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Original Article NEUROLOGY

Validation and reliability study of the Turkish version of the everyday cognition - 12 (T- ECog) scale

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ABSTRACT

OBJECTIVE: Assessing the activities of daily living (ADL) is important in cognitive impairment. The everyday cognition scale includes 12 items (ECog-12). It evaluates complex ADLs and executive functions. This scale can differentiate healthy elderly people from patients with mild cognitive impairment (MCI) as well as MCI from dementia patients. Our aim is to validate a Turkish version of ECog-12.

METHODS: The study group consisted of 40 healthy elders, 40 patients with Alzheimer's disease (AD), and 40 patients with MCI. In addition to T-ECog-12, test - your memory- Turkish version (TYM-TR), Geriatric Dementia Scale (GDS), the Blessed orientation-memory-concentration (BOMC), and Katz ADL tests were administered to all participants for concurrent validity.

RESULTS: Cronbach's alpha test showed excellent internal consistency (0.93). When T-ECog-12 was compared to the other tests, strong positive correlations were found between the GDS and BOMC; in addition, strong negative correlations were found between Katz ADL and TYM-TR scale. ECog-12 was found to be sensitive in differentiating healthy individuals from individuals with dementia (AD and MCI) (Area under the curve [AUC]=0.82, CI=0.74–0.89). It was found to have low sensitivity in discriminating between MCI and healthy individuals (AUC=0.52, CI=0.42–0.63).

CONCLUSION: T-ECog-12 was found to be reliable and valid for Turkish population. This scale is reliable and effective in diagnostic distinguishing healthy individuals from dementia.

Keywords: Cognition; dementia; mild cognitive impairment.

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Mild cognitive impairment (MCI) is a mild disturbance in memory that may occur before dementia. When there is a decline in cognitive functions, it is important to determine the extent to which it affects a patient's activities of daily living (ADL) [1]. Therefore, the International Working Group on MCI proposed to evaluate complex ADL in the diagnosis of MCI [2]. The evaluation of complex ADL may take a long time in clinical practice and may not be easy to do during the examination. To assess the functional status of cognitively impaired individuals properly, several tools such as general assessment tools, self-report, informant reports, and performance-based measurements can be used [3, 4]. When all these assessment tools are reviewed separately, some of these measurements can be problematic in reflecting the real-life performance of the patients. As the patients have cognitive impairments, their answers can differ from those of their caregivers' in self-report questions [5–7]. Performance-based tasks would be time-consuming and some researchers argue that they do not reflect patients' normal cognition. Therefore, informant-report tools may be more suitable and practical patients, as their caregivers know them very well and are able to compare their changes in daily life activities [8, 9].

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Everyday cognition scale (ECog) is an informant-report scale. It was developed to evaluate the functional abilities of older adults, MCI, and dementia patients. It assesses the six domains as memory, language, visuospatial function, planning, organization, and divided attention [7]. Furthermore, another validation and reliability study was conducted with 12 items to reduce the size of the original scale [10]. In Turkiye, we have limited scales available to assess daily living activities. Thus, this study aims to validate Turkish version of ECog includes 12 items (ECog-12).

Highlight key points

- Activities of daily living is affected in MCI and AD.
- ECog-12 is a valid and reliable scale to differentiate healthy elderly, MCI and AD.
- T-ECog-12 was found to be reliable and valid for Turkish population.

MATERIALS AND METHODS

Study Design

The present study was designed in two stages. In the first stage, the translation of ECog has been made by two local professional translators which they are native Turkish speakers and bilingual in English. After this translation, Turkish version of ECog has been reconciliation by a linguistic validation editor and has been decided one of the translation versions. This version has been translated by a translator who is a native English language and bilingual in both Turkish and English. The backward translation version of the ECog-12 compared with the original version. The final translation was checked by 10 healthy volunteers for cognitive debriefing. In this manner, T-ECog-12, the final Turkish version of ECog-12, was formed (Appendix 1).

After that, the reliability and validity tests of the Turkish version of ECog-12 were examined. Internal consistency was evaluated by examining the item-total correlations and Cronbach's alpha coefficients. The item-total correlations were calculated by removing each of the 12 items. We calculated Cronbach's alpha values with by extracting each item from the scale. Cut-off values for Cronbach's alpha have been accepted as >0.7 acceptable, >0.8 good, and >0.9 excellent. Values above 0.3 have been accepted for item-total correlation. Concurrent validity was tested by comparing other-related scales. T-ECog-12 scores were calculated as total scores.

