Awareness and Knowledge Levels of Osteoporosis in Patients with Multiple Sclerosis

Multipl Sklerozlu Hastalarda Osteoporoz Farkındalık ve Bilgi Düzeyleri

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Abstract

Objective: This study examines the awareness and knowledge levels of osteoporosis in patients with multiple sclerosis (MS).

Materials and Methods: A total of 88 adult patients with MS (22 male, 66 female) were included in the study. The demographic and socioeconomic status of all patients were recorded. First, a question was asked the participants: "Have you ever heard of osteoporosis before?". After that, a survey was conducted on the participants. The survey consisted of a questionnaire assessing their knowledge using a 30-item instrument reflecting 9 knowledge domains (eg, risk factors, diagnosis, prognosis).

Results: The mean age of the patients was 39.85±9.67 years. The duration of the disease was median [interquartile range (IQR) (Q1-Q3) 4 (1-10)] years. Expanded disability status scale score of the patients was median [IQR (Q1-Q3) 2 (1-4.5)]. Most of the participants (81.8%) were aware of osteoporosis. Awareness of osteoporosis was higher in those who received corticosteroid treatment and had comorbid diseases (respectively p=0.011 and p=0.009). On average, the knowledge questions score was 13 (0-23). Mean knowledge scores were not associated with education status or gender. The knowledge score levels were higher in those who had heard of osteoporosis than in those who had not heard, respectively 14 (10-18) to 4 (0-13,75) (p<0.001).

Conclusion: Although awareness of osteoporosis was high in MS patients, the level of knowledge on osteoporosis was insufficient. Awareness and knowledge levels of osteoporosis were higher in those who received corticosteroid treatment. Additionally, osteoporosis awareness was higher in those who had comorbid diseases. Increasing knowledge about osteoporosis may be important for preventing osteoporosis and reducing its complications in MS patients.

Keywords: Multiple sclerosis, osteoporosis, bone mineral density, awareness

Öz

Amaç: Bu çalışmanın amacı multipl sklerozlu (MS) hastalarda osteoporoz farkındalık ve osteoporoz bilgi düzeylerini incelemektir.

Gereç ve Yöntem: MS (22 E, 66 K) toplam 88 erişkin hasta çalışmaya dahil edildi. Tüm hastaların demografik ve sosyoekonomik durumları kaydedildi. Katılımcılara ilk olarak "Osteoporozu daha önce duydunuz mu?" sorusu soruldu. Ardından katılımcılara osteoporoz ile ilgili dokuz bilgi alanını yansıtan (örneğin, risk faktörleri, tanı, prognoz) 30 maddelik bir anket uygulandı.

Bulgular: Hastaların yaş ortalaması 39,85±9,67 yıl idi. Hastalık süresi medyan [IQR(Q1-Q3)] 4 (1-10) yıldı. Hastaların genişletilmiş özürlülük durum ölçeği skoru ortanca [IQR(Q1-Q3)] 2 (1-4,5) idi. Katılımcıların çoğu (%81,8) osteoporozu daha önce duyduklarını belirtti. Komorbid hastalığı olanlarda ve daha önce kortikosteroid kullanımı olanlarda osteoporoz farkındalığı daha yüksekti (sırasıyla p=0,009, p=0,011). Osteoporoz bilgi puanı medyan 13 (0-23) idi. Ortalama bilgi puanları eğitim durumu ve cinsiyet ile ilişkili değildi. Osteoporozu duyanlarda duymayanlara göre osteoporoz bilgi puanı daha yüksekti [sırasıyla 14 (10-18) ile 4 (0-13,75) (p<0.001)].

Sonuç: MS hastalarında osteoporoz farkındalığı yüksek olmakla birlikte, osteoporoz bilgi düzeyi yetersizdi. Kortikosteroid tedavisi alanlarda osteoporoz farkındalık ve bilgi düzeyleri daha yüksekti. Yine komorbid hastalıkları olanlarda osteoporoz farkındalığı daha yüksekti. MS hastalarında osteoporoz hakkında bilgi birikiminin artması, osteoporozun önlenmesi ve komplikasyonlarının azaltılması açısından önemli olabilir.

