

Development, Validity and Reliability of the 4-point Likert Turkish version of Cognitive Failures Questionnaire

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Abstract

Aim: Cognitive failures are suggested to be a transdiagnostic endophenotype that increases the vulnerability for psychiatric disorders. Broadbent's Cognitive Failures Questionnaire (CFQ), is among the most widely used scales to assess cognitive function observed in an ecological manner. Despite its wide use in research and correlation with biological markers, CFQ is criticized for its unstable factorial structure among studies and 5-Likert structure that may lead to bias for neutral answers. Here we aimed to develop a 4-Likert Turkish version of CFQ, search its validity, reliability and factorial structure.

Material and Methods: CFQ has been translated to Turkish in two steps. CFQ, Perceived Deficit Questionnaire-D (PDQ-D), Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI) were applied to 272 participants (187 healthy controls, 55 patients diagnosed with depression, 30 patients diagnosed with anxiety disorder).

Results: The Cronbach's alpha coefficient of 4-Likert Turkish version of CFQ was found as 0.91. Principal component analysis extracted five factors and explained 53.7 % of total variance. CFQ scores were significantly different among groups. Both depressive and anxious groups reported higher CFQ scores compared to controls. CFQ significantly and strongly correlated with PDQ-D and showed a moderate correlation with BDI and BAI.

Conclusion: 4-Likert Turkish version of CFQ is a valid and reliable tool to assess cognitive failures in non-demented groups. Our analysis revealed a five factorial structure for CFQ, however previous literature with the 5-Likert version shows different factor structures and does not indicate a dimensional stability.

Keywords: Anxiety; cognitive failure; depression; validity

INTRODUCTION

Cognitive dysfunction is a core feature related to all of the psychiatric disorders (1) and it is a transdiagnostic endophenotype that affects remission and relapses (1). On the other hand, early life adversities and chronic stress can also lead to cognitive failures (2), and increase the vulnerability for all psychiatric disorders through cognitive dysfunction (3). As cognitive dysfunction presents as a bidirectional mediator between etiologies and pathologies, a wider screening and awareness of cognitive parameters is essential for an understanding of psychiatric disorders and patients' complaints.

Broadbent's Cognitive Failures Questionnaire, which was developed in 1982, is among the most widely used scales to assess perceived cognitive function observed in an

ecological manner. Broadbent reported its development for specifically assessment of attention, perception, memory and motor function/action (slips of action as false triggering). In their original paper, they suggest participant's scores in CFQ correlate with other people's observations about the participant's cognitive failures and also that by measuring the events in the last 6 months; it measures trait vulnerability for cognitive failures, instead of a state dependent change (3). Still, among the other self-report measures of daily life cognitive deficits as Cognitive Slippage Scale, Dysexecutive Syndrome Questionnaire, Prospective and Retrospective Memory Questionnaire; CFQ has the widest coverage and widest use (4). It is a validated measure of real world daily lapses as accidents and injuries, cognitive capacity and daily cognitive symptoms that people may experience (4) and

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until now, it has been translated to many languages, as German (5) and Brazilian (6).

Studies have shown CFQ's neurobiological correlates as decreased grey matter volume in left superior parietal lobule and decreased GABA levels in occipital lobe (7), in addition to its relationship with D2 receptor polymorphism (8) and 50 % heritability (9). However, since CFQ is a subjective measure, its scores may not always correlate with computerized measures of cognition (10,11). There is a possibility that the scores of CFQ may be affected from the patients' neuroticism levels, expectations and awareness about their cognition, and from their self-perceptions that may be modulated by their mood (12).

Despite its wide use in research and correlation with biological markers, there are two main questions about the use of CFQ. Firstly, regarding its factorial structure, Broadbent et al. suggested using the scale as one factor, but it was suggested that its unidimensional structure should be questioned. Some studies suggested that it presents a general cognitive factor and a factor for forgetfulness about names, but four, five or even seven factor structures were also presented based on the analysis and study group (13,14). It is also suggested that different factors are not related to different reliable constructs (15), therefore the dimensionality of CFQ is still a question under debate. Secondly, CFQ is a 5-point Likert scale, however it is also criticized by the fact that 5-point Likert scales may lead to bias for neutral answers. 5-point Likert version used by many countries gave inconsistent results for the factor analysis. In the original paper by Broadbent et al (3), it was reported that participants preferred a 4 point scale and cronbach's alpha level rose from 0.79 to 0.89 when 4 point scale is used (3). 4-point Likert structure of CFQ could provide a better self-report scale of cognitive symptoms and it could provide a different factorial structure. Based on this previous knowledge and mentioned gaps, here we aimed to develop a 4-point Likert Turkish version of CFQ, search its validity, reliability, and factorial structure.