Subjects

Alzheimer's dementia (AD) and MCI patients were consecutively enrolled from the outpatient department. Probable AD diagnosis was made according to NINCDS-ADRDA (National Institute of Neurological and Communicative Disorders and Stroke - AD and Related Disorders Association) criteria [11]. The diagnosis of MCI was established by according to the criteria of Petersen et al. [12]. Randomized healthy volunteers were enrolled in the study. According to Clinical Dementia Rating (CDR) scale, stage I and II AD cases were added to the study [13]. Sociodemographical and clinical characteristics such as age, gender, and education were assessed. Groups were divided into four subgroups regarding age (50–60, 61–70, 71–80, and 81–90 years old). The level of education was classified as primary school, high school, and university.

Instruments

T-ECog-12

This scale consists of different domains such as memory, language, visuospatial function, planning, organization, and executive function which have been developed from the original ECog [7, 10]. For every item, informants were asked to compare the patient's current level of everyday functioning to that of 10 years ago. Questions were answered by the caregivers and/or family members and close friends of the subjects. A 4-point scale was used to rate participants: 1=better or no change, 2=occasionally worse, 3=consistently a little worse, 4=consistently much worse, and "I do not know." The total scores of participants ranged from 1 to 4; excluding "I do not know" scores which were rated as 9 points; its score is calculated by adding all scores, ranging from 12 to 48, with higher scores reflecting the worst cognitive state. Patient's score is obtained by dividing the total score by the number of items. After a 4-week interval, participants were readministered T-ECog-12.

Neuropsychological Measures

Test Your Memory - Turkish (TYM-TR) version is a cognitive screening test that can be self-administered in a short time [14]. The reliability and validity study of the Turkish version of the TYM was done by Mavis et al. [15]. A total score is 50 points, while scores lower than 34 indicate inadequate cognitive status. The blessed orientation-memory-concentration (BOMC) test is a standardized tool for assessing memory, orientation, and concentration [4]. It

Table 1. Reliability analysis of T-ECog-12 items

Item no	Item	Mean±SD	Cronbach's α	ICC
1	Remembering where she/he has placed objects.	1.9±0.8	0.933	0.640
2	Remembering the current date or day of the week.	1.7±0.9	0.930	0.734
3	Communicating thoughts in a conversation.	1.7±0.8	0.927	0.820
4	Understanding spoken directions or instructions.	1.7±0.8	0.931	0.701
5	Reading a map and helping with directions when someone else is driving.	1.5±1	0.931	0.724
6	Finding his/her way around a house visited many times.	1.4±0.7	0.933	0.668
7	The ability to anticipate weather changes and plan accordingly (i.e. bring a coat or umbrella).	1.5±0.8	0.933	0.655
8	Thinking ahead.	1.6±0.9	0.929	0.753
9	Keeping living and workspace organized.	1.4±0.7	0.935	0.594
10	Balancing the checkbook without error.	1.6±0.9	0.930	0.732
11	The ability to do two things at once.	1.8±0.9	0.926	0.827
12	Cooking or working and talking at the same time.	1.6±0.9	0.930	0.748

Mean values and confidence intervals of reliability analysis for T-ECog-12 scale. Variables presented as mean±standard deviation (SD) because of normal distribution. Cut-off values of Cronbach's alpha are as follows: >0.78 (acceptable), >0.8 (good), and >0.9 (excellent). Internal consistency correlation (ICC) is statistically significant at p≤0.001.

is comprised 6 questions, and each wrong answer is rated 1 point. The highest possible score is 28 which indicates poor orientation, memory, and concentration. The validation of BOMC was done by Akca-Kalem et al. [16].

The Katz Index of Independence in ADL Scale (Katz ADL) is a valid tool for assessing the level of independence in the elderly [17]. Each item is rated either "0," dependent, or "1," independent. A total score of 6 is considered "independent" and 0 points is considered "fully dependent." It was validated by Arik et al. [18].

The Geriatric Depression Scale (GDS) is a 30-item self-report assessment [19]. It is used to identify depression in older adults. Items are answered "yes" or "no." Scores range from 0 to 30, with higher scores indicating severe depression. It was validated by Ertan and Eker [20].