Anahtar kelimeler: Multipl skleroz, osteoporoz, kemik mineral yoğunluğu, farkındalık

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Introduction

Multiple sclerosis (MS) is a chronic demyelinating disease affecting the brain and spinal cord, which usually has a relapsing-remitting course (1,2). It is one of the most common causes of neurological disability in young adults and affects approximately 1.3 million people worldwide (3). Osteoporosis is a disease characterized by low bone mineral density (BMD) and deterioration of bone tissue predisposing to fragility fractures (4-6). Several current studies have suggested that patients with MS have lower BMD and higher rates of osteoporosis than healthy adults (7-9). Causes of osteoporosis in MS include immobility, vitamin D deficiency, chronic inflammatory process, use of glucocorticoids (10-12). Patients with MS have an increased risk of falling due to impaired gait, balance, coordination, cognition, and cerebellar, sensory, and pyramidal functions (3). Therefore, there is an increased risk of osteoporotic fractures in patients with MS compared to the general population (3,9). Furthermore, since MS patients have a higher risk of fracture, the awareness of osteoporosis is crucial among them. If the awareness of osteoporosis is determined and information about the disease can be increased in MS patients, the negative consequences such as fractures and physical disabilities will also be reduced to that extent (11,13). There was not any study found during our literature search on the awareness of osteoporosis in patients with MS and the factors affecting it. The study examined the awareness and knowledge levels of osteoporosis and the factors affecting them in adult patients with MS.

Materials and Methods

Study Design and Population

We conducted a cross-sectional survey study. The approval of the local Ethics Committee at Dokuz Eylül University was obtained prior to the start of the study (decision no: 2016/26-31, date: 06.10.2016). Since MS is a rare disease, all MS patients who applied to the outpatient clinic during the study period (between May 2016 and May 2018) and met the inclusion criteria were included in the study, without a specific sample size. One hundred thirteen patients were interviewed. Nineteen patients did not want to participate in the study. One patient had been illiterated and one patient had severe cognitive dysfunction and four patients had a diagnosis of osteoporosis, they were not included. A total of 88 patients were included. All subjects gave written informed consent before participating in the study. The inclusion criteria of the study; being an adult patient with MS and volunteer to participate in the study. The exclusion criteria were not agreeing to voluntarily participate in the study, the presence of severe cognitive dysfunction, and the presence of a diagnosis of osteoporosis.

Data Collection

The demographic characteristics of the patients were recorded. The presence of additional disease, previous osteoporosis diagnosis, glucocorticoid medication, how the subjects reached information sources about osteoporosis, menopausal status, and a history of osteoporotic fracture were questioned. To consider a participant as being aware of osteoporosis, we asked if they have heard about osteoporosis before, and the ones who had heard about it previously were considered aware. A questionnaire developed from a previous study (14), with a content reliability of 0.89, was performed on participants. The 30-item questionnaire comprises questions that cause, signs/symptoms, risk factors, prognosis, diagnosis, treatment, complications, and prevention of osteoporosis. Patients responded to the questions as "agree," "disagree," or "unsure." Knowledge scores were created assigning 1 point to every correct answer and 0 points to every incorrect or "unsure" answer. The items were summed for a possible range of 0 to 30, with higher scores reflecting greater knowledge.

Statistical Analysis

The SPSS software version 24.0 (SPSS IBM Corp.; Armonk, NY, USA) was used for statistical analyses. The Kolmogorov-Smirnov test was used to determine the normality of data distribution. Demographics and descriptive data are presented as median (interquartile range Q1-Q3) or mean standard deviation. Pearson's chi-squared and Fisher's Exact tests were used to compare between categorical variables. Group comparisons of baseline characteristics were performed with independent samples t-test, as appropriate. Statistical significance was defined as $p<0.05$. The factors on osteoporosis awareness were assessed univariate and multivariate logistic regression. Covariates [age, gender (F), education (high school and above), presence of comorbid disease, corticosteroid administration] were tested. The correlation between the age and knowledge level of patients was evaluated using Spearman's correlation analysis.

