



The Psychometric Property Evaluation of the Turkish Version of the Osteoporosis Awareness Scale

Osteoporoz Farkındalık Ölçeği Türkçe Formunun Psikometrik Özelliklerinin Değerlendirilmesi

© Sibel Ocak Aktürk, © Recı Meseri*, © Melek Gülsün Özentürk**

Çanakkale Onsekiz Mart University Faculty of Health Sciences, Department of Midwifery, Çanakkale, Turkey

*Ege University Faculty of Health Sciences, Department of Nutrition and Dietetics, İzmir, Turkey

**Ege University Faculty of Health Sciences, Department of Midwifery, İzmir, Turkey

Abstract

Objective: This study aimed to determine the validity and reliability of the Turkish version of the Osteoporosis Awareness Scale (OAS) developed to assess people's osteoporosis awareness.

Materials and Methods: This methodological study was designed to investigate the validity and reliability of the "OAS" in Turkish society. This study included healthcare workers who worked in Community Health and Family Health Centers (n=346). Numbers, percentages, t-test, correlation analysis, Cronbach's alpha reliability coefficient, and factor analysis methods were used to analyze the data.

Results: The Cronbach's alpha reliability coefficient was 0.94 for the overall OAS and 0.86, 0.82, 0.88, 0.88, 0.85 for its bone physiology, preventive behaviors, risk factors, exercise, and characteristics of osteoporosis sub-dimensions, respectively. The exploratory factor analysis demonstrated that the scale explained 66.16% of the total variance. According to the confirmatory factor analysis, factor loadings of the scale ranged between 0.64 and 0.82, and CMIN(x2)/df was 3.384, goodness-of-fit index was 0.85, normed fit index was 0.83, comparative fit index was 0.88, and RMSEA was 0.08.

Conclusion: Results indicate that the Turkish version of the OAS highly valid and reliable, which can be administered in future studies.

Keywords: Osteoporosis, awareness, validity and reliability, osteoporosis awareness scale

Öz

Amaç: Bu araştırma ile osteoporozla yönelik farkındalığı değerlendirmek üzere geliştirilen Osteoporoz Farkındalık Ölçeği (OAS) Türkçe Formu'nun geçerlik ve güvenilirliğini belirlemek amaçlanmıştır.

Gereç ve Yöntem: Araştırma, "OAS"nin Türk toplumundaki geçerlik ve güvenilirliğini değerlendirmek üzere planlanmış metodolojik tipte bir çalışmadır. Bu çalışmanın örneklemini İzmir İl Sağlık Müdürlüğü bünyesinde yer alan İzmir ili Karşıyaka ilçesine bağlı birinci basamak sağlık hizmeti veren birimlerde, (Toplum Sağlığı ve Aile Sağlığı Merkezleri), görevli olan ve çalışmaya katılmayı kabul eden sağlık çalışanları oluşturmuştur (n=346). Verilerin analizinde sayı, yüzde, t-testi, korelasyon analizi, Cronbach alfa güvenilirlik katsayısı ve faktör analizi yöntemleri kullanılmıştır.

Bulgular: Ölçeğin tamamının Cronbach alfa güvenilirlik katsayısı 0,94; beş alt boyutun Cronbach alfa güvenilirlik katsayısı sırasıyla 0,86, 0,82, 0,88, 0,88, 0,85'tir. Madde-toplam puan korelasyonları ise 0,497 ile 0,739 arasında değer almaktadırlar (p<0,05). Ölçeğin kararlılığını değerlendirmek için dört hafta ara ile yapılan test-tekrar test uygulamasının puan ortalamaları arasında fark bulunmamıştır (p>0,05). Açıklayıcı faktör analizi ile ölçeğin, toplam varyansın %66,16'sını açıkladığı saptanmıştır. Maddelerin faktör yükleri 0,50 ile 0,82 arasında olup, doğrulayıcı faktör analizi ile ölçeğin faktör yüklerinin 0,64 ile 0,82 arasında ve CMIN(x2)/df =3,384, uyum iyiliği indeksi =0,85, normlu uyum indeksi =0,83, karşılaştırmalı uyum indeksi =0,88, RMSEA'nın 0,08 olduğu saptanmıştır.

Sonuç: Sonuçlar, OAS'nin Türkçe geçerliği ve güvenilirliğinin yüksek olduğunu ve yapılacak araştırmalarda kullanılabileceğini göstermektedir.

