration tended to decline after the initial 10-15 minutes (10). Given the challenges associated with long educational sessions, we planned a short, focused, 20-minute program.

This study aimed to assess the effect of a short, focused 20-minute osteoporosis education program in senior day centers and observe its benefits on knowledge and awareness among late middle-aged and elderly people by applying pre- and post-education questionnaires. The study also aimed to follow up the participants for one month and apply the same questionnaire in a medium time frame to see if the effect was lasting.

We hypothesize that there will be no significant difference in the pre-education osteoporosis awareness scores when comparing across various demographics such as gender, education level, age, and diagnosis status, serving as our initial null hypothesis. Secondly, we posit that the educational session itself may not lead to significant changes in awareness or in the adoption of healthier lifestyle behaviors among the elderly participants, which constitutes our second null hypothesis. Finally, we consider the possibility that any improvements in awareness or lifestyle behaviors observed immediately following the intervention may not be sustained over time. Our alternative hypotheses suggest

that significant differences in baseline awareness will exist among different demographic groups, that the educational intervention will indeed foster a meaningful increase in osteoporosis awareness and positive lifestyle changes, and that these benefits, despite some decline, will remain high compared to pre-education levels after one-month period.

MATERIALS and METHODS

This interventional study used a single-group assignment model. This study followed a before-and-after design to assess the impact of osteoporosis education on awareness levels among late middle-aged and elderly individuals.

This study received ethical approval from the local clinical studies ethics committee (approval date: 08.06.2023; decision no. 8/18) and was registered under the clinical trial identifier NCT05936177. All participants provided voluntary informed consent and the study adhered to the Declaration of Helsinki and good clinical practice guidelines.

We conducted a sample size calculation using the GPower 3.1 software to ensure statistical rigor before initiating the study. The calculation was guided by an a priori power analysis, aiming for a high probability ($1-\beta = 0.98$) to detect true effects. We set a stringent significance threshold ($\alpha = 0.02$) and estimated the effect size (d) to be 0.5, indicating a moderate impact. As our hypothesis posited that osteoporosis education would increase awareness scores, we employed a one-tailed test. Based on these considerations, the sample size required was 70 individuals.

The inclusion criteria were individuals between 50 and 90 years of age, of all sexes with no restrictions, who could be enrolled in the education session, and who could complete follow-up assessments. Exclusion criteria encompassed individuals with severe cognitive impairments and mental health conditions, pre-existing knowledge or educational background in osteoporosis, recent participation in other osteoporosis education programs, inability to independently complete the questionnaire, or engage in follow-up communication.

There were four senior centers in Muratpasa Municipality, Antalya. We used random.org to select three of the four centers and sent SMS messages to the attendees, resulting in the recruitment of 76 participants.

Before the educational session, the participants provided demographic information, including age, sex, educational background, personal history of osteoporosis and osteoporotic fractures, and family history of fractures. They also completed the OKAT, a questionnaire that included the causes, risk factors, prevention, diagnosis, and treatment of the disease. This test was originally developed by Kim et al., in 1991 and tested by Kılıc and Erci for validity and reliability in Turkish (11, 12). Later, it was shortened in 2003 by Winzenberg et al., as a 20-item questionnaire with 'true,' 'false,' or 'don't know' answers (13). Each correct response scored 1 point, and incorrect/'don't know' responses scored 0. The maximum achievable score was 20. The pre-education questionnaire filled out before the education was referred to as 'OKAT-A.' Educational sessions were conducted at three different senior centers on separate days, once at each center, with each participant group accommodating approximately 25 people. It included a 20 minute informative session led by the same physiatrist covering various osteoporosis-related topics with 16 slides. The slides used information from two reputable sources: the patient information pages of the International Osteoporosis Foundation website (http://www.osteoporosis.foundation/patients) and the WHO Health Education Booklet, to deliver concise information on osteoporosis definition, causes, risks, complications, dietary options, and exercise recommendations. After the educational session, participants were requested to complete the same questionnaire again, referred to as 'OKAT-B,' to assess any changes in knowledge. In addition, they had the opportunity to address their queries following completion of the questionnaire.