Results

A total of 88 adult patients with MS (22 male, 66 female) were included in the study. The median age of the patients was 39.85±9.67 (range, 20-64) years. Baseline characteristics are shown in Table 1. The awareness of osteoporosis in patients with MS was 81.8% (n=72). Thirty-seven patients (42.04%) had known that MS disease was a risk factor for developing osteoporosis. Awareness of osteoporosis was higher in those who received corticosteroid treatment and had comorbid diseases (respectively p=0.011 and p=0.009). The median knowledge score of all subjects was 13 (8,25-17). The knowledge score levels were higher in those who had heard of osteoporosis than those who had not heard, respectively 14 (10-18) to 4 (0-13,75) (p<0.001). There was a significant difference between the osteoporosis knowledge scores of patients with received corticosteroid treatment before (p=0.003). The factors related to osteoporosis knowledge score levels are shown in Table 2. When the sources of osteoporosis information were questioned in patients, the results were as follows: doctors (34.1%), television-

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internet (25%) and relatives (23.9%) and were in the first place, followed by friends (9.1%) newspapers and magazines (4.5%) and others (3.4%). When education levels were divided as primary school and high school and above, no significant relationship was found between educational levels and the level of knowledge of osteoporosis (p=0.154). However, the effect of education level was shown in the multiple regression analysis. Univariate and multivariate regression analyses of osteoporosis awareness are shown in Table 3. It was observed that as the age of the patients increased, their level of knowledge also increased (p=0.008, Spearman's rho=0.281). Table 4 presents descriptive data for the knowledge items.

Discussion

In this study, we determined that although there was high awareness of osteoporosis in patients with MS, the knowledge level of osteoporosis was poor in most of this population.

In our study, the awareness of osteoporosis in patients with MS was 81.8%. Osteoporosis awareness varies in different studies. In a study conducted in a Greek female population, it was reported that 96% of the participants knew the definition of osteoporosis (15). Nguyen et al. (14) reported that awareness of osteoporosis in the Vietnamese women population is 81.6%. Gemalmaz and Oge (16) found awareness of osteoporosis in the Turkish women population as 60.8% in their study. In another study evaluating osteoporosis awareness and osteoporosis knowledge level in Turkish patients with neuromuscular disease, osteoporosis awareness was 97.9% (17). Our study results were comparable to these studies in terms of osteoporosis awareness. The fact that our patients with MS were regularly followed up in a particular unit may also have contributed to the high awareness of osteoporosis in these patients.

Osteoporosis awareness was higher in those who received corticosteroid treatment and had comorbid diseases. This may be related to increased health literacy in patients to understand other diseases and corticosteroid side effects. It may also be related to informing the patients by other physicians.

Table 2. Osteoporosis knowledge score level-related factors

Osteoporosis knowledge score level-related factors	p-value*
Have heard of osteoporosis before	<0.001
Gender	0.23
Education status	0.13
Received corticosteroid treatment	0.003
Comorbid disease	0.164
Menopausal status	0.403
History of fracture	0.571

*The Mann-Whitney U test and independent sample t-tests were used to compare the knowledge levels of patients and related factors, as appropriate

Table 1. Demographic and descriptive data of patients

Item	Awareness of osteoporosis[a]			
	All patients (n=88)	Yes (n=72)	No (n=16)	p-value
Age, years (mean ± SD)	39.85±9.67	40.7±9.8	36.2±8.1	0.094
Female, n (%)	66 (75)	53 (73.6)	13 (81.3)	0.751
Symptom duration, years [median, IQR (Q1-Q3)]	8 (4-13)	8.5 (4-13.5)	8 (4-12)	0.545
Disease duration, years [median, IQR (Q1-Q3)]	4 (1-10)	4.5 (1-9.75)	4 (1-10)	0.484
EDSS score, [median, IQR (Q1-Q3)]	2 (1-4.5)	2 (1-4.62)	2 (0-3.5)	0.470
Body mass index (kg/m²)	24.37±4.45	24.7±4.6	22.9±3.2	0.141
Education status				
Primary school n (%)	20 (22.7)	14 (19.4)	6 (37.5)	0.183
High school and above n (%)	68 (77.3)	58 (80.6)	10 (62.5)	
Comorbid disease, n (%)	30 (34.1)	29 (40.3)	1 (6.3)	0.009*
Menopausal status				
Pre, n (%)	48 (72.7)	37 (69.8)	11 (84.6)	0.488
Post, n (%)	18 (27.3)	16 (30.2)	2 (15.4)	
Corticosteroid administration, n (%)	70 (79.5)	61 (84.7)	9 (56.3)	0.011*
History of fracture, n (%)	14 (15)	12 (16.7)	2 (12.5)	0.680
Osteoporosis knowledge score [median, IQR (Q1-Q3)]	13 (8.25-17)	14 (10-18)	4 (0-13.75)	0.002*