MATERIAL and METHODS

Subjects

The data used in this study stemmed from a study with a larger sample which aimed to recruit data for the validation of three different scales. For this study, participants were recruited through advertisements in the hospital and university, waiting lounges of the hospital and also the general population who gave informed consent for participation after the invitation by the research assistants. Inclusion criteria were age between 18 and 65 years, not being illiterate and having a sufficient educational capacity to comply with the study protocol. Exclusion criteria for both the patient and general population groups were having received a schizophrenia spectrum disorder, bipolar I or dementia diagnosis, having a history of a head trauma, being under the influence of an alcohol, drug or substance intoxication, having a general medical condition that may influence cognitive processes, alcohol/substance use disorder,

substance-induced mental disorders or psychiatric disorders due to a general medical condition. For this particular study, only patients that had fully valid data for CFQ, and other scales mentioned in the instruments section, were included from the larger dataset recruited. Patients with a diagnosis of a depressive disorder or anxious disorder formed the clinical sample. Patients' diagnosis was given after a structured clinical interview based on ICD-10 diagnosis by three psychiatrists (HYE, OK and ACE). Patients with a comorbidity of anxiety and depressive disorders were excluded.

Each research assistant was trained by HYE for the standardized way of collecting data and securing the attention check of the participants. Each participant signed a written informed consent. Participants did not receive compensation except for feedback about their measurement scores. In case high scores in the scales were detected in the general population group, they were psycho-educated for a psychiatric consultation. The patient and general population groups were matched for age, sex, education and income level. All evaluations were completed on the same day. The study was approved by the Koc University Local Ethical Committee. All procedures complied with the Declaration of Helsinki.

Instruments

A sociodemographic data form was used to collect data about participants' age, sex, educational level, income, marital status, and occupational status, any known psychiatric diagnosis, and treatment. Also, they were asked to report if they had an ongoing psychiatric treatment and any known psychiatric diagnoses. All questionnaires and self-report scales were applied through the Qualtrics survey system.

CFQ: For the development of the Turkish version of the Cognitive Failures Questionnaire as a 4-point Likert questionnaire, we obtained permission from the authors that developed the original version of CFQ. In our study, the participants responded to a 4-point Likert scale (0=never, 1= rarely, 2=occasionally, 3=often) and the full score was 75. Translation has been completed in two steps. The first Turkish translation was done independently by HYE and MYI, a psychiatrist and psychologist with an expertise in cognitive functioning and evaluation. The translated version was compared to achieve a final agreed version. A native English speaker psychologist with experience in neuropsychology, back-translated the Turkish version to English. HYE and MYI checked for the back-translated sentences for inconsistencies with the original version and for the integrity of the meaning to correct the Turkish translation. Secondly, the corrected Turkish version was back-translated by another English speaking person and the integrity of the meaning and consistency with the original version was checked by HYE and MYI and the final Turkish version was implemented. Lastly, 8 medical school students were requested to fill the questionnaire and check for mixed expression of sentences or

misunderstandings and feedback about the last adapted version was received as it is well understood by the participants.

Perceived Deficit Questionnaire-D (PDQ-D): This scale was first designed to measure depression in multiple sclerosis patients and later validated to measure cognitive deficits in major depressive disorder (MDD) patient groups (16). It includes 20 questions rated as a 5-point Likert scale in a range of 0 (never) to 4 (very often). The total score is between 0-80. 4 subscales composed of 5 items and named as attention/concentration, retrospective memory, prospective memory, and planning/organization has been suggested by some authors, but it was not replicated in other studies (16). Turkish version of the scale composed of one factor (17). Therefore, in this study, we only used the total score of PDQ-D in the analysis.

Beck Depression Inventory (BDI): To evaluate the depressive symptoms of the participants, BDI has been used. This inventory has been developed by Beck et al. (18) and the Turkish version has been validated by Hisli N. (19). This scale measures cognitive, affective and vegetative symptoms of depression, and it uses 21 items that are rated from 0 to 3. Higher scores indicate higher depressive symptoms and scores range from 0 to 63.

Beck Anxiety Inventory (BAI): This inventory has been developed by Beck et al. (20) and the Turkish version has been validated by Ulusoy et al (21). This scale measures symptoms of anxiety, using 21 items that are rated from 0 to 3. Higher scores indicate higher anxious symptoms and scores range from 0 to 63.

