Psychometric properties of the Turkish version of the freezing of gait questionnaire for patients with Parkinson's disease

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Abstract

Objective: Freezing of gait (FOG) is one of the disabling symptoms in Parkinson's disease (PD). The diagnosis and assessment of FOG may be difficult, but it is absolutely necessary. The aim of this study was to develop a Turkish version of the freezing of gait questionnaire (FOG-Q) and to assess the validity and reliability of the Turkish version of the FOG-Q in patients with PD. This study also investigated whether FOG-Q scores changed in subgroups based on severity of PD, fear of falling (FOF), and subtype of PD, and if the reliability of the FOG-Q was affected by these conditions.

Methods: Following the translation process, 48 consecutive patients with PD were evaluated using the Turkish version of FOG-Q, the Unified Parkinson's Disease Rating Scale (UPDRS), modified Hoehn and Yahr (mHY), Berg Balance Scale (BBS), Falls Efficacy Scale (FES), Timed Up and Go Test (TUG), and Five Times Sit to Stand Test (FTSST).

Results: The mean (SD) and median (q1-q3) FOG-Q scores were 4.44 (5.3) and 2 (0–15). FOG-Q demonstrated positive, strongest correlations with FES, TUG, UPDRS total score, and UPDRS part II-III (rs=0.693-0.603), and moderate correlations with FTSST, mHY, and UPDRS part I (rs = 0.579-0.448). BBS negatively correlated with FOG-Q (rs = -0.643). Inter-rater and intra-rater reliability ranged from 0.849 and 0.914. The FOG-Q scores increased with disease progression and FOF (p<0.05).

Conclusion: The Turkish version of the FOG-Q is a valid and reliable tool for the assessment of FOG in PD patients who are native Turkish speakers.

Keywords: Freezing of gait, Parkinson's disease, reliability, Turkish version, validity

INTRODUCTION

Freezing of gait (FOG) is defined by an episodic block to generating effective stepping despite the intention to walk (1). The prevalence of FOG is between 21% and 27% in the early stages of Parkinson's disease (PD) (2, 3). However, this ratio increases up to 80% in the later stages of PD (4). Freezing of gait is more commonly triggered in different situations, such as at the initiation of gait, during turning, when passing through narrow spaces, or walking in crowded places or immediately before reaching a destination (5).

Freezing of gait is often associated with falls (6) and reduced quality of life in patients with PD (7, 8). Therefore, it is necessary to evaluate and determine the treatment methods for symptomatic cases. Several assessments were developed to evaluate FOG subjectively and objectively (9-11). Most of these assessments require experience and expenditure (9-11), and for this reason, they may be not easy to use in clinical settings. In addition, because of the short episodic characteristic of the freezing phenomenon, it is difficult to be objectively observed by health professionals. Therefore, patient-based evaluations are needed.

The 6-item questionnaire, the freezing of gait questionnaire (FOG-Q), was developed by Giladi et al. (12). Items 1, 2, 4, 5, and 6 of the scale are related to the experiences of patients, especially during the last week; the third item identifies the unique experiences of the patient associated with freezing. Each item is assessed with a 5-point Likert

scale (0 = no symptom, 4 = worst case) and the maximum score on the scale is 24 (12). The FOG-Q is a valid and reliable questionnaire that has been translated into different languages (6, 13-15). However, to our knowledge, there is no Turkish version of the questionnaire that specifically assesses FOG (according to the results of a search performed for between 2007 and 2017 using PubMed, Scopus, and Google Scholar).

The primary aim of this study was to develop a Turkish version of the FOG-Q and to assess the validity and reliability of the Turkish version of FOG-Q for patients with PD.

This study also investigated whether FOG-Q scores changed in subgroups based on the severity of PD, fear of falling (FOF), and subtype of PD, and if the reliability of FOG-Q was affected by these conditions.

METHODS

Translation and Adaptation

Authorization was obtained from the developing authors for the Turkish version of the questionnaire. The Turkish version of FOG-Q was developed according to a standard protocol using forward and backward translations (16). According to the protocol, the FOG-Q was independently translated by three health professionals who are native Turkish speakers with fluent English language skills and two lecturers from the Department of English Language & Literature. The five translated versions were compared with each other and the final consensual version was prepared. Then, this version was back translated into English by a native English speaker with fluent Turkish language. The back-translated version was compared with the one developed by Giladi et al., and adopted as the final version, the Turkish version of FOG-Q (Appendix) (12). The FOG-Q was then administered to 5 patients for pilot testing.