SD: Standard deviation, IQR: Interquartile range, EDSS: Expanded disability status scale. Group comparisons of baseline characteristics were performed with independent samples t-test or χ² test, as appropriate (p<0.05). [a]For the question, "have you ever heard of osteoporosis disease?", patients who answered yes were considered aware of osteoporosis. They were included in the awareness group.
*p<0.05 statistically significant

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Table 3. Univariate and multivariate regression analysis of osteoporosis awareness

Parameters	Results from univariate analysis			Results from multiple analysis		
	OR	95% CI	p-value	OR	95% CI	p-value
Age	1.053	0.991-1.119	0.098	1.081	0.993-1.176	0.071
Gender (female)	1.553	0.399-6.055	0.526	1.104	0.207-5.902	0.907
Disease duration	1.040	0.934-1.158	0.480	-	-	-
EDSS score	1.100	0.851-1.424	0.466	-	-	-
Education (high school and above)	2.486	0.773-7.996	0.127	7.812	1.548-39.423	0.013*
Presence of comorbid disease	10.116	1.266-80.838	0.029*	21.953	2.026-237.895	0.011*
Corticosteroid administration	0.232	0.071-0.753	0.015*	9.660	1.984-47.029	0.005*
History of fracture	1.400	0.281-6.976	0.681	-	-	-

EDSS: Expanded disability status scale, OR: Odds ratio, CI: Confidence interval, *p<0.05 statistically significant

Table 4. Percentage correct for osteoporosis knowledge items, by domain

Domain	(Correct response: T= True, F= False)	Correct, n (%)
Definition of osteoporosis	1) Osteoporosis is a condition of an easy joint (F)	53 (60)
	2) Osteoporosis is a condition of low bone mineral density (T)	63 (71)
	3) Osteoporosis is a condition of high bone mineral density (F)	50 (56)
Common causes of Osteoporosis	4) Overweight is a common cause of osteoporosis (F)	17 (19)
	5) Lack of estrogen is a common cause of osteoporosis (T)	32 (36)
	6) High protein diet is a common cause of osteoporosis (T)	21 (23)
Common signs of osteoporosis	7) A headache is a common sign/symptom of osteoporosis (F)	27 (30)
	8) Frequent fractures are a common sign/symptom of osteoporosis (T)	50 (56)
	9) Mood change is a common sign/symptom of osteoporosis (F)	27 (30)
Risk factors for osteoporosis	10) Low rice intake is a risk factor for osteoporosis (F)	27 (30)
	11) Post menopause is a risk factor for osteoporosis in women (T)	58 (65)
	12) Smoking is a risk factor for osteoporosis (T)	40 (45)
	13) Having MS disease is a risk factor for osteoporosis (T)	37 (42)
Risk of osteoporosis over a lifetime	14) Men are at the highest risk of osteoporosis during their childhood (F)	17 (19)
	15) Women are at the highest risk of osteoporosis after menopause (T)	59 (67)
Diagnosis of osteoporosis	16) Osteoporosis is diagnosed using the X-ray of the bone (T)	33 (37)
	17) Osteoporosis is diagnosed with a physical exam (F)	22 (25)
	18) Osteoporosis is diagnosed with blood tests (F)	16 (18)
Treatment of osteoporosis	19) Osteoporosis can be treated with calcium and vitamin D (T)	59 (67)
	20) Osteoporosis can be treated with surgical correction (F)	30 (34)
	21) Osteoporosis can be treated with hormone replacement (T)	16 (18)
Complications of osteoporosis	22) Diabetes is a complication of osteoporosis (F)	15 (17)
	23) Hypertension is a complication of osteoporosis (F)	20 (22)
	24) Hip fracture is a complication of osteoporosis (T)	64 (72)
Prognosis	25) Osteoporosis can lead to joint swelling and morning stiffness (F)	3 (3,4)
	26) Osteoporosis can lead to hip fractures and subsequent complications (T)	57 (64)
Prevention of osteoporosis	27) Moderate physical exercise can reduce the risk of osteoporosis (T)	47 (53)
	28) Increased rice consumption can reduce the risk of developing osteoporosis (F)	19 (21)
	29) A diet rich in calcium and vitamin D can reduce the risk of developing osteoporosis (T)	53 (60)
	30) Cigarette smoking cessation can reduce the risk of developing osteoporosis (T)	45 (51)

