Validity and reliability of the Turkish version of the Neurological Disorders Depression Inventory for Epilepsy (NDDI-E)

Gül Ferda Cengiz [a,*], Nermin Tanık [b]

[a] Bozok University School of Medicine, Department of Psychiatry, Yozgat, Turkey
[b] Bozok University School of Medicine, Department of Neurology, Yozgat, Turkey

ARTICLE INFO

ABSTRACT

The aim of this study was to test the validity and reliability of the Turkish version of the Neurological Disorders Depression Inventory for Epilepsy (NDDI-E), which was developed to rapidly investigate depressive symptoms in patients with epilepsy. A consecutive sample of 51 patients with epilepsy was included in the study. The Beck Depression Inventory (BDI) and the Turkish version of the NDDI-E were applied to the participants. During the application, it was observed that the participants could quickly fill the scale without any difficulties in understanding the translated items. The Cronbach's α coefficient was 0.721. Receiver operating characteristic analysis showed an area under the curve of 0.902 (95% confidence interval [CI] = 0.822–0.983), a cutoff score of >15, a sensitivity of 88.2%, a specificity of 82.4%, a positive predictive value of 71.4%, a negative predictive value of 93.3%. The NDDI-E Turkish version scores were significantly and positively correlated with those of the BDI (Spearman's ρ = 0.832, p < 0.001). In conclusion, it has been determined that the Turkish version of the NDDI-E can be used as a valid and reliable measurement tool to detect major depression in Turkish people with epilepsy.

1. Introduction

While the rate of major depression in the general population [1] is around 4.7%, it reaches up to 20% in patients with epilepsy [2]. It has been reported that one of every four patients with epilepsy had depression, and 40% of them were not diagnosed [3]. Depression severity is independent of seizure severity and depression may be seen even in controlled cases [4]. Depression is not only associated with an increased risk of epilepsy, but also with worse epilepsy outcomes [5]. Lifetime prevalence rate of suicide is elevated in patients with epilepsy compared with that of the general population. The greatest effect in the high rates that has been found is due to psychiatric comorbidity [6]. Therefore, accompanying depression should not be neglected in patients with epilepsy.

For this purpose, the use of scales questioning depressive symptoms is quite functional. However, since the depression scales used in the general population include items that overlap with the side effects of antiepileptic drugs such as fatigue, sleep disorders, weight gain, and memory disorders, the specificity and the sensitivity of the scales in this patient group decreases [7,8]. The Neurological Disorders Depression Inventory for Epilepsy (NDDI-E) has been designed as a scale for screening the symptoms of depression in busy clinics in a short time

and does not include antiepileptic side effects [7]. The NDDI-E scale has also been shown to be an important scale in assessing quality of life in patients with epilepsy [9]. This scale has been translated into many languages including Chinese [10], Greek [11], Korean [12], Arabic [13], German [14], Spanish [15], and Italian [16], and validity and reliability studies have been performed. However, there is no validity and reliability study for the Turkish version yet. The aim of this study was to test the psychometric properties of the Turkish version of the NDDI-E scale.

2. Methods

2.1. Subjects

All consecutive patients who applied to the outpatient clinic of Bozok University Hospital, Department of Neurology, were invited to participate in the study. The study conducted between August 2018 and March 2019. Inclusion criteria were as follows: must be diagnosed with epilepsy based on clinical findings and electroencephalogram (EEG) recordings according to International League Against Epilepsy (ILAE) criteria, must be at least 18 years of age, must be a native Turkish speaker, and must be a volunteer participant in the study. The exclusion criteria were as follows: having significant intellectual disability, cognitive deficits, malignancy, any chronic

* Corresponding author.
E-mail address: glferda@hotmail.com (G.F. Cengiz).

Table 1
Demografic and clinical variables of the participants.