One month later, we conducted a follow-up interview, either in person or over the phone, with 41 of the 76 participants, as we were able to reach only 41 of them, to assess the level of retained knowledge and lifestyle changes. During this follow-up, we requested the participants to complete the questionnaire once more, labeling it as the 'OKAT-C.' Furthermore, we gathered information about any changes they may have made to their dietary habits, exercise routines, and sun exposure since the initial educational intervention. The flow of participant involvement in this study is illustrated in Figure 1.

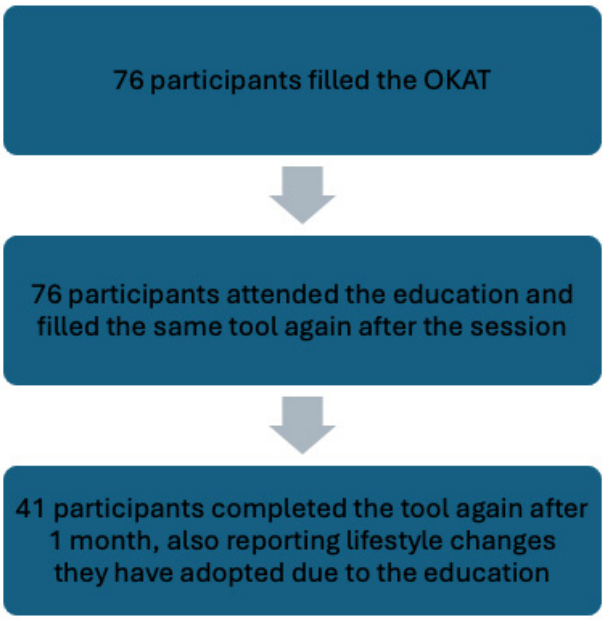

Figure 1. Participant Study Flow

To assess the suitability of this sample size, which was 41 for the 1 month assessment, we conducted a post-hoc power analysis using the GPower 3.1. With 41 individuals available, we aimed to detect differences in means between the OKAT-B and OKAT-C using a one-tailed test (hypothesizing that the scores would decrease in 1 month), and we set an effect size of 0.5, and an alpha error probability of 0.05. The power analysis resulted in a pow-

er of 0.93, indicating that our sample size was well suited for detecting significant differences between the two dependent means.

The primary outcome measure was the change in the participants' knowledge and awareness of osteoporosis after the educational intervention, with higher OKAT scores indicating improved awareness. This evaluation was conducted at baseline, immediately after the education session (short timeframe), and 1 month after the education session (medium timeframe). The secondary outcome measure evaluated the participants' lifestyle changes, including an assessment of whether education influenced their dietary calcium intake, exercise routines, and sun exposure. These assessments were conducted at baseline and one month after the education session.

These methods were consistent throughout the study period. Owing to direct interaction in our educational intervention, complete blinding was not possible. However, standardized OKAT questions and scoring minimized the assessment bias. A single-group intervention design was used for this study.

We planned to assess the effects of the education program by comparing participants' OKAT-A scores with OKAT-B scores, and OKAT-A scores with OKAT-C scores. We also planned to compare the OKAT-B scores with the OKAT-C scores to determine whether the participants forgot what they had learned in the education session. Additionally, we planned to examine changes in lifestyle behaviors (diet, exercise, and sun exposure) following the program. Statistical analyses were conducted using GraphPad Prism 10 (GraphPad Software, San Diego, CA, USA). The level of statistical significance was set at $p<0.05$. As the current literature lacks Minimal Clinically Important Difference values for OKAT, we performed statistical analyses using the raw scores. No outliers or extreme values were detected, and all the data points fell within the expected range.

RESULTS

Demographic Variables

The study population consisted of 76 individuals with a sex distribution of 60 females (79%) and 16 males (21%). The age of the participants ranged from 53 to 79 years, with a mean age of 67.67 years (±6.32). 75% of the participants had a high school or university degree (highly-educated), while 25% had completed primary or secondary school (low-educated). Approximately 28% of the participants had a previous diagnosis of osteoporosis; 7% had a history of osteoporotic fractures; and 14% reported a family history of hip, wrist, or vertebral fractures (Table I).