Anahtar kelimeler: Osteoporoz, farkındalık, geçerlik ve güvenilirlik, osteoporoz farkındalık ölçeği

Introduction

Osteoporosis is an irreversible skeletal system disease that usually progresses without any symptoms, affects bone density and quality, and thus causes an increase in bone fragility. Nowadays, with the increase in life expectancy, osteoporosis has become an important public health problem due to its increasing incidence (1,2).

Osteoporosis, which causes bone fragility in individuals as they age, is also responsible for the increase in morbidity and mortality rates in old age, which is also considered as a social problem, because it requires costly investment allocated to osteoporosis treatment and causes workforce losses (3).

While sex (female), ethnicity (Asian, Spanish), advanced age, family history of osteoporosis or fractures are among the non-modifiable risk factors leading to osteoporosis, inadequate calcium intake, obesity, physical inactivity, smoking, alcohol use, vitamin D deficiency and caffeine intake are among the modifiable risk factors (3,4). Osteoporosis is a preventable disease if risk factors are identified early and changes in lifestyle are made (5). Due to osteoporosis and its complications, an individual's activities of daily living are restricted and the individual may experience psychological problems as well. Therefore, the individual's quality of life is gradually affected adversely. Women are at a higher risk than are men, and thus women should be informed about the early diagnosis of osteoporosis and how to prevent it from a young age by providing them with continuous and regular training (6,7). Health professionals such as physicians, midwives and nurses who have served the same population for many years in primary health care services can significantly contribute to efforts aimed at determining the risk groups and raising people's awareness of this issue.

In the literature, various scales have been developed on osteoporosis. These scales are used to determine individuals' osteoporosis knowledge levels (8-10), diagnosis of the disease (11), their health beliefs about osteoporosis (12), and their perception of self-efficacy towards osteoporosis (13). Populations of studies conducted on osteoporosis are mostly women and students (14-16). On the other hand, the number of studies conducted with health professionals who assume significant responsibilities in the diagnosis, evaluation and treatment of osteoporosis is rather limited (17-19). In this context, the aim of this study was to evaluate osteoporosis awareness for health professionals and to determine the validity and reliability of the Turkish version of the Osteoporosis Awareness Scale (OAS).

Materials and Methods

Study Design and Sample

The population of this methodological study planned to perform the validity and reliability study of the Turkish version of the OAS in society comprised of healthcare professionals working in Community Health and Family Health Centers in Karşıyaka district of İzmir Province affiliated to the İzmir Provincial Health

Directorate. The study was conducted between March and June 2019 in İzmir. A sample size of 5-10 times the number of items in the scale is recommended for scale validity and reliability studies (20). Since OAS consists of 31 items, a sample size of 155 and 310 participants was expected. According to the recommendations, a sample size of more than ten times the number of items was aimed, and 346 health professionals were included in this study. The inclusion criterion of the study is as follows: working as a health worker in the units providing primary health care services in Karşıyaka district of İzmir province. The data were collected by face-to-face interview technique. Data collection was applied by using face-to-face interview technique.

Data Collection Tools

The study data were collected using the Healthcare Professional Information Form and the Turkish version of the OAS. It took each participant about 10-15 minutes to fill in the tools.

Healthcare Professional Information Form

The form developed by the researchers based on the relevant literature (3,12). includes 10 items questioning the healthcare professionals' socio-demographic characteristics and their knowledge of general health.

Osteoporosis Awareness Scale

The scale Developed by Choi et al. (3) in 2008 in English consists of 31 items and 5 sub-dimensions. The responses given to the items of the OAS are rated on a 4-point Likert type scale ranging from 1 to 4 (4= I know very well, 3= I know, 2= I know a little, 1= I do not know at all). The minimum and maximum possible scores to be obtained from the OAS are 31 and 124 respectively. The higher the mean score obtained from the overall scale is the higher the level of awareness of osteoporosis is. The scale does not have reverse-scored items and cut-off point. While Cronbach's alpha (α) reliability coefficient of the scale was found to be 0.948, Confirmatory Factor Analysis (CFA) was not performed in the original study.

Statistical Analysis

In the analysis of the study data, descriptive statistics were given in the arithmetic mean, standard deviation, numbers and percentages. Whether the data were normally distributed was determined using the Shapiro-Wilk normality test. The data obtained were analyzed using the IBM SPSS Version 24.0 statistics package program. P-values less than 0.05 were considered statistically significant.