	Mean/ mean rank ± SD or number (%)			p value
	Total	With depression	Without depression	
	(N = 51)	(N = 17)	(N = 34)	
Sex				
Female	26 (51)	8 (47.1)	18 (52.9)	0.692[a]
Male	25 (49)	9 (52.9)	16 (47.1)	
Age	34.03 ± 11.98	25.5	26.25	0.865[b]
Education (N (%))				
5 years	11(21.6)	4 (23.5)	7 (20.6)	0.542[a]
8 years	9 (17.6)	4 (23.5)	5 (14.7)	
12 years	19 (37.3)	7 (41.2)	12 (35.3)	
>12 years	12 (23.5)	2 (11.8)	10 (29.4)	
Employment				
Housewife	20 (39.2)	6 (35.3)	14 (41.2)	0.228[a]
Employed	18 (35.2)	6 (35.3)	12 (35.3)	
Unemployed	4 (7.8)	3 (17.6)	1 (2.9)	
Retired	1 (2.0)	0	1 (2.9)	
Student	6 (11.8)	1 (5.9)	5 (14.7)	
other	2 (3.9)	1 (5.9)	1 (2.9)	
Marital status				
Single	14 (27.5)	3 (17.6)	11 (32.4)	0.221[a]
Married	36 (70.6)	13 (76.5)	23 (67.6)	
Divorced	1 (2.0)	1 (5.9)	0	
Seizure type				
Generalized onset	29 (56.9)	11 (64.7)	18 (52.9)	0.706[a]
Focal onset	19 (37.3)	5 (29.4)	14 (41.2)	
Unknown onset	3 (5.9)	1 (5.9)	2 (5.9)	
Age at onset of epilepsy	22.14 ± 12.4	22.29	27.15	0.264[b]
Seizures in last one year	3.58 ± 5.93	27.12	25.44	0.69[b]
Antiepileptic drugs				
None	1 (2.0)	0	1 (2.9)	0.430[a]
Monotherapy	41 (80.4)	14 (82.4)	27 (79.4)	
Dual therapy	8 (15.7)	2 (11.8)	6 (17.6)	
Polytherapy	1 (2.0)	1 (5.9)	0	
Current antidepressants intake	6 (11.8)	2 (11.8)	4 (11.8)	1.0[a]

[a] Chi-square test.
[b] Mann–Whitney U test.

disorder other than epilepsy, additional neurological disorder, nonepileptic seizures, and illiteracy.

A total of 65 patients were invited. Fourteen patients were excluded. Of these, 5 patients did not volunteer to participate in the study; 3 patients had a former diagnosis of intellectual disability; 2 were considered as having cognitive disability as they scored less than 25/30 in the Mini Mental State Examination test; 1 had a diagnosis of cerebral neoplasm, and 3 patients had no seizures in the last 5 years. In total, 51 patients who met the above-mentioned inclusion criteria were included in the study.

Sociodemographic characteristics, such as age, educational level, occupation, seizure types, number of seizures in the last year, and

antiepileptic and antidepressant medications were recorded. Informed consent was obtained from each patient before inclusion. Ethics committee approval was obtained from the local ethics committee(protocol number:2017-KAEK-189_2018.07.25_12).

2.2. Study design

2.2.1. Translation of the NDDI-E

The English version of the NDDI-E was translated into Turkish by both authors. The translated forms were evaluated and turned into a single form. The form was translated back to English by another medical doctor who had a good level of English without knowledge about the study. Afterwards, both versions were compared by a native English speaker and found it to be compatible with each other. The final version of the Turkish NDDI-E was applied to 20 patients for clarity, and no additional correction was required.

2.2.2. Psychometric tests

2.2.2.1. Beck Depression Inventory (BDI).
In this study, Beck Depression Inventory (BDI), which is frequently used in patients with epilepsy [17], is known to have high sensitivity and specificity. It is a self-report scale consisting of 21 questions that measures the symptoms and severity of depression. Each item is scored between 0 and 3 [18]. It was developed by Beck et al. [18], and a Turkish validity and reliability study is available [19]. After the inventory was administered to the patients, the diagnosis of depression was confirmed in a semistructured clinical interview (based on the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition [DSM-5] criteria) by the first author who was a psychiatrist.