Table I. Demographic Characteristics of Study Participants

Category	Description	Number (%)
Mean age, years	67.67 (SD: 6.32)	
Sex	Female participants	60 (79%)
	Male participants	16 (21%)
Educational Level	University and high school graduates	57 (75%)
	Secondary and primary school graduates	19 (25%)
Osteoporosis Diagnosis	Diagnosis of osteoporosis	21 (28%)
	No diagnosis of osteoporosis	55 (72%)
Osteoporotic Fracture	Presence of osteoporotic fracture	5 (7%)
	No history of osteoporotic fracture	71 (93%)
Family History of Fracture	Family history of hip, wrist, vertebra fracture	11 (14%)
	No family history of hip, wrist, vertebra fracture	65 (86%)

Table II presents the results of the OKAT-A with the percentage of correct answers for each item. Of the 20 questions, only 9 were answered correctly by more than 50% of the participants. There were 3 questions that had correct answer percentages below 15%: 'osteoporosis usually causes symptoms before fractures occur,' 'any type of physical activity is beneficial for osteoporosis,' and 'there is a small amount of bone loss in the 10 years following the onset of menopause.'

Table II. Correct Answers of Pre-education OKAT

Items	Correct Answers (%)
1. Osteoporosis leads to an increased risk of bone fractures. (True).	68 (89.5%)
2. Osteoporosis usually causes symptoms (e.g. pain) before fractures occur. (False).	10 (13.2%)
3. Having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life. (False).	30 (39.5%)
4. Osteoporosis is more common in men. (False).	38 (50%)
5. Cigarette smoking can contribute to osteoporosis. (True).	57 (75%)
6. White women are at highest risk of fracture as compared to other races. (True).	40 (52.6%)
7. A fall is just as important as low bone strength in causing fractures. (True).	56 (73.7%)
8. By age 80, the majority of women have osteoporosis. (True).	58 (76.3%)
9. From age 50, most women can expect at least one fracture before they die. (True).	38 (50%)
10. Any type of physical activity is beneficial for osteoporosis. (False).	4 (5.3%)
11. It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors. (True).	43 (56.6%)
12. Family history of osteoporosis strongly predisposes a person to osteoporosis. (True).	33 (43.4%)
13. An adequate calcium intake can be achieved from two glasses of milk a day. (True).	41 (53.9%)
14. Sardines and broccoli are good sources of calcium for people who cannot take dairy products. (True).	49 (64.5%)
15. Calcium supplements alone can prevent bone loss. (False).	36 (47.4%)
16. Alcohol in moderation has little effect on osteoporosis. (True).	26 (34.2%)
17. A high salt intake is a risk factor for osteoporosis. (True).	44 (57.9%)
18. There is a small amount of bone loss in the 10 years following the onset of menopause. (False).	5 (6.6%)
19. Hormone therapy prevents further bone loss at any age after menopause. (True).	37 (46.7%)
20. There are no effective treatments for osteoporosis available in Turkey. (False).	29 (38%)

Pre-education OKAT scores

The mean OKAT-A score of the 76 individuals was 9.76 (±3.40) (95% confidence interval (CI): 8.99 to 10.54), ranging from 3 to 18. The median OKAT-A score was 9 (97.14% CI: 9 to 11).

We performed two-tailed unpaired t-tests to compare the OKAT-A scores of low-educated and highly-educated individuals and found a statistically significant difference (p=0.04). The mean scores were 8.37 (±3.52) for those with low-educated and 10.23 (±3.27) for those with high education, resulting in a difference of 1.86 (95% CI: 0.10 to 3.62). The pre-education scores of highly-educated individuals were higher than those of low-educated individuals. We examined the relationship between age and OKAT-A scores using Pearson's correlation analysis and found a very weak linear relationship, with a correlation coefficient close to zero (r:-0.05, 95% CI: -0.27 to 0.18). The negative sign of the Pearson correlation indicated a slight inverse relationship, suggesting that, as age tended to increase, OKAT-A scores tended to decrease, but not significantly (p=0.69).

We performed two-tailed unpaired t-tests to compare the OKAT-A scores between males and females; there was no statistically significant difference (p=0.40). The mean scores were 9.13 (±3.61) for males and 9.93 (±3.36) for females, resulting in a difference of -0.80 (95% CI: -2.72 to -1.11). We performed two-tailed unpaired t-tests to compare the OKAT-A scores of individuals with and without osteoporosis diagnosis; there was no statistically significant difference (p=0.18). The mean scores were 10.62 (±3.17) for individuals with a diagnosis and 9.44 (±3.46) for those without, resulting in a difference of 1.18 (95% CI: -2.91 to 0.55).

The statistical analysis results of the pre-education OKAT values according to education level, age, sex, and presence of osteoporosis diagnosis are summarized in Table III.