Validity and Reliability Analysis

Language Validity

In order to make the language equivalence, the scale was translated from English to Turkish by experts in the field of health sciences who know both languages. After the translations were made, the translations made by the expert researchers were analyzed and the most appropriate expressions to be used in the Turkish version of the scale were determined and the

translated text on which consensus was reached was created. Then the final form of Turkish version of the scale produced was translated back to English from Turkish by another expert with a good command of both languages and the approval of the author of the original scale was obtained.

Content and Construct Validity Analyses

To find out whether the overall OAS and its items adequately define the feature to be measured, experts were consulted to obtain their opinions. The experts' opinions were evaluated through the Davis (21) technique. The content validity index (CVI) of the OAS and its items was calculated by dividing the number of experts who rated an item as "appropriate" or "needs slight revision" by the number of all the experts. A CVI higher than 0.8 indicates that the items of the scale are sufficient in terms of content validity (22). The content validity of the measurement tool was scored by five experts who have a good knowledge of the field of science for which the scale was prepared.

The exploratory factor analysis (EFA) was conducted to investigate the relationship between the scale items and factors. Before performing the factor analysis, whether the data set provided multivariate normality was investigated using the Bartlett's test of Sphericity (BTS), and the adequacy level of the sample size was evaluated with the Kaiser-Meyer-Olkin (KMO) test. While the EFA was performed, the principal components analysis, and of the rotation methods, the Orthogonal Rotation and Varimax rotation were used to reveal the implicit structure of the OAS.

CFA was performed in order to find out whether the model that was previously tested and determined with EFA fitted the model to be adapted to the culture of the society. The IBM SPSS AMOS (Statistical Package for the Social Sciences-Analysis of Moment Structures) 25.0 analysis program was used to perform the CFA.

Reliability Analysis

In the present study, the stability of the scale over time was checked with the intermittent method in which 40 people included in the study sample underwent the test-retest application at a 4-week interval. To determine the internal consistency of the scale, the Cronbach's α reliability coefficient and the item-total score analysis were used.

Ethical Considerations

In order to perform the validity and reliability study of the Turkish version of the OAS in primary health care workers, the permission was obtained from Choi et al. (3) who developed the OAS via e-mail. To conduct the study, ethical approval from a Ege University Medical Research Ethics Committee (decision no: 19-2T/23, date: 06.02.2019) was obtained. From the healthcare professionals who agreed to participate in the study, verbal and written consent was obtained. The participants who were administered the data collection tools using the face-to-face interview technique marked the options of the items they chose in the tools.

Results

Sample Characteristics

The research was completed with 346 healthcare workers who met the inclusion criteria. Their mean age was 46.7 ± 9.9 years. The distribution of the participants according to their professions is as follows: 34.7% were physicians, 37% were midwives, 4.3% were nurses and 4% were from other professions (dentist, dietician, psychologist etc.). Their mean length of service in the profession was 23.1 ± 9.5 years ranging from 1 to 49 years. Of the healthcare professionals, 8.1% were senior high school graduates, 17.9% had an associate's degree, 3.4% had a bachelor's degree, and 35.5% had a post-graduate degree (Table 1).

Validity Analysis

Language and Content Validity

In the present study, while opinions of three experts were obtained to ensure the language validity of the measurement tool, opinions of five experts were obtained to evaluate the

Table 1. Socio-demographic characteristics of the participating healthcare professionals (n=346)

Socio-demographic characteristics	Number	%
Sex		
Men	91	26.3
Women	255	73.7
Marital status		
Married	284	82.1
Single	62	17.9
Total	346	100
Educational attainment		
Senior high school	28	8.1
Associate's degree	62	17.9
Bachelor's degree	133	38.4
Postgraduate degree	123	35.5
Profession		
Physician	120	34.7
Midwife	128	37
Nurse	84	24.3
Other	14	4
Length of service in the profession		
1-5 years	12	3.47
6-10 years	26	7.51
11-15 years	49	14.16
16-20 years	47	13.58
21-25 years	57	16.47
26-30 years	78	22.54
31-35 years	54	15.61
36-40 years	20	5.78
≥ 41 years	3	0.87
Total	346	100

content validity. The CVI was 0.95 for the overall Turkish version of the OAS and varied between 0.60 and 1 for its items.

Construct Validity

Exploratory Factor Analysis

According to the results of the KMO and Bartlett Sphericity tests conducted to evaluate the adequacy of the sample size and to determine whether the data were homogeneously distributed before the EFA was conducted, the following values were determined: KMO: 0.921; χ (351): 6110.786; BTS: $p < 0.05$.