2.2.2.2. The Turkish version of the Neurological Disorders Depression Inventory for Epilepsy.
The NDDI-E is a self-report scale consisting of 6 items scored between 1 (never) and 4 (always/often). It provides rapid screening of depressive symptoms in patients with epilepsy.

2.3. Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 15. The categorical variables were presented as percentage and counts. The continuous variables were demonstrated as the mean and standard deviation. Categorical data were analyzed by a chi-square test, while continuous variables were analyzed by the Mann–Whitney U test. The level of statistical significance was set at $p < 0.05$ (two-tailed). Internal consistency was measured by the Cronbach's α coefficient. Receiver operating characteristic (ROC) curve analysis was performed to assess the validity, including sensitivity and specificity, of the Turkish version of the NDDI-E. Area under the curve and its 95% confidence intervals (CIs) were calculated. To test

Table 2
English version/Turkish version and frequency of responses for each item of the NDDI-E.

| Item	Always/often Her zaman/sık sık	Sometimes Bazen	Rarely Nadiren	Never Hiçbir zaman
	(4)	(3)	(2)	(1)
1.Everything is a struggle/ Her şey için çok çabalıyorum	25 (49%)	17 (33.3%)	6 (11.8%)	3 (5.9%)
2.Nothing I do is right/ Hiçbir şeyi doğru yapamıyorum	3 (5.9%)	14 (27.5%)	21 (41.2%)	13 (25.5%)
3.Feel guilty/ Kendimi suçlu hissediyorum	10 (19.6%)	12 (23.5%)	14 (27.5%)	15 (29.4%)
4.I'd be better off dead/ Ölmeyi isterdim	3 (5.9%)	8 (15.7%)	7 (13.7%)	33 (64.7%)
5.Frustrated/ Hayal kırıklığına uğradım	9 (17.6%)	7 (13.7%)	18 (35.3%)	17 (33.3%)
6.Difficulty finding pleasure/ Zevk almakta zorlanıyorum	7 (13.7%)	14 (27.5%)	12 (23.5%)	18 (35.3%)
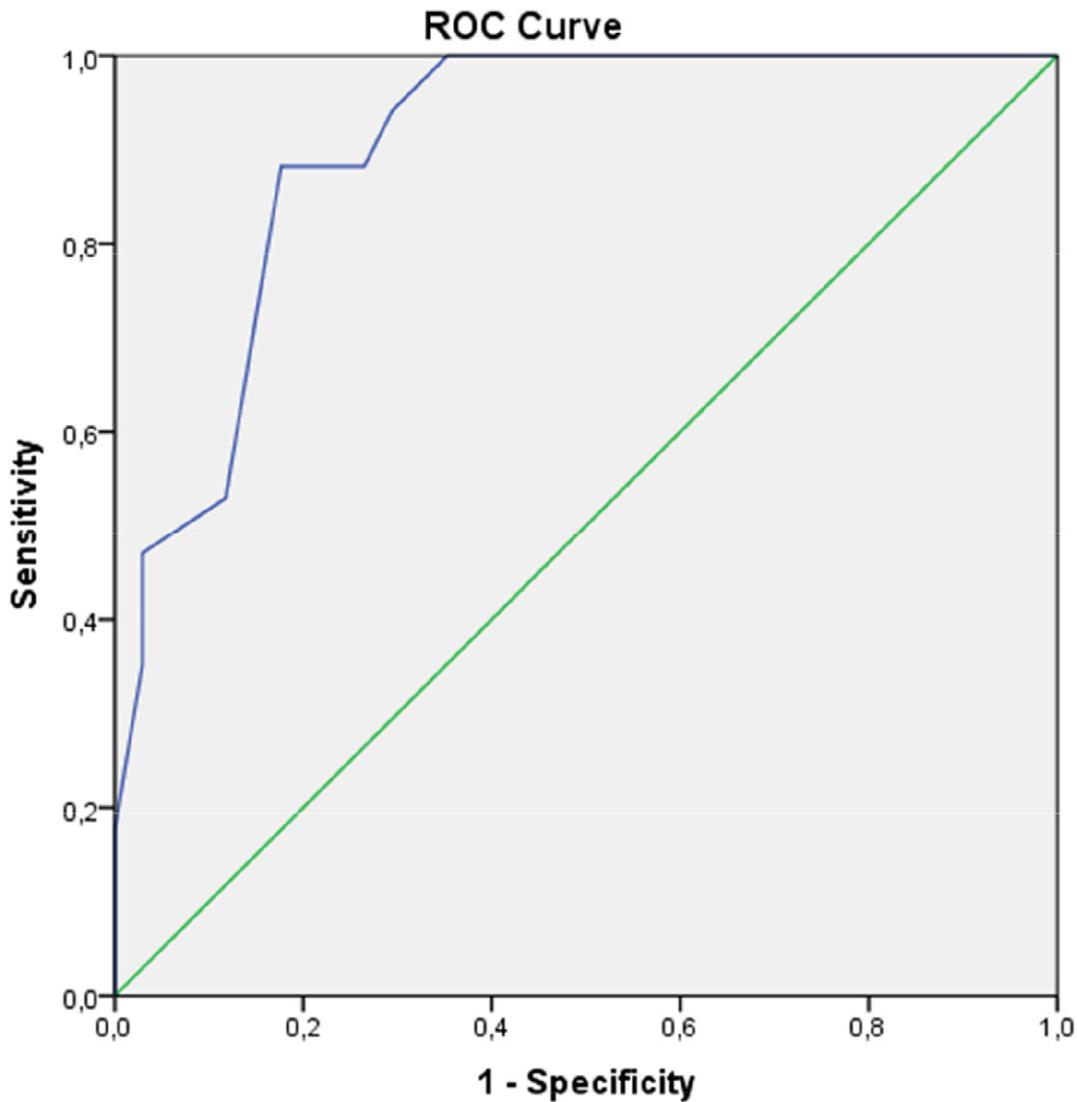
Fig. 1. The ROC curve of the Turkish version of the NDDI-E.