Participants

It has been reported that the sample size of the reliability and validity studies should generally be between 5 and 10 times the scale items in the literature (17). We evaluated 48 patients who attended the Movement Disorders Outpatient Clinic of Ordu University Educational Research Hospital in January and February 2018, and were diagnosed as having Parkinson's disease according to the UK Brain Bank diagnostic criteria. Other eligibility criteria for participants were having good cognitive functions (>24 on Standardized Mini Mental Test-SMMT) and being able to walk with/without walking devices. The SMMT was used as a screening instrument to detect cognitive impairment. We excluded patients with other associated motor disorders, concomitant injuries, severe sensorial deficits or evident peripheral neuropathy and orthopedic conditions that could interfere with gait.

The study was approved by the Ordu University Ethics Committee for Clinical Investigations (2017/57) and all patients gave their written informed consent. This trial was registered with ClinicalTrials.gov, number NCT03413787.

Procedures

The clinical assessments of the patients were performed by the first researcher. All patients completed the demographic and clinical assessment on the same day. The FOG-Q was completed separately by the other researchers. The researchers conducted surveys in different rooms. Each participant attended 2 sessions that were conducted 2 weeks apart, during which they completed the full FOG-Q protocol. All evaluations of patients were performed when they were in an "ON" period.

Clinical Assessment

Fifty-six patients who were voluntary participants were first evaluated for eligibility criteria using the SMMT. Forty-eight patients were eligible to participate. All 48 participants were tested during the ON-period with regard to anti-parkinsonian medication intake.

First, our Turkish version of the FOG-Q was independently and separately administered by a neurologist and another health professional. Subsequently, the participants, in randomized order, were assessed to determine the validity of the Turkish version of FOG-Q using the Unified Parkinson's Disease Rating Scale (UPDRS), modified Hoehn and Yahr Stage (H/Y), Berg Balance Scale (BBS), Falls-Efficacy Scale (FES), Timed Up and Go (TUG), and Five Times Sit to Stand Test (FTSST). All measurements used for the validity testing are classified as 'recommended' (18).

Unified Parkinson's Disease Rating Scale (UPDRS)

The UPDRS is divided into four parts; part I (Mentation, Behavior and Mood), part II (Activities of Daily Living), and part IV (motor complications) are patient and caregiver-oriented questionnaires. Part III (motor examination) is an objective assessment of the patient's motor abilities. Each item is scored using a 5-point scale, where 0 means an absence of symptoms and 4 represents the worst stage (19). The UPDRS is used as a gold standard reference scale (20). The UPDRS was shown to have good validity in Turkish patients with PD (21).

Modified Hoehn and Yahr Stage (mH/Y)

The severity of PD was determined using the mH/Y scale, which contains five stages where 0 indicates no visible symptoms and 5 represents a patient with PD who is unable to walk unless assisted (22).

Berg Balance Scale (BBS)

The BBS consists of 14 items dealing with maintenance of different bodily postures during activities of daily life, spontaneous response to voluntary movements of the trunk and extremities, and postural control. Scores range from 0 (inability to perform the task) to 4 points (ability to achieve the task independently) (23). The Turkish version of this scale, with va-

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lidity and reliability already demonstrated, was used to assess the ability of participants to sustain their balance while performing functional activities (24).

Falls-Efficacy Scale (FES)
The participants were assessed using the Turkish version of the FES. This scale is used to measure the perceived FOF. It comprises 10 questions. The participant is asked how safe they felt while performing various activities. Participants rate each of the questions between 0 (not safe) and 10 (very safe) points and the total score ranges between 0 (low efficacy related with falling) and 100 (high efficacy related with falling), with the points summed at the end (25, 26).

Timed Up and Go (TUG)
The TUG is a reliable and valid measurement tool to assess functional mobility in patients with PD (27). The time taken to complete these procedures is recorded: stand up from a standard armchair, walk 3 m, turn 180°, walk back to the chair, and sit down again.

Five Times Sit to Stand Test (FTSST)
This test was used to determine mobility in a repetitive manner. Each participant is instructed to cross their arms over their chest and sit with their back against the upright back rest of the chair. The participant is asked to sit and stand five times as quickly as possible, and then the time is recorded (28).

Statistical Analysis
The statistical analyses were performed using the Statistical Package for the Social Sciences Version 21 (SPSS IBM Corp.; Armonk, NY, USA) software package.

The Kolmogorov-Smirnov test was conducted to investigate the normality of the distribution of variables. Due to the lack of normal distribution, nonparametric tests