After the analysis performed during the validity and reliability study of the Turkish version of the OAS, the number of the items was reduced to 27. Of the items, in the measurement tool, item 18 whose factor loading was low and items 22, 23 and 29 which overlapped were excluded from the analysis. The remaining 27 items within the scope of the analysis were collected under five sub-dimensions: bone physiology, preventive behaviors, risk factors, exercise and characteristics of osteoporosis (Table 2).

The factor loadings of the OAS range between 0.509 and 0.820. These factors account for 66.165% of the total variance. As for the sub-dimensions, bone physiology, preventive behaviors, risk factors, exercise and characteristics of osteoporosis accounted for 14.28%, 14.25%, 13.53%, 12.22% and 11.89% of the total variance respectively (Table 2).

Confirmatory Factor Analysis

According to the CFA, the structural equation modeling results of the scale were significant at the level of $p < 0.05$, and that the 27 items and five sub-dimensions constituting the scale were related to the scale structure (Figure 1, Table 3).

The model was modified. During the modification, variables that decreased the fit were determined, and new covariates were created for those with high covariance among residual values (e1-e2; e5-e6; e8-e13; e9-e13; e23-e24). According to the renewed fit indices after the modification, root mean square error of approximation (RMSEA) (0.08), goodness-of-fit index (GFI) (0.85), comparative fit index (CFI) (0.88), root mean squared residual (RMR) (0.036) and χ^2 (3.384) ($p < 0.05$) values indicated the fit of the model was at an acceptable level (Figure 1, Table 3).

Reliability Analysis

According to the reliability analysis of the OAS and its sub-dimensions, Cronbach's α reliability coefficients were as follows: 0.949 for the overall OAS, 0.866 for the bone physiology sub-dimension, 0.862 for the preventive behaviors sub-dimension, 0.882 for the risk factors sub-dimension, 0.866 for the exercise and 0.858 for the characteristics of osteoporosis sub-dimension. The analysis of the item-total score correlations of the OAS revealed that the distribution of the item total correlation values of the scale items ranged between 0.497 and 0.739 ($p < 0.05$) (Table 2).

Internal Consistency of the Subscales

A statistically positive and significant relationship was determined between the mean scores for the sub-dimensions of the OAS obtained from the test-retest application. The dependent samples t-test conducted to determine whether there was a difference between the mean scores obtained from the scale and its sub-dimensions demonstrated that the difference between the two application scores was not statistically significant ($p > 0.05$).

Discussion

Content Validity of the OAS

If the CVI is above 0.80, then the measurement tool can be said to have content validity (21,23,24). While the CVI of the sub-dimensions of the Turkish version of the OAS ranged between 0.60 and 1.00, the CVI of the overall OAS was 0.95.

Construct Validity of the Scale

According to the literature, KMO values should be between 0.5 and 1.0, and values below 0.5 indicate that the sample is not sufficient for the factor analysis (25). In order to perform the factor analysis, whether the data set provides the multivariate normality is assessed by the BTS. A p-value less than 0.05 in the Bartlett's test of sphericity means that the data provide multivariate normal distribution (25). In the present study, KMO was 0.921; χ (351) was 6110.786; BTS p-value was

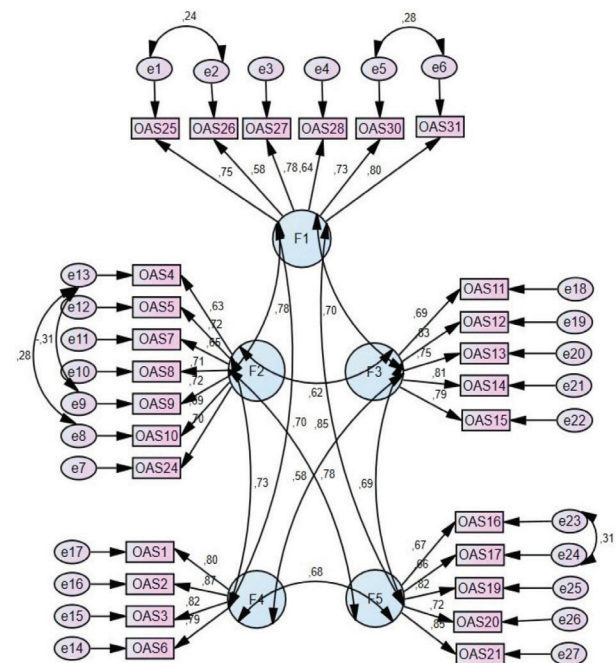


Figure 1. Model according to the confirmatory factor analysis of the Osteoporosis Awareness Scale
F1: Bone physiology, F2: Preventive behaviors, F3: Risk factors, F4: Exercise, F5: Characteristics of osteoporosis sub-dimensions, RMSEA: Root mean square error of approximation, OAS: Osteoporosis Awareness Scale
 $\chi^2=3.384$ ($p < 0.05$), RMSEA=0.08