the convergent validity, we investigate the relationships between the NDDI-E and the BDI by using Spearman's ρ.

3. Results

A total of 51 patients with epilepsy (26 female, 25 male) were included in the study. Demographic and clinical variables are shown in Table 1. The number of the patients with depression was 17, while the number of the patients without depression was 34. There were no significant differences between the group with depression and group without depression. In the group without depression, the mean score of the BDI was 6.17 ± 4.95, and the mean score of the NDDI-E was 11.91 ± 3.26. In the group with depression, the scores of the same scales were detected 24.7 ± 6.52 and 17.29 ± 2.2, respectively. All of the subjects completed the Turkish version of the NDDI-E without any difficulties in understanding and replying to the items. Translated version and the frequency of responses for each item of the NDDI-E were presented in Table 2. (See Fig. 1.)

The Cronbach's α value for the Turkish version of the NDDI-E was 0.721, which indicates an acceptable level of internal consistency and reliability (Table 3). As shown in Table 3, there were significant and positive relationship between all of the items and total NDDI-E score. None of the items would increase the Cronbach's α value if deleted.

The ROC analysis (Table 4) showed an area under the curve of 0.902 (95%CI = 0.822–0.983). At a cutoff score >15, the Turkish version of the NDDI-E had a sensitivity of 88.2%, a specificity of 82.4%, a positive predictive value (PPV) of 71.4%, and a negative predictive value (NPV) of 93.3%. The scores of the Turkish version of the NDDI-E were significantly and positively correlated with those of the BDI (Spearman's $\rho = 0.832$, $p < 0.001$).

4. Discussion

The Turkish version of the NDDI-E scale showed successful psychometric properties. The Cronbach's α value was found to be 0.721. Although this value is lower than the values found in other versions of

Table 3
Corrected item-total correlations and Cronbach's α if an item is deleted from the NDDI-E.