Statistical Analysis

Data analyses were performed using Statistical Package for the Social Sciences software (SPSS 16, Chicago, IL, USA). Descriptive statistical analysis was used to describe the basic features of the data. The numerical data are expressed as mean and standard deviation (SD). Determination of reliability was performed with Cronbach-alpha coefficient and item-total score analyses. Scores between 0.70 and 0.95 are considered acceptable reliability indicators. Concurrent validity was assessed between the T-ECog test and Katz ADL, BOMC, TYM-TR, and GDS scores by Pearson's correlation analysis. The t-test was used for pairwise comparisons. Healthy volunteers, AD, and MCI groups were compared for the measured scores by one-way ANOVA and the Tukey *post-hoc* test. $P<0.05$ indicated statistical significance. Receiver operating characteristic (ROC) curve analysis was performed to determine the effectiveness of T-ECog-12 in healthy volunteers, MCI, and AD.

Ethics

Information about the research was given to all participants. Patients or their legal guardians provided informed signed consent. The study protocol and ethics procedures were approved by the Maltepe University Clinical Research Ethics Committee (acceptance number: 2020/900/57).

RESULTS

The ratio of male/female was 41/59% of total 120 patients, and the mean age was 72.7±7 years. The study group consisted of 40 healthy volunteers, 40 patients with AD, and 40 patients with MCI. Cronbach's α result of the T-ECog-12 was found to be 0.93, and its test–retest reliability was 0.68. Table 1 shows the mean scores, the SD,

Table 2. Correlation between T-ECog-12 and the other generic measures

Other scales	T-ECog-12 total score
Katz ADL	-0.427**
GDS	0.212*
TYM-TR	-0.383**
BOMC	0.566**
Re-test/T-ECog-12	0.683**

T- ECog-12: Turkish everyday cognition -12; Katz ADL: Katz Index of Independence in Activities of Daily Living Scale; GDS: Geriatric Depression Scale; TYM-TR: Test your memory - Turkish; BOMC: Blessed Orientation-Memory-Concentration Test; *: P=0.02; **: P<0.0001.

internal consistency correlations, and Cronbach's α result for each domain of the T-ECog-12 test. There was a positive correlation between T-ECog-12 and GDS, BOMC. There was a negative correlation between T-ECog-12 and Katz ADL, TYM-TR (Table 2). The mean scores of the T-ECog-12 scale for each group were 1.2±0.2 for healthy volunteers, 1.5±0.3 for the MCI group, and 2.1±0.8 for the AD group. There was found no difference between female (1.5±0.6) and male (1.7±0.7) groups (p=0.10) according to mean T-ECog-12 scores. When the groups were compared according to total scores of the T-ECog-12, there was a significant difference between the healthy volunteers and MCI group (p=0.0001); MCI and AD groups (p= 0.0001) (Table 3). The mean scores of T-ECog-12 according to age groups were 1.3±0.4 in 50–60 years old group (n=22), 1.5±0.7 in 61–70 years old group (n=42), 2.1±1 in 71–80 years old group (n=38), and 2.2±1 in 81–90 years old group (n=18) (F[3,119]=7.5 p=0.0001). No difference was found between education level and mean T-ECog-12 scores (F[4.118]=1.61, p=0.17).

ROC curves were used to distinguish between the healthy volunteers, MCI, and AD. The specificity of T-ECog-12 was found to be 0.82 in differentiating the healthy volunteers from the cognitively impaired groups (MCI and AD) (95% CI=0.74–0.89). Optimal cut-off values are calculated (Table 4). The highest sensitivity score was obtained in discriminating AD from the healthy volunteers. The lowest sensitivity score was obtained in discriminating MCI from healthy volunteers (Area under the curve [AUC]=0.52).

DISCUSSION

Assessing the ADL is quite necessary to follow the prognosis during the early stages of dementia. For this purpose, ECog-12 is widely used in clinical and research fields such as AD Neuroimaging Initiative (ADNI) [21].

The ECog domains were most consistently related with the neuropsychological measures that examined episodic memory, semantic memory, spatial ability, and executive functions [10].