Table 2. Exploratory factor analysis, Cronbach's alpha reliability coefficient and item total correlation of the Osteoporosis Awareness Scale

Items	Items number	Factors					Item total correlation
		F1	F2	F3	F4	F5	
Bone is mainly made of calcium.	28	0.696	-	-	-	-	0.625
Bone density loss starts at the end of the 30s.	30	0.693	-	-	-	-	0.691
Osteoporosis is a condition in which the bone becomes porous due to deterioration in bone mass.	31	0.661	-	-	-	-	0.732
Eating salty foods interferes with the absorption of calcium in the body.	25	0.640	-	-	-	-	0.704
Regular meals usually do not meet the daily calcium requirement of the body.	26	0.623	-	-	-	-	0.570
The ages at which the bone mass peaks are between the 20s and 30s.	27	0.561	-	-	-	-	0.691
Drinking at least two glasses (500 mL) of milk a day is a good source of calcium.	10	-	0.820	-	-	-	0.707
Anchovies and dairy products are good sources of calcium in the prevention of osteoporosis.	4	-	0.635	-	-	-	0.585
Diets that cause excessive weight loss should be avoided to prevent osteoporosis.	5	-	0.622	-	-	-	0.657
Eating yellow, green leafy vegetables helps prevent osteoporosis.	9	-	0.621	-	-	-	0.636
Osteoporosis can be prevented with lifestyle changes such as having a diet rich in calcium, and exercising.	7	-	0.595	-	-	-	0.604
People who consume too much alcohol, tobacco, and caffeine are at greater risk for osteoporosis.	8	-	0.586	-	-	-	0.635
Taking regular calcium supplements before menopause can prevent osteoporosis.	24	-	0.509	-	-	-	0.620
People who constantly take steroids (cortisone) are at a greater risk for osteoporosis.	11	-	-	0.807	-	-	0.665
People with a family history of osteoporosis are at a greater risk for osteoporosis.	15	-	-	0.776	-	-	0.738
People who have had ovarian surgery are at a greater risk for osteoporosis.	14	-	-	0.752	-	-	0.755
People who underwent gastrectomy (partial or complete surgical removal of the stomach) are at a greater risk for osteoporosis.	12	-	-	0.719	-	-	0.745
Small-boned or thin people are at a greater risk for osteoporosis.	13	-	-	0.659	-	-	0.687
Jogging at a slow pace or walking helps prevent osteoporosis.	2	-	-	-	0.796	-	0.812
Twenty to 30 minutes of regular exercise is important for the promotion and maintenance of bone health.	1	-	-	-	0.786	-	0.741
A sedentary lifestyle or lack of weight-bearing exercises increases the likelihood of developing osteoporosis.	6	-	-	-	0.718	-	0.713
Regular exercise is essential in the prevention of osteoporosis.	3	-	-	-	0.710	-	0.749
Bones of people with osteoporosis can fracture easily.	16	-	-	-	-	0.789	0.673
Menopause can accelerate the progression of osteoporosis.	21	-	-	-	-	0.631	0.771
Postmenopausal estrogen therapy can slow the progression of osteoporosis.	20	-	-	-	-	0.620	0.646
Osteoporosis can be diagnosed with a bone mineral density test.	19	-	-	-	-	0.602	0.735
Osteoporosis is more common in women than it is in men.	17	-	-	-	-	0.600	0.628
Cronbach's alpha reliability coefficient		0.866	0.862	0.882	0.886	0.858	0.949
Variance explained (%)		14.28	14.25	13.53	12.22	11.89	66.165
Eigenvalue (λ)		11.972	1.875	1.501	1.349	1.167	-
KMO=0.921; ^{xy} (351)=6110.786; BTS p<0.05. F1: Bone physiology, F2: Preventive behaviors, F3: Risk factors, F4: Exercise, F5: Characteristics of osteoporosis accounted, BTS: Bartlett's test of Sphericity, KMO: Kaiser-Meyer-Olkin							

less than 0.05 These results indicate that the sample size was sufficient for the EFA and the distribution of the data set was homogeneous.