Table III. Statistical Analysis of Pre-education Scores

Category	Description	Results	Statistical Significance
Overall OKAT-A Score		Mean: 9.76 ±3.40	-
OKAT-A score by education level	low-educated vs. highly-educated	Mean: 8.37±3.52 vs. 10.23±3.27	P=0.04*
OKAT-A score by age	Pearson correlation analysis	r: -0.05	p=0.69
OKAT-A score by sex	male vs. female	Mean: 9.13±3.61 vs. 9.93±3.36	p=0.40
OKAT-A score by osteoporosis diagnosis	with diagnosis vs. without diagnosis	Mean: 10.62±3.17 vs. 9.44±3.46	p=0.18

* statistically significant

Evaluating the effect of education

Among the 76 participants, the mean OKAT-A score was 9.76 (±3.41), with a range of 15 (minimum: 3, maximum: 18) (95% CI: 8.99 to 10.54), and the median OKAT-A score was 9 (97.14% CI: 9 to 11). The mean OKAT-B score was 14.04 (±2.72), with a range of 12 (minimum: 7, maximum: 19) (95% CI: 13.42 to 14.66) and the median OKAT-B score was 14 (97.14% CI: 14 to 15).

The results of the one-tailed paired t-test conducted to assess the difference between the OKAT-A and OKAT-B scores of the 76 participants showed high significance (p<0.001). This one-tailed test was employed, in line with our hypothesis that education would lead to an increase in scores. The mean differences was 4.28 (±3.29). The 95% confidence interval (CI) for the mean difference ranged from 3.52 to 5.03. Figure 2 illustrates the pre and post-education OKAT scores of 71 participants. Table IV presents the immediate impact of education on 76 participants.

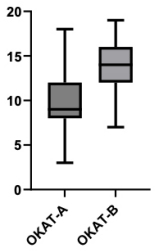

Figure 2. OKAT scores of 76 participants before and immediately after the education. Midlines represent median values. (OKAT-A: pre-education scores, OKAT-B: post-education scores).

Among the 41 participants who completed the one month follow-up, the mean OKAT-A score was 9.56 (±3.61), with a range of 13 (minimum:5, maximum:18) (95% CI: 8.42 to 10.70), and the median OKAT-A score was 9 (97.25% CI: 8 to 11). The mean OKAT-C score was 13.88 (±2.71), with a range of 11 (minimum: 8, maximum: 14) (95% CI: 13.02 to 14.73), and the median OKAT-C score was 14 (97.25% CI: 13 to 15).

The results of the two-tailed paired t-test conducted to assess the difference between the OKAT-A and OKAT-C scores of the 41 participants also showed high significance (p<0.001). The mean difference between was 4.32 (±3.13). The 95% confidence interval (CI) for the mean difference ranged from 3.33 to 5.31. Table IV presents the sustained effects of education observed on 41 participants over the course of one month.

Table IV: Statistical Analysis of OKAT Score Changes Pre- and Post-Education and After One-Month Follow-Up

Statistical Analysis	Comparison	Test Type	Significance	Mean Difference	95% Confidence Interval
Impact of Education (immediate)	OKAT-A vs. OKAT-B (76 participants)	One-tailed paired t-test (76)	p<0.001*	4.28±3.29	3.52 to − 5.03
Impact of Education (1 month)	OKAT-A vs. OKAT-C (41 participants)	Two-tailed paired t-test (41)	p<0.001*	4.32±3.13	3.33 to − 5.31
Knowledge Decline (1 month)	OKAT-B vs. OKAT-C (41 participants)	Two-tailed paired t-test (41)	P=0.014*	-0.73±1.82	-1.31 to −0.16

* statistically significant

Knowledge Decline in 1 month

We compared the OKAT-B scores of the 41 participants who completed the questionnaire one month later with their respective OKAT-C scores. Among the 41 participants, the mean OKAT-B score was 14.61 (±2.66), with a range of 12 (minimum:7, maximum:19) (95% CI: 13.77 to

15.45), and the median was 15 (97.25% CI: 14 to 16). The mean OKAT-C score was 13.88 (±2.71), with a range of 11 (minimum:8, maximum: 14) (95% CI: 13.02 to 14.73), and the median was 14 (97.25% CI: 13 to 15).
A two-tailed paired t-test was used to assess the difference between the OKAT-B and OKAT-C scores, and there was a statistically significant difference (p=0.014). The mean difference was −0.73 (±1.82) (95% CI: -1.31 to -0.16). Figure 3 illustrates the pre-education OKAT, post-education OKAT, and OKAT -one month scores of 41 participants. Table IV presents the knowledge decline observed on 41 participants over the course of one month.