MS: Multiple sclerosis

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We found that osteoporosis knowledge scores were lower in MS patients who had not heard of osteoporosis disease before. Similar to our result, it has been shown that hearing of osteoporosis disease increases the level of osteoporosis knowledge in different osteoporosis awareness studies (18,19). Although there was a high rate of awareness in our study group, this was not accompanied by actual knowledge. While osteoporosis awareness of the patients was 81.8%, osteoporosis knowledge levels of patients were inadequate. The knowledge level was especially low in terms of two critical aspects of the disease: causes and signs of osteoporosis. The low-level knowledge about osteoporosis may be related to not being informed by the physician following the patient. This situation indicates that information should also be given frequently by physicians. Also, although the definition of osteoporosis was unknown well enough, the subjects answered questions about the complications of osteoporosis at a high rate. This may be related to the difficulty of understanding some medical terms, and because of the emphasized fracture risk of osteoporosis by the information sources.

In our study, patients with awareness of osteoporosis were older, but it was not statistically significant. Contrary to our study, several studies have shown a significant inverse relationship between age and osteoporosis knowledge level (20-22). The fact that our study included only MS patients and the relatively lower mean age in our study group compared to these studies may have led to this result.

Some studies showed that when the education level of patients increased the level of knowledge about osteoporosis increased (15,16). In another study involving 1,114 osteoporotic patients, there was no significant difference between education level and awareness of osteoporosis (5). In our study, awareness of osteoporosis and knowledge scores did not differ by education. However, the effect of education level was shown in the multiple regression analysis. When the patients are compared according to their education level, the lack of difference between the levels of knowledge score may be related to the small number of patients with low education levels in the study.

Different results were reported in the literature when access to information sources regarding osteoporosis was examined. Radio-television, newspapers, friends-relatives, and doctors were reported as information resources (14,16,23). In our study, when the sources of information about osteoporosis were examined, doctors ranked first and television ranked second in MS patients. In addition, it has also been found that having a relative with osteoporosis disease leads to higher awareness of osteoporosis. The fact that our patients with MS are regularly followed up in a unit may have contributed to the fact that the most frequent source of information is doctors.

Fourteen patients had a history of fractures, and 72% predicted that hip fracture might occur because of osteoporosis. However, there was no effect of fracture history on osteoporosis awareness and osteoporosis knowledge level in patients with MS. Fractures are the most important complications that may lead to morbidity and mortality in patients with MS (3,24). The assessment of risk factors for osteoporosis is essential for preventing fractures in patients with MS (12,13,25). Education may play an important role in determining and preventing risk factors.

Our study had some limitations. First, there was no control group to compare patients with MS in our study. In addition, we enrolled patients who were admitted to the outpatient clinic who were monitored regularly. We could not standardize and exclude the effect of regular follow-up on awareness and knowledge levels because our study had a cross-sectional design. Future studies evaluating the awareness and knowledge levels of this population with a larger sample size are needed.

Conclusion

In this study, although awareness of osteoporosis was high in MS patients, the level of osteoporosis knowledge was insufficient. Awareness and knowledge levels of osteoporosis were higher in those who received corticosteroid treatment. In addition, osteoporosis awareness was higher in those who had comorbid diseases. Increasing knowledge about osteoporosis may be important for preventing osteoporosis and reducing its complications in MS patients.

Ethics

Authorship Contributions

References

1. Compston A, Coles A. Multiple sclerosis. Lancet 2008;372:1502-17.

2. Huang Z, Qi Y, Du S, Chen G, Yan W. BMI levels with MS Bone mineral density levels in adults with multiple sclerosis: a meta-analysis. Int J Neurosci 2015;125:904-12.

3. Ye S, Wu R, Wu J. Multiple sclerosis and fracture. Int J Neurosci 2013;123:609-16.

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4. Sambrook P, Cooper C. Osteoporosis. Lancet 2006;367:2010-8.

5. Shin HY, Kang HC, Lee K, Park SM. Association between the awareness of osteoporosis and the quality of care for bone health among Korean women with osteoporosis. BMC Musculoskelet Disord 2014;15:334.