Statistical analysis

Descriptive statistics for age, gender, education, income and occupational status, including the mean scores of self-reported psychometric scales were determined for the participants. Descriptive statistics for clinical measures were inspected for quality control. In the reliability analysis of CFQ, Cronbach's alpha coefficient was calculated, in addition to scale mean if an item is deleted, item-total score correlation, and scores for Cronbach's alpha coefficient if item was deleted were used. Kaiser-Meier-Olkin measure and Bartlett's test were used to measure sampling adequacy. Exploratory factor analysis was performed as principal component analysis with varimax rotation and factors with an eigenvalue greater than 1 and items with factor loadings greater than 0.35 were taken into consideration.

To determine any potential differences between the clinical population and general populations' sex, education, income, and occupational status distributions, chi-square test was used. Comparison of the groups for mean scores of CFQ was conducted using one-way ANOVA and two-group comparisons were conducted through post-hoc Bonferroni test. Correlation of CFQ with age, BDI, BAI and PDQ-D scores were conducted using Pearson correlation test. All statistical analysis were carried out using the SPSS statistical program package version 26.

RESULTS

Table 1. Reliability measures of the 4-point Likert Turkish version of CFQ scale

Item-Total Statistics	Scale Mean if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CFQ1	25.89	0.61	0.91
CFQ2	26.33	0.63	0.91
CFQ3	26.59	0.52	0.91
CFQ4	26.83	0.40	0.91
CFQ5	26.97	0.59	0.91
CFQ6	26.51	0.44	0.91
CFQ7	26.14	0.54	0.91
CFQ8	26.54	0.37	0.91
CFQ9	26.11	0.47	0.91
CFQ10	26.11	0.34	0.92
CFQ11	26.94	0.40	0.91
CFQ12	26.96	0.48	0.91
CFQ13	26.64	0.59	0.91
CFQ14	26.65	0.57	0.91
CFQ15	26.17	0.69	0.91
CFQ16	26.97	0.53	0.91
CFQ17	26.68	0.59	0.91
CFQ18	27.17	0.57	0.91
CFQ19	26.11	0.53	0.91
CFQ20	26.03	0.55	0.91
CFQ21	26.36	0.58	0.91
CFQ22	26.03	0.64	0.91
CFQ23	27.07	0.45	0.91
CFQ24	26.17	0.46	0.91
CFQ25	26.68	0.65	0.91

Study sample

272 participants were included in the study. 187 of the participants were healthy population controls, whereas 55 participants were diagnosed with a depressive diagnosis and 30 of the participants were diagnosed with an anxious disorder. The mean age of the participants was 35.2±13.2 years (min:18, max: 64) and the mean age of the groups were not significantly different ($p>0.54$, One-way ANOVA). 171 of the participants (62.9 %) were women. 94 (42.7 %) of the participants' educational level was high school or lower, 154 (56.6 %) participants' educational level was higher or equal to than high school. Gender and educational level of the three groups were not statistically different (χ^2 : 3.66, $p>0.05$, and χ^2 : 0.76, $p>0.05$, Chi-Square test, respectively). Mean score of BDI was 12.6±10.1 (min:0, max: 43), BAI was 12.7±10.6 (min:0, max: 48), PDQ-D was 18.5±14.7 (min:0, max: 69) and CFQ score was 27.6±12.7 (min:4, max: 65).

Table 2. Factor loadings of the 4-point Likert Turkish version of CFQ scale

CFQ Item Number	Items of the 4-point Likert CFQ Item	Factor				
		1	2	3	4	5
Factor 1: General Cognitive Failure						
CFQ 22	Do you find you can't quite remember something although it's "on the tip of your tongue"?	0.69			0.36	
CFQ23	Do you find you forget what you came to the shops to buy?	0.68				
CFQ25	Do you find you can't think of anything to say?	0.60		0.38		
CFQ14	Do you find yourself suddenly wondering whether you've used a word correctly?	0.59		0.37		
CFQ21	Do you start doing one thing at home and get distracted into doing something else (unintentionally)?	0.56				
CFQ17	Do you forget where you put something like a newspaper or a book?	0.53				
CFQ12	Do you find you forget which way to turn on a road you know well but rarely use?	0.53				
CFQ2	Do you find you forget why you went from one part of the house to the other?	0.50	0.46			
CFQ13	Do you fail to see what you want in a supermarket (although it's there)?	0.48	0.43			
CFQ24	Do you drop things?	0.40				
Factor 2: Inattention						
CFQ4	Do you find you confuse right and left when giving directions?		0.70			
CFQ6	Do you find you forget whether you've turned off a light or a fire or locked the door?		0.63			
CFQ3	Do you fail to notice signposts on the road?		0.48			
CFQ5	Do you bump into people?	0.36	0.47			
CFQ18	Do you find you accidentally throw away the thing you want and keep what you meant to throw away - as in the example of throwing away the matchbox and putting the used match in your pocket?	0.43	0.46			
Factor 3: Concentration						
CFQ8	Do you say something and realize afterwards that it might be taken as insulting?			0.73		
CFQ19	Do you daydream when you ought to be listening to something?			0.64		
CFQ10	Do you lose your temper and regret it?			0.60		
CFQ15	Do you have trouble making up your mind?	0.36		0.48		
CFQ9	Do you fail to hear people speaking to you when you are doing something else?			0.46	0.40	
CFQ1	Do you read something and find you haven't been thinking about it and must read it again?			0.37	0.40	
Factor 4: Names						
CFQ7	Do you fail to listen to people's names when you are meeting them?				0.80	
CFQ20	Do you find you forget people's names?				0.79	
Factor 5: Social Failures						
CFQ11	Do you leave important letters unanswered for days?					0.81
CFQ16	Do you find you forget appointments?					0.62