In the literature, in multi-factor measurement tools, if item factor loadings explain 40% to 60% of the total variance, this is accepted as sufficient (26,27). According to studies, the higher the variance ratio is, the stronger the factor structure of the scale is. In the present study, it was determined that the Turkish version of the OAS explained 66.165% of the total variance and had five sub-dimensions with an eigenvalue above 1. That the variance explained was high in the present study indicates that the scale accurately measured the property to be measured. In addition, these results indicate that the Turkish version of the OAS is consistent with the construct of the original scale which has five sub-dimensions.

In the literature, it is stated that if the loading value of an item of a measurement tool is less than 0.32 in more than one sub-dimension and that if the difference between the factor loadings of the item in two sub-dimensions is less than 0.10, which indicates that the items overlap, then this item should be removed from the scale (25,28).

It is stated that if an item is to be included in any factor of a measurement tool, then its factor loading value should be at least 0.32 (25). Therefore, based on the results of the EFA performed in the present study, the items 18, 22, 23, 29 were removed from the scale because the item 18 had a factor loading less than 0.32 and the difference between the factor loading values of the items 22, 23, 29 in two factors was less than 0.10.

CFA was not performed in the original study. In the CFA conducted in the present study, a value of ≤ 0.08 for RMSEA indicates acceptable fit, while ≤ 0.05 indicates perfect fit (29).

According to the first level multifactorial CFA results, in the indexes of the Turkish version of the OAS, RMSEA was 0.08, which indicated the fit was acceptable. Although there are different citations in the literature regarding the criteria of goodness of fit, values of $0.80 \leq CFI \leq 0.90$, $0.80 \leq$ normed fit index ≤ 0.95 , $0.85 \leq GFI \leq 0.90$, and $0 \leq RMR \leq 0.080$ indicate acceptable

fit (29,30). According to the goodness of fit indices of the Turkish version of the OAS, CFI was 0.88, GFI was 0.85, RMR was 0.036, χ^2 was 3.384 ($p < 0.05$) and RMSEA was 0.08, which indicated that an acceptable level of fit was achieved (Table 3). After the CFA, it was determined that the factor loadings of the Turkish version of the OAS were over 0.50 and varied between 0.64 and 0.82.

Reliability of the OAS

The Cronbach's α reliability coefficient ranges between 0 and 1. The fact that a scale's Cronbach's α coefficient is as close to 1 as possible means that the scale is highly reliable (31,32). If the Cronbach's α coefficient is less than 0.40, the scale is not reliable, if it is between 0.40 and 0.59, its reliability is low, if it is between 0.60 and 0.79, it is regarded quite reliable, and if it is between 0.80 and 1.00, it is considered very reliable (23,29). The Cronbach's α reliability coefficient of the OAS developed by Choi et al. (3) (2008) was 0.948.

In the current study, the Cronbach's α reliability coefficient of the Turkish version of the OAS was 0.949 for the overall scale, 0.866 for the "bone physiology" sub-dimension, 0.862 for the "preventive behaviors" sub-dimension, 0.882 for the "risk factors" sub-dimension; 0.886 for the "exercise" sub-dimension, and 0.858 for the "characteristics of osteoporosis" sub-dimension (Table 2). That the Cronbach's α values of the OAS and its sub-dimensions are over 0.80 in the present study indicates that both the overall OAS and its sub-dimensions are highly reliable.

In item selection, there is no certain standard indicating that the item's reliability will be insufficient when the item's correlation coefficient is lower than which value of the correlation coefficient. However, according to Büyüköztürk (20), Şencan (27), and Karasar (33), if the correlation coefficient is greater than 0.25, 0.30 and 0.50 respectively, the item is regarded reliable. It is recommended that items with low correlation should be removed from the measurement tool (27,28,33). In the present study, the correlation coefficients of the 27-item scale ranged between 0.497 and 0.739 and thus they were accepted as statistically significant for all the items of the OAS (Table 2).

The minimum required value for the item-total test correlation to be sufficient is 0.30 (34). In the current study, the item-total correlation was above 0.30.

In order to determine the distinctiveness of the items in the scale, the raw scores obtained from each factor were ranked in the ascending order from the lowest to the highest, and the mean scores of the groups in the bottom 27% and top 27% were compared with the independent samples t-test. The result of the comparison indicated a significant difference between the mean lower and upper group item scores for each sub-dimension in terms of all the items at the $p < 0.05$ level. Therefore, it can be said that the sub-dimensions of the scale are distinctive in terms of measuring the desired quality.