	Corrected item-total correlation	Cronbach's α if an item is deleted
Item 1	0.464	0.682
Item 2	0.354	0.710
Item 3	0.565	0.646
Item 4	0.485	0.674
Item 5	0.428	0.692
Item 6	0.439	0.689

Table 4
ROC analysis and diagnostic efficiency of the Turkish version of the NDDI-E for the diagnosis of current MDD.

Cutoff score	Sensitivity	Specificity	PPV	NPV	AUC	SE	95%CI	p value
>13	94.1	70.6	61.5	96.0				
>14	88.2	73.5	62.5	92.6				
>15	88.2	82.4	71.4	93.3	0.902	0.041	0.822–0.983	<0.001
>16	52.9	88.2	69.2	78.9				
>17	47.1	97.1	88.9	78.6				

PPV = positive predictive value.
NPV = negative predictive value.
AUC = area under the curve.
SE = standard error.
CI = confidence interval.

the scale, it can be said that it has sufficient internal consistency since it is above the critical value of 0.7. The relatively lower value may be because of the smaller sample size. The cutoff score of the scale was found to be over 15, similar to the Greek [11], Arabic [13], and the original version [7], 88.2% sensitive, 82.4% specific, NPV 93.3%, and it was concluded that it was successful to distinguish patients with depression from those without. When the literature is investigated, it is seen that the different cutoff scores have been found in various studies in different countries; thus, the importance of testing the validity and reliability of the scales before using was also demonstrated. A very strong positive correlation was found between the Turkish version of the NDDI-E and the BDI, which is one of the most commonly used depression scales, and it showed that the scale was successful in terms of validity. It was observed that the scale was very practical during the application; it was not difficult for the patients to understand the questions, and depression screening was very easy.

In our study, the ratio of men and women was approximately equal. There was no significant difference between the genders in terms of depressive symptoms in accordance with the results in the Korean and Serbian versions of the scale. In the literature, there are studies reporting that depression is more common in female patients with epilepsy than in male patients, and conversely, there are also studies that did not find a significant difference between them [20,21].

Contrary to a previous study reporting that subjects with depression and epilepsy were significantly more likely to be single and unemployed than subjects with epilepsy without depression [22], no significant difference was found between these two groups in our study. The difference in the number of patients may have had an impact on the results, as well as the fact that women in our country do not take an active role in the business life, usually being a housewife.

There was no significant difference between the group with depression and the group without depression in terms of seizure type.

The relatively small sample size is a limitation of this study. Since the population of the province where the study is conducted is relatively small, the number of patients with epilepsy who visit the outpatient clinics is also small. Therefore, it is difficult to reach high number of patients.

In conclusion, the results showed that the Turkish version of the NDDI-E scale could be used as a valid and reliable measurement tool. The advantage of the scale is that it is short and understandable, and it can be easily applied by both neurologists and psychiatrists. It is thought that the scale will facilitate screening of depressive symptoms in patients with epilepsy, and thus, help to avoid overlooked cases, especially in busy clinics.

Declaration of competing interest

None.