Reliability analysis and factor structure of the CFQ scale

To determine the CFQ's internal consistency reliability, the Cronbach's alpha coefficient was calculated and found to be 0.91. For CFQ, the item-total item correlation indices ranged from 0.34 to 0.65. Scale mean if an item is deleted, ranged between 27.17 and 25.89. The corrected item-total correlations and Cronbach's alpha if an item is deleted have shown that each assessment of CFQ revealed good reliability (Table 1).

Factor analysis showed that the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.91 and that Bartlett's Test of Sphericity, was significant ($p < 0.001$). As these tests were significant, we interpreted the factor analysis results. Principal components analysis extracted five factors with eigenvalues over 1 and explained 53.7 % of total variance. Based on the factor loadings, items 2, 12-14, 17, 21-25 were grouped as factor 1 (General Cognitive Failure), items 3-6,18 were grouped as factor 2 (inattention), items 1, 8-10, 15,19 were grouped in factor 3 (concentration), items 7,20 were grouped as factor 4 (names), items 11 and 16 were grouped as factor 5 (social failures). Factor structure, component values for each item and their factor loadings are given in Table 2. Cronbach's alpha levels for each factor has also been calculated, and it was found as 0.85 for factor 1, 0.69 for factor 2, 0.75 for factor 3, 0.78 for factor 4 and 0.59 for factor 5.

Discriminative validity of CFQ

CFQ scores were significantly different among groups ($p < 0.002$, one-way ANOVA). Both depressive and anxious groups reported higher CFQ scores compared to controls ($p = 0.001$, post-hoc Bonferroni test). Mean scores for the depressive group, anxious group and controls were 33.1 ± 13.9 , 29 ± 12.6 , 25.7 ± 11.9 , respectively.

Convergent and divergent validity of CFQ with other self-report scales

CFQ score negatively correlated with age (Pearson correlation coefficient: -0.18 , $p = 0.003$). CFQ score significantly and strongly correlated with PDQ-D scores (Pearson correlation coefficient: 0.78 , $p < 0.001$). CFQ also showed a moderate correlation with BDI (Pearson correlation coefficient: 0.48 , $p < 0.001$) and BAI scales (Pearson correlation coefficient: 0.54 , $p < 0.001$).

DISCUSSION

We found that the Turkish version of CFQ, as a 4-point Likert scale, is highly reliable. The 4-point Likert structure of CFQ as we used in our study, explained the higher percentage of the variance and the item-total item correlations were higher than the 5-point Likert structure, and it showed higher internal consistency compared to previous studies, as summarized in the following references (13,14,22,23).

Regarding the factorial structure of the 4-point Likert Turkish version of CFQ, our study is not directly comparable to the previous studies due to the fact that we developed a new 4-point Likert version of CFQ. Our analysis revealed 5 factors. The first factor named 'General Cognitive Failure' included items about working memory and visuospatial