These results indicate that all the items of the Turkish version of

Table 3. Fit indices in the confirmatory factor analysis before and after the modification of the Osteoporosis Awareness Scale

	Acceptable fit criteria*	Pre-modification fit indices	Post-modification fit indices
RMSEA	$0.05 \leq RMSEA \leq 0.08$	0.09	0.08
NFI	$0.80 \leq NFI \leq 0.95$	0.82	0.83
CFI	$0.80 \leq CFI \leq 0.90$	0.86	0.88
GFI	$0.85 \leq GFI \leq 0.90$	0.82	0.85
RMR	$0 \leq RMR \leq 0.080$	0.038	0.036
CMIN/df	$3 \leq \chi^2/df \leq 5$	3.714	3.384

* (1-3), NFI: Normed fit index, CFI: Comparative fit index, GFI: Goodness-of-fit index, RMR: Root mean squared residual, RMSEA: Root mean square error of approximation

the OAS have adequate correlation with the total score of the five sub-dimensions, which suggests that the item reliability of the sub-dimensions of the scale is high (Table 2).

Strength and Limitations

One of the strengths of the present study is that in the study, the awareness of physicians, midwives, nurses and all other healthcare professionals who served the same population in primary health care for many years about osteoporosis was investigated. The main limitation of the study was that it was conducted only with healthcare professionals in a single center.

Conclusion

According to the results of the present study, The Turkish version of the OAS is a valid and reliable measurement tool and it can be used to assess "awareness of osteoporosis". Evaluation of the awareness of students studying in health-related departments such as medicine, midwifery, nursing, etc. about osteoporosis from their school years and the elimination of any missing/incorrect information before graduation are very important. The quality of the healthcare services provided by healthcare workers will be improved through the in-service training programs to be organized to assess their awareness of osteoporosis. It may be recommended that the OAS should be administered to the healthy population in order to increase the society's awareness of osteoporosis, the importance of early diagnosis of osteoporosis and prevention of osteoporosis, and if appropriate, it should be included in the screenings performed especially in primary care units.

Ethics

Ethics Committee Approval: To conduct the study, ethical approval from a Ege University Medical Research Ethics Committee was obtained (decision no: 19-2T/23, date: 06.02.2019).

Informed Consent: From the healthcare professionals who agreed to participate in the study, verbal and written consent was obtained.

Peer-review: Internally peer-reviewed.

Authorship Contributions

Concept: S.O.A., M.G.Ö., Design: S.O.A., M.G.Ö., Data Collection or Processing: S.O.A., R.M., Analysis or Interpretation: S.O.A., M.G.Ö., R.M., Literature Search: S.O.A., Writing: S.O.A., M.G.Ö., R.M.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

References

1. Föger-Samwald U, Dovjak P, Azizi-Semrad U, Kersch-Schindl K, Pietschmann P. Osteoporosis: Pathophysiology and therapeutic options. *EXCLI J* 2020;19:1017-37.