References

[1] Ferrari AJ, Somerville AJ, Baxter AJ, Norman R, Patten SB, Vos T, et al. Global variation in the prevalence and incidence of major depressive disorder: a systematic review of the epidemiological literature. Psychol Med 2013;43(3):471–81.
[2] Fiest KM, Dykeman J, Patten SB, Wiebe S, Kaplan GG, Maxwell CJ, et al. Depression in epilepsy: a systematic review and meta-analysis. Neurology 2013;80(6):590–9.
[3] Siarava E, Hyphantis T, Katsanos AH, Pelidou SH, Kyritsis AP, Markoula S. Depression and quality of life in patients with epilepsy in Northwest Greece. Seizure: European Journal of Epilepsy 2019;66:93–8.
[4] Attarian H, Vahle V, Carter J, Hykes E, Gilliam F. Relationship between depression and intractability of seizures. Epilepsy Behav 2003;4(3):298–301.
[5] Josephson CB, Lowerison M, Vallerand I, Sajobi TT, Patten S, Jette N, et al. Association of depression and treated depression with epilepsy and seizure outcomes: a multicohort analysis. JAMA Neurol 2017;74(5):533–9.
[6] Jones JE, Hermann BP, Barry JJ, Gilliam FG, Kanner AM, Meador KJ. Rates and risk factors for suicide, suicidal ideation, and suicide attempts in chronic epilepsy. Epilepsy Behav 2003;4:31–8.
[7] Gilliam FG, Barry JJ, Hermann BP, Meador KJ, Vahle V, Kanner AM. Rapid detection of major depression in epilepsy: a multicentre study. Lancet Neurol 2006;5:399–405.
[8] Piedad J, Rickards H, Besag FM, Cavanna AE. Beneficial and adverse psychotropic effects of antiepileptic drugs in patients with epilepsy. CNS Drugs 2012;26(4):319–35.
[9] Micoulaud-Franchi JA, Bartolomei F, Duncan R, McGonigal A. Evaluating quality of life in epilepsy: the role of screening for adverse drug effects, depression, and anxiety. Epilepsy Behav 2017;75:18–24.
[10] Tong X, An D, Lan L, Zhou X, Zhang Q, Xiao F, et al. Validation of the Chinese version of the neurological disorders depression inventory for epilepsy (C-NDDI-E) in West China. Epilepsy Behav 2015;47:6–10.
[11] Zis P, Yfanti P, Siatouni A, Tavernarakis A, Gatzonis S. Validation of the Greek version of the neurological disorders depression inventory for epilepsy (NDDI-E). Epilepsy Behav 2013;29(3):513–5.
[12] Ko PW, Hwang J, Lim HW, Park SP. Reliability and validity of the Korean version of the Neurological Disorders Depression Inventory for Epilepsy (K-NDDI-E). Epilepsy Behav 2012;25(4):539–42.
[13] Alkhamees HA, Selai CE, Shorvon SD, Kanner AM. The use of the NDDI-E in Arabic to identify symptoms of depression of moderate or greater severity in people with epilepsy. Epilepsy Behav 2014;32:55–8.
[14] Metternich B, Wagner K, Buschmann F, Anger R, Schulze-Bonhage A. Validation of a German version of the neurological disorders depression inventory for epilepsy (NDDI-E). Epilepsy Behav 2012;25(4):485–8.
[15] Di Capua D, Garcia-Garcia ME, Reig-Ferrer A, Fuentes-Ferrer M, Toledano R, Gil-Nagel A, et al. Validation of the Spanish version of the Neurological Disorders Depression Inventory for Epilepsy (NDDI-E). Epilepsy Behav 2012;24(4):493–6.
[16] Mula M, Iudice A, La Neve A, Mazza M, Bartolini E, De Caro MF, et al. Validation of the Italian version of the neurological disorders depression inventory for epilepsy (NDDI-E). Epilepsy Behav 2012;24(3):329–31.
[17] de Oliveira GN, Lessa JMK, Gonçalves AP, Portela EJ, Sander JW, Teixeira AL. Screening for depression in people with epilepsy: comparative study among neurological disorders depression inventory for epilepsy (NDDI-E), hospital anxiety and depression scale depression subscale (HADS-D), and Beck depression inventory (BDI). Epilepsy Behav 2014;34:50–4.
[18] Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. Arch Gen Psychiatry 1961;4(6):561–71.
[19] Hisli N. Beck depresyon envanterinin universite ogrencileri icin gecerliligi, guvenilirligi.(A reliability and validity study of Beck Depression Inventory in a university student sample). J Turkish Psychol 1989;7:3–13.
[20] Gaus V, Kiep H, Holtkamp M, Burkert S, Kendel F. Gender differences in depression, but not in anxiety in people with epilepsy. Seizure 2015;32:37–42.
[21] Piazzini A, Canevini MP, Maggiori G, Canger R. Depression and anxiety in patients with epilepsy. Epilepsy Behav 2001;2(5):481–9.
[22] Thompson AW, Miller JW, Katon W, Chaytor N, Ciechanowski P. Sociodemographic and clinical factors associated with depression in epilepsy. Epilepsy Behav 2009;14(4):655–60.