Table 3. T-ECog-12, other generic measures, and demographic characteristics and of the participants

Variables	Healthy volunteers	Mild cognitive impairment's group	Alzheimer's dementia group	p
Age (years)	71.4±6	71.1±8	72.6±7	0.08
Sex (female/male)	29/11	21/19	21/19	0.11
Educational level (%)				
Primary school	–	–	5	0.07
High school	41	44	57	
University	59	56	38	
Mean score of T-ECog-12	1.2±0.2	1.5±0.3	2.1±0.8	**0.0001**
Katz ADL	6	5.7±0.8	4.6±2.1	**0.0001**
GDS	7.8±5.3	7.3±5.3	10±6.5	**0.1**
TYM-TR	44.3±8.4	38.7±5.8	22.9±13.4	**0.0001**
BOMC	2.7±4	5.4±4.3	11.5±8.5	**0.0001**

Values are presented as mean±standard deviation. T- ECog-12: Turkish everyday cognition -12; Katz ADL: Katz Index of Independence in Activities of Daily Living Scale; GDS: Geriatric Depression Scale; TYM-TR: Test your memory - Turkish; BOMC: Blessed Orientation-Memory-Concentration Test.

Table 4. The discrimination sensitivity and specificity of T-ECog-12 in healthy volunteers, MCI, and AD patients

Comparison of T-ECog-12 scores	AUC	Specificity (%) (with 80% sensitivity)	Optimal cut-off score
Healthy volunteers vs AD and MCI	0.82 (CI=0.74–0.89)	95	1.70
AD vs healthy volunteers	0.86 (CI=0.79–0.94)	95	1.74
AD vs MCI	0.71 (CI=0.60–0.83)	98	2.2
MCI vs healthy volunteers	0.52 (CI=0.42–0.63)	55	1.45

T- ECog-12: Turkish everyday cognition -12; AUC: Area under the curve; AD: Alzheimer's dementia; MCI: Mild cognitive impairment.

In this study, the validity and reliability of the ECog-12 were analyzed and compared with other neuropsychological tests. Internal consistency of the T-ECog-12 scale was found as 0.93, and its test–retest reliability was 0.68. In their study, Farias et al. [10] found that the ECog scale has 0.95 sensitivity in differentiating the dementias from the normal group. However, they also reported that it has low sensitivity in differentiating mild dementia and MCI from normal controls. When only ECog-12 is used, it has 62% sensitivity in separating MCI from the healthy group; when it is used with the mini-mental test, its sensitivity and its specificity were found as, respectively, 80% and 76%.

In our study, we found that T-ECog-12 has a sensitivity of 98% in discriminating MCI from AD; however, it has decreased to 55% when it comes to discriminate MCI from healthy controls. Distinguishing the MCI group from healthy controls using cognitive tests is still challenging. Performance- and information-based instruments used for distinguishing between MCI and healthy individuals were found to have low sensitivity [22–24]. It is reported that the sensitivity is increased when the information-based scales are used together with the short performance-based scales [25]. It is reported that ECog-12 is a scale that is not affected by education level. This situation is also consistent with the result of our study [10]. Its being informant-based might be a disadvantage, as the caregiver burden and mood might affect the answers [26]. However, the reliability of self-reported scales can be also questioned in dementia patients [24, 25, 27].

In the Korean version of the ECog, the Cronbach's α score was 0.93 and the test–retest reliability was 0.73 [28].

Russo et al. [29] noted that Cronbach's ECog α score was. 98 and the AUC in the ROC analysis was 0.97 and was more sensitive than the Functional Activities Questionnaire (FAQ) in distinguishing dementia or MCI from normal. In the Korean validation study, the cut-off score of the ECog in differentiating MCI from the healthy group was 1.41. The cut-off score was 1.61 in distinguishing Alzheimer's from the healthy volunteer group and 1.59 in distinguishing the MCI plus AD group from the healthy group [28]. The cut-off values we found are also similar.

In the study of Park et al. [30], the ECog scale with 39 items was used in individuals with AD and frontotemporal dementia. Their findings show that different patterns of everyday functional parameters can distinguish dementia types.

Most domains of ECog were found related to the hippocampus and total brain volumes [31]. The memory domain of the ECog scale was found significantly correlated with 18F-fluorodeoxyglucose uptake in positron emission tomography (PET) in the angular gyrus and posterior cingulate gyrus [32].

The ECog scale was originally developed to measure mild functional changes in activities of daily living (ADL) [7]. Compared to the Katz ADL, T-ECog-12 was found to be more sensitive in differentiating healthy volunteers from MCI [5].