2. Mak YW, Kao AHF, Tam LWY, Tse VWC, Tse DTH, Leung DYP. Health-promoting lifestyle and quality of life among Chinese nursing students. *Prim Health Care Res Dev* 2018;19:629-36.
3. Choi E, Kim J, Chung M, Hwang K. [Development of an osteoporosis awareness scale for women]. *J Korean Acad Nurs* 2008;38:813-21.
4. Muñoz-Garach A, García-Fontana B, Muñoz-Torres M. Nutrients and Dietary Patterns Related to Osteoporosis. *Nutrients* 2020;12:1986.
5. Hejazi J, Davoodi A, Khosravi M, Sedaghat M, Abedi V, Hosseini S, et al. Nutrition and osteoporosis prevention and treatment. *Biomedical Research and Therapy* 2020;7:3709-20.
6. Abdolalipour S, Mirghafourvand M. Effect of Education on Preventive Behaviors of Osteoporosis in Adolescents: A Systematic Review and Meta-Analysis. *Int Q Community Health Educ* 2021;41:325-47.
7. Golob AL, Laya MB. Osteoporosis: screening, prevention, and management. *Med Clin North Am* 2015;99:587-606.
8. Winzenberg TM, Oldenburg B, Frendin S, Jones G. The design of a valid and reliable questionnaire to measure osteoporosis knowledge in women: the Osteoporosis Knowledge Assessment Tool (OKAT). *BMC Musculoskelet Disord* 2003;4:17.
9. Pande KC, de Takats D, Kanis JA, Edwards V, Slade P, McCloskey EV. Development of a questionnaire (OPQ) to assess patient's knowledge about osteoporosis. *Maturitas* 2000;37:75-81.
10. Hallit S, El Hage C, Hajj A, Salameh P, Sacre H, Rahme C, et al. Construction and validation of the Lebanese Osteoporosis Knowledge Scale among a representative sample of Lebanese women. *Osteoporos Int* 2020;31:379-89.
11. Kayacan H. Osteoporosis scale for the diagnosis in primary health care institutions (thesis). Süleyman Demirel Univ; 2011.
12. Kim KK, Horan ML, Gendler P, Patel MK. Development and evaluation of the Osteoporosis Health Belief Scale. *Res Nurs Health* 1991;14:155-63.
13. Horan ML, Kim KK, Gendler P, Froman RD, Patel MD. Development and evaluation of the Osteoporosis Self-Efficacy Scale. *Res Nurs Health* 1998;21:395-403.
14. Koçak FA, Barut Ö, Kurt EE, Şaş S, Durmaz HÖ, Tuncay F, et al. Knowledge Level and Awareness About Calcium Deficiency, Vitamin D Deficiency and Osteoporosis Among Physical Therapy and Rehabilitation School Students *Turk J Osteoporos* 2020;26:23-9.
15. Oumer KS, Liu Y, Yu Q, Wu F, Yang S. Awareness of osteoporosis among 368 residents in China: a cross-sectional study. *BMC Musculoskelet Disord* 2020;21:197.
16. Shawashi TO, Darawad M. Osteoporosis Knowledge, Beliefs and Self-efficacy Among Female University Students: A Descriptive Study. *The Open Nursing Journal* 2020;14:211-9.
17. Aydın T. Awareness of Osteoporosis in Orthopaedic Surgeons. *Turkish Journal of Osteoporosis* 2020;26:63-9.
18. Dai W, Peng L, Xiong Y, Reynolds N, He A, Liu M, et al. Osteoporosis health beliefs and self-efficacy among orthopedic nurses in Hunan Province, China. *Int J Orthop Trauma Nurs* 2021;40:100839.
19. Peng L, Reynolds N, He A, Liu M, Yang J, She P, et al. Osteoporosis knowledge and related factors among orthopedic nurses in Hunan province of China. *Int J Orthop Trauma Nurs* 2020;36:100714.
20. Büyükköztürk Ş. Data analysis handbook for social sciences. Ankara: Ak Publishing; 2017.
21. Davis LL. Instrument review: Getting the most from a panel of experts. *Applied nursing research* 1992;5:194-7.
22. Yurdugül H, Bayrak F. Content validity measures in scale development studies: Comparison of content validity index and kappa statics. *Hacettepe University Journal of Education* 2012:264-71.
23. Alpar R. Practical Statistics and Validity Reliability with Examples from Sports Health and Education Sciences. 5th ed. Ankara: 2018.
24. Erdoğan S, Nahcivan N, Esin MN. Hemşirelikte araştırma: süreç, uygulama ve kritik. 2.Baskı ed: Nobel Tıp Kitabevi; 2015. p.193-233.
25. Seçer İ. Psikolojik test geliştirme ve uyarlama süreci: SPSS ve LISREL uygulamaları: Anı yayıncılık; 2018.

26. Gürbüz S, Şahin F. Sosyal Bilimlerde Araştırma Yöntemleri Felsefe-Yöntem-Analiz. 4thedition Seçkin Yayınevi. 2017;134:131-236.
27. Şencan H. Sosyal ve davranışsal ölçümlerde geçerlilik ve güvenilirlik. Ankara: Seçkin Matbaası. 2005.
28. Büyüköztürk Ş. Factor Analyses. Educational Administration in Theory and Practice. 2002. p. 470-83.
29. Karagöz Y. SPSS ve AMOS uygulamalı nitel-nicel-karma bilimsel araştırma yöntemleri ve yayın etiği. Nobel Akademik Yayıncılık. Ankara: 2017.
30. Simon D, Kriston L, Loh A, Spies C, Scheibler F, Wills C, et al. Confirmatory factor analysis and recommendations for improvement of the Autonomy-Preference-Index (API). Health Expect 2010;13:234-43.
31. Tavşanlı E. Tutumların ölçülmesi ve SPSS ile veri analizi (Measurement of attitudes, and data analysis with SPSS). Ankara: Nobel Publishing; 2010.
32. Doğan İ, Özdamar K. The effect of different data structures, sample sizes on model fit measures. Communications in Statistics-Simulation and Computation 2017;46:7525-33.
33. Karasar N. Bilimsel araştırma yöntemi (28. Baskı). Ankara: Nobel yayın dağıtım. 2015.
34. Kline P. The handbook of psychological testing: Psychology Press; 2000.