6. Ní Chróinín D, Glavin P, Power D. Awareness of osteoporosis, risk and protective factors and own diagnostic status: a cross-sectional study. Arch Osteoporos 2013;8:117.

7. Åivo J, Kurki S, Sumelahti ML, Hänninen K, Ruutiainen J, Soilu-Hänninen M. Risk of osteoporotic fractures in multiple sclerosis patients in southwest Finland. Acta Neurol Scand 2017;135:516-21.

8. Marrie RA, Cutter G, Tyry T, Vollmer T. A cross-sectional study of bone health in multiple sclerosis. Neurology 2009;73:1394-8.

9. Bisson EJ, Finlayson ML, Ekuma O, Leslie WD, Marrie RA. Multiple sclerosis is associated with low bone mineral density and osteoporosis. Neurol Clin Pract 2019;9:391-9.

10. Ozgocmen S, Bulut S, Ilhan N, Gulkesen A, Ardicoglu O, Ozkan Y. Vitamin D deficiency and reduced bone mineral density in multiple sclerosis: effect of ambulatory status and functional capacity. J Bone Miner Metab 2005;23:309-13.

11. Dionyssiotis Y. Bone loss and fractures in multiple sclerosis: focus on epidemiologic and physiopathological features. Int J Gen Med 2011;4:505-9.

12. Gupta S, Ahsan I, Mahfooz N, Abdelhamid N, Ramanathan M, Weinstock-Guttman B. Osteoporosis and multiple sclerosis: risk factors, pathophysiology, and therapeutic interventions. CNS Drugs 2014;28:731-42.

13. Kampman MT, Eriksen EF, Holmøy T. Multiple sclerosis, a cause of secondary osteoporosis? What is the evidence and what are the clinical implications? Acta Neurol Scand Suppl 2011;(191):44-9.

14. Nguyen NV, Dinh TA, Ngo QV, Tran VD, Breitkopf CR. Awareness and knowledge of osteoporosis in Vietnamese women. Asia Pac J Public Health 2015;27:NP95-105.

15. Alexandraki KI, Syriou V, Ziakas PD, Apostolopoulos NV, Alexandrakis AI, Piperi C, et al. The knowledge of osteoporosis risk factors in a Greek female population. Maturitas 2008;59:38-45.

16. Gemalmaz A, Oge A. Knowledge and awareness about osteoporosis and its related factors among rural Turkish women. Clin Rheumatol 2008;27:723-8.

17. Dilek B, Şahin E, Sertpoyraz FM, Gündüz NE, Dikici A, Engin O, et al. Awareness and knowledge levels of osteoporosis in patients with neuromuscular diseases: a multicentre study. Neurol Sci Neurophysiol 2019;36:120-4.

18. Saw SM, Hong CY, Lee J, Wong ML, Chan MF, Cheng A, et al. Awareness and health beliefs of women towards osteoporosis. Osteoporos Int 2003;14:595-601.

19. El Hage C, Hallit S, Akel M, Dagher E. Osteoporosis awareness and health beliefs among Lebanese women aged 40 years and above. Osteoporos Int 2019;30:771-86.

20. Pérez-Edo L, Ciria Recasens M, Castelo-Branco C, Orozco López P, Gimeno Marqués A, Pérez C, et al. Management of osteoporosis in general practice: a cross-sectional survey of primary care practitioners in Spain. Osteoporos Int 2004;15:252-7.

21. Blazkova S, Vytrisalova M, Palicka V, Stepan J, Byma S, Kubena AA, et al. Osteoporosis risk assessment and management in primary care: focus on quantity and quality. J Eval Clin Pract 2010;16:1176-82.

22. Werner P, Vered I. Management of osteoporosis: a survey of Israeli physicians' knowledge and attitudes. Isr Med Assoc J 2000;2:361-4.

23. Khan JA, McGuigan FE, Akesson KE, Ahmed YM, Abdu F, Rajab H, et al. Osteoporosis knowledge and awareness among university students in Saudi Arabia. Arch Osteoporos 2019;14:8.

24. Bisson EJ, Ekuma O, Marrie RA, Leslie WD, Finlayson ML. Factors associated with receiving bone mineral density screening among people with multiple sclerosis. Mult Scler Relat Disord 2019;28:305-8.

25. Hearn AP, Silber E. Osteoporosis in multiple sclerosis. Mult Scler 2010;16:1031-43.