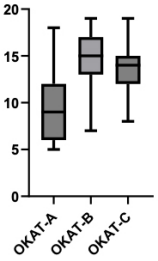

Figure 3. OKAT scores of 41 participants before, immediately after and one month after the education. Midlines represent median values. (OKAT-A: pre-education scores, OKAT-B: post-education scores, OKAT-C: scores one month after the education).

Life Style Changes

After receiving osteoporosis education, among the 41 participants that we reached after one month, some participants made lifestyle changes, with dietary modifications being the most common. Among the 41 participants, 13 (31.71%) increased their calcium intake as recommended during the education session and 17 (41.46%) did not change their diet. The remaining 11 participants (26.83%) reported that they had already had a high calcium intake in their diet prior to education. Ten participants (24.39%) increased their physical activity as recommended and 17 (41.46%) did not alter their exercise habits. The remaining 14 participants (34.15%) mentioned that they had already engaged in regular exercise prior to their education. Ten participants (24.39%) increased their sun exposure as advised. 23 participants (56.10%) maintained their previous sun-exposure habits. The remaining eight participants (19.51%) stated that they already had the maximum level of sun exposure even before education (Figure 4).

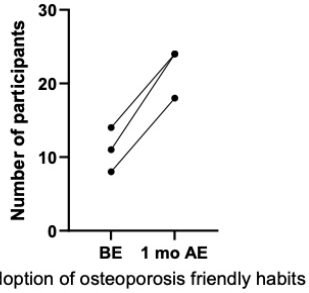

Figure 4. Number of individuals practicing dietary calcium intake, exercise, and sun exposure before and one month after the education (BE: Before education, 1 mo AE: one month after education).

DISCUSSION

In this study, we assessed the impact of a brief osteoporosis education session by comparing pre- and post-education questionnaire scores, as well as pre-education and one-month questionnaire scores. We also evaluated knowledge retention through one-month follow-up scores and examined lifestyle changes resulting from education.
We conducted this investigation to improve osteoporosis knowledge in late middle-aged and elderly individuals at senior centers, acknowledging its significant impact on the quality of life, disability, and healthcare costs in an aging world.

Although the three senior houses had almost an even sex and education distribution, our study's 76 participants were mostly highly-educated females. This may reflect women's greater interest in osteoporosis programs and proactive pursuit of knowledge enrichment among educated individuals. The prevalence of osteoporosis in our study (28%) was similar to that reported in Asia (24.3%) (2). Only 7% of participants reported a history of osteoporotic fractures, and 14% indicated a family history of hip, wrist, and vertebral fractures. However, it is important to note that these percentages may be higher due to potential misconceptions. Some participants might have confused minor trauma fractures due to osteoporosis with ordinary fractures, or may not have been aware of undiagnosed vertebral compression fractures. Additionally, some participants may not have had an accurate recollection of their parents' medical conditions and fracture history.
In the pre-education questionnaire there were three questions with correct answer percentages below 15%; 'osteoporosis usually causes symptoms before fractures occur', 'any type of physical activity is beneficial for osteoporosis' and 'there is a small amount of bone loss in the 10 years following the onset of menopause'. Therefore, clinicians should emphasize lesser-known features such as the silent nature of osteoporosis, importance of specific exercises, and rapid bone loss after the onset of menopause.
Participants with university and high school degrees had high osteoporosis awareness in our study, consistent with prior research, where older and less-educated women showed lower knowledge levels (14). Another study also showed that higher-educated women have better osteoporosis knowledge but may not always apply it to daily life (15).
In this study, we observed that highly-educated individuals had significantly higher scores on the pre-education questionnaire, which is in line with our hypothesis. However, no statistically significant differences in pre-education OKAT scores were found between genders or between individuals with and without a diagnosis of osteoporosis. While our initial hypotheses suggested that females and those with osteoporosis would score higher, our study did not support these expectations. Furthermore, although there was a trend of decreasing pre-education OKAT scores with increasing age, the difference was not statistically significant. Contrary to our hypothesis, younger par-

ticipants did not exhibit higher knowledge scores.
A systematic review by Gai et al highlighted the effectiveness of educational interventions in preventing osteoporosis in older adults (16). In a study of perimenopausal women aged 42-52, an osteoporosis-specific educational intervention improved knowledge and health beliefs (17). In a two-year trial with 470 women aged 25-44, interventions including an osteoporosis leaflet and group-based education improved osteoporosis knowledge, and group-based education showed the most significant increase (18). However, another systematic review highlighted the limited evidence for the effectiveness of osteoporosis patient education and emphasized the need for high-quality randomized controlled trials in this area (19).