abilities. Factor 2 was called 'inattention', factor 3 was called 'concentration' and factor 4 was called 'names'. The last factor called 'social failures' included two items about forgetting appointments and unanswering important letters. When studies that investigated the factorial structure of CFQ were inspected, it is seen that many of the previous items grouped in these studies, were not grouped in the same factors in our study. None of the previous literature defined a factor called social failures. Previous studies suggest different factorial structures of CFQ due to varying sample sizes and varying patient samples. In a study by Larsson et al, with the largest sample size so far (14), they found that CFQ has three factors, two of which can be interpreted as 'General Cognitive Failure' and 'Name Processing'. In the study by Wallace et al (22), where they used varimax rotation and items had to have a factor loading of 0.4, they found a four factorial structure which they named as 'Memory', 'Distractibility', 'Blunders', and 'Names'. Items 7 and 20 are consistently grouped under the 'Names' factor in studies and our 4-point Likert version yielded the same results. However, the items included in our 'Forgetfulness' and 'Distractibility' factors do not overlap with the items grouped in 'Memory' and 'Distractibility' factors in the study by Wallace et al (22). Study by Bridger et al also reported a five factor structure when university students were recruited, however this study also used the 5-point Likert version of CFQ and the items' factor loadings were very different from what we have found (24). Study based on the Maastricht Aging Study found three factors named 'Forgetfulness', 'Distractibility' and 'False triggering' (23). We believe that our validation provides a reliable conceptual loading of the factors.

When divergent and convergent validity of 4-point Likert Turkish version of CFQ is analyzed, the correlation of 4-point Likert CFQ with PDQ-D was found to be higher than 5-point Likert CFQ's correlations with memory functioning questionnaire and subjective cognitive complaints scale (25).

In our study, CFQ scores also correlated with BDI scores. In the original paper by Broadbent, they propose that chronic social stressors are related to the answers in CFQ. Chronic stress could be a factor that leads to both increased scores in CFQ and BDI, or patients with depressive symptoms may overestimate their cognitive deficits. In support of the role of depression in cognitive failures, it was found that depressive symptoms explained some of the variability in CFQ scores in a group of elderly non-demented patients (26). Patients with depressed mood may report higher cognitive failures than measured with objective tests and they may have a negative cognitive bias while evaluating themselves (12,27). The observed effect could be through modifying emotion-cognition interaction. On the other hand, a study with small sample size revealed that employees with burnout symptoms, which reflect the work stress, reported higher cognitive failures (28), however life

events stress was unrelated with the interaction of chronic obstructive pulmonary disorders and CFQ (29). Here, we can say that the 4-point Likert version of CFQ preserves its relation with depressive symptoms compared to the 5-point Likert version. On the other hand, higher number of prospective studies that record CFQ, adverse life events and mood related psychiatric symptomatology are needed to answer this relationship.

In our study, CFQ scores also correlated with BAI scores. Previous studies also found its correlation with State-Trait Anxiety Test Scores and Neuroticism dimension of Eysenck Personality Scale (12). In accordance with our findings, a study using a 15 item version of CFQ also found a moderate correlation of CFQ scores with fear, hostility, guilt and sadness items of PANAS (30). In our discriminative validity analysis, we also found that both depressive and anxious patient groups reported higher cognitive failures.

In our study, age negatively correlated with CFQ scores. A previous study showed that 5-point Likert version of CFQ also correlated with age-related changes in the brain, as measured by PET (31). But, age was not a predictor of 5-point Likert CFQ (9) and CFQ was even associated with better reports in another study (6). We assume that correlation of higher daily cognitive failures with age is as expected.

In this study, we did not assess participants with a minimal test or an objective cognitive task battery. Also, our study did not have an objective measure to exclude patients with 'Mild Cognitive Impairment' or 'Attention Deficit Hyperactivity Disorder' other than the clinical interviews, which is a limitation. However, our participants composed of an adult population with an age range of 18 to 65 and none of the participants received a mild cognitive impairment or dementia diagnosis based on the clinical interview. As another limitation, we did not compare the 4-point Likert version of Turkish CFQ with a 5-point Likert version. This gap in methodology limits our discussion to discuss if the 4-point Likert version has a higher measurement capacity compared to the 5-point Likert version. We tried to discuss our findings based on the previous literature that used 5-point Likert version of CFQ.

Here, we did not aim to test the test-retest reliability of the 4-point Likert Turkish version of CFQ. Previous literature showed stability of CFQ scores one week after the first evaluation (6), and that consistency of results may be found even at two years (24). As another limitation, our patient group is composed of patients with a depressive or anxious disorder diagnosis, therefore the scale may show a different factorial structure and discriminability properties in other patient groups. Also, our dataset included only 30 patients with an anxious disorder diagnosis. Therefore, we could not separate subgroups of anxiety disorders and conduct a discriminative validity analysis among different anxiety disorders. However, the association of separate anxiety disorders with self-report cognitive failures needs to be studied in the future.

CONCLUSION

In conclusion, our study shows that 4-point Likert Turkish version of CFQ is a valid and reliable tool to assess cognitive failures in non-demented groups. Our analysis revealed a five factorial structure for CFQ, however previous literature with the 5-point Likert version shows different factorial structures and does not indicate a dimensional stability. Total score of the scale should be taken into account when using the scale.

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