Although basic ADLs are not affected, complex (instrumental) ADLs may be deteriorated in MCI. There is a need for practical screening tests that take a short time to administer in the outpatient clinic and that can measure both cognitive functions and ADLs. The Lawton–Brody Scale [33], the FAQ [34], Performance-based Skills Assessment Scale [35], and Direct Assessment of Functional Status [36] are instrumental ADL scales. They evaluate telephone use, shopping, food preparation, housekeeping, laundry, transportation, responsibility for own medications and finances, and remembering appointments and hobbies [33–36]. The application of these scales requires more time.

It has been shown that executive dysfunctions may indicate in impairment in instrumental ADLs. While the impairment of executive functions may identify healthy individuals from MCI, impairment in instrumental ADL predicts MCI cases that will progress to AD [33–36].

The limitation of our study was the sample size, conducting with larger MCI groups would have given more consistent results in assessing the reliability of this scale.

Conclusion

The ECog-12 has a structure that evaluates executive functions and instrumental daily living activities, hence we aimed to validate the Turkish version of this scale. In a clinical setting, the T-ECog-12 is a reliable tool for differentiating healthy older, MCI and AD cases from each other in Turkish population.

Ethics Committee Approval: The Maltepe University Clinical Research Ethics Committee granted approval for this study (date: 01.07.2020, number: 2020/900/57).

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

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Authorship Contributions: Concept – NC, FSK, SS, MFA, SK; Design – NC, FSK, SS, MFA, SK; Supervision – NC, FSK, SS, MFA, SK; Fundings – NC, FSK, SS, MFA, SK; Materials – NC, FSK, SS, MFA, SK; Data collection and/or processing – NC, FSK, SS, MFA, SK; Analysis and/or interpretation – NC, FSK, SS, MFA, SK; Literature review – NC, FSK, SS, MFA, SK; Writing – NC, FSK, SS, MFA, SK; Critical review – NC, FSK, SS, MFA, SK.

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Appendix 1. The Turkish version of the Everyday Cognition – 12

Türkçe Günlük Bilişsellik Ölçeği (T-ECog-12)

Not: Bu test hastanın bakıcısı, aileden birisi ya da bir arkadaşı tarafından doldurulmalıdır.

Hastanın Adı…….. Uygulama Tarihi…….

Bilgi Veren / Bakıcı Formu

Uygulama: Lütfen sorulara hastanızın günlük yaşam becerilerini 10 yıl öncesi ile ŞİMDİKİ durumunu karşılaştırarak yanıt veriniz. Başka bir deyişle, 10 sene önce bu günlük yaşam aktivitelerini nasıl yaptığını hatırlamaya çalışın ve herhangi bir değişiklik gördüyseniz belirtiniz. Değişikliğin düzeyini 5'li ölçek üzerinden: 1) hiç değişiklik yok ya da 10 sene öncesinden daha iyi yapıyor 2) bazı durumlarda daha kötü ama her zaman değil 3) 10 sene önceye göre biraz daha kötü yapıyor 4) 10 sene önceye göre çok kötü yapıyor ya da 5) bilmiyorum olmak üzere puanlayınız. Cevabınıza uygun olan sayıyı yuvarlak içine alınız.

	10 yıl öncesiyle karşılaştırıldığında, herhangi bir değişiklik...	Daha iyi ya da hiç değişiklik yok	Tartışılır/ Bazen daha kötü	Giderek hafifçe kötüleşiyor	Giderek çok kötüleşiyor	Bilmiyorum
1	Eşyaları nereye koyduğunu hatırlamak	1	2	3	4	9
2	Tarihi ya da haftanın gününü hatırlamak	1	2	3	4	9
3	Konuşma esnasında düşüncelerini ifade etmek	1	2	3	4	9
4	Sözel tarifleri veya açıklamaları anlamak	1	2	3	4	9
5	Başkası araba sürerken haritayı takip etmek ve yolu tarif etmek	1	2	3	4	9
6	Daha önce çok defa ziyaret ettiği ev ya da binada yolunu bulmak	1	2	3	4	9
7	Hava durumunu takip etmek ve ona göre planlama yapmak	1	2	3	4	9
8	Geleceği planlamak	1	2	3	4	9
9	Yaşam alanını ve iş ortamını düzenli tutmak	1	2	3	4	9
10	Hesap işlerini hatasız yapmak	1	2	3	4	9
11	Aynı anda iki işi yapmak	1	2	3	4	9
12	Yemek pişirirken ya da iş yaparken aynı anda konuşmak	1	2	3	4	9