In this study, a 20-minute brief educational session conducted on a group basis by a physiatrist significantly enhanced knowledge and awareness of osteoporosis among middle-aged and elderly participants. It is worth noting that shorter educational sessions may have advantages, especially for middle-aged and older individuals. Based on the experience of the physiatrist who conducted the training, there was no dispersion of attention among the listeners during the 20-minute duration.

This education model in our study increased knowledge and awareness, which was largely sustained during the one-month follow-up. Although there was a statistically significant decline in knowledge in one month when compared to post-education scores, the practical impact was relatively minor, as it was near one point. Comparing the one-month scores with the pre-education scores revealed that the educational intervention maintained a lasting impact. Nevertheless, to improve future interventions, we suggest repeating educational programs to prevent knowledge decay.
While knowledge about a topic is important, it does not always guarantee the practical application of that knowledge. For instance, being informed about osteoporosis may not automatically result in the adoption of healthy bone habits. This can often be linked to a lack of self-efficacy, where individuals find it challenging to effectively implement necessary lifestyle changes. Therefore, when assessing educational interventions such as ours, it is essential to evaluate their impact on self-efficacy. One study found that osteoporotic women had low self-efficacy influenced by factors such as aging, lack of exercise, poor diet, and knowledge gaps (20). Another study assessed the effectiveness of an osteoporosis education program in improving calcium intake, knowledge, and self-efficacy among older black adults and reported positive outcomes (21). A study on Chinese immigrants aged ≥ 45 years in the U.S. evaluated a self-efficacy-based osteoporosis education program. The results revealed significant improvements in osteoporosis knowledge, exercise self-efficacy, and medication adherence among participants who received the intervention (22). Prior to our study, approximately one-quarter (31.71%, 24.39%, 24.39%) of the participants had already adopted healthy habits before the education session, possibly because they were health-conscious senior center attendees. After the educational intervention, an additional quarter (26.83%, 34.15%, and 19.51%) of the participants embraced healthy habits based on the guidance provided during education.

A systematic review of international literature on multifaceted osteoporosis group education found that it can improve knowledge, quality of life, physical activity, psychosocial functioning, and treatment adherence (23). As our study's findings highlight the substantial potential of a concise 20-minute educational intervention led by a physician and incorporating resources from the IOF and the WHO, this program can be used either as a standalone approach or as an integral component within more comprehensive educational programs. An enhanced program can involve dietary guidance from a dietitian, and exercise sessions conducted by a physiotherapist.

Group meetings in senior centers are valuable in terms of health information. In our training sessions with approximately 25 participants per group, we demonstrated the suitability of senior citizens' day centers for these meetings. Such educational organizations hold potential for future research and development. Disseminating health information regarding osteoporosis in senior centers may be a promising approach for combating this common problem. Additionally, clinicians should emphasize lesser-known features such as the silent nature of osteoporosis, the importance of specific exercises, and rapid bone loss after the onset of menopause.

Limitations

A limitation of this study is that our participant pool consisted of proactive, well-educated individuals engaged in community center activities, which may potentially limit broader population representation. However, these proactive individuals may derive the greatest benefit from educational interventions, which aligns with the focus of the present study.

This study's use of a single-group design, without a control group, is another limitation. We opted for this approach to immediately provide all participants with potentially beneficial education. Future research should consider including a control group, offering education after the study to enhance comparability while upholding ethical considerations.

CONCLUSION

Osteoporosis can lead to fractures, disabilities, and a reduced quality of life, necessitating a focus on its prevention, detection, and treatment. Senior centers can serve as valuable places for educating people. This study encourages healthcare professionals to incorporate concise education into their regular practices, potentially improving their health. Identifying effective educational methods using this model is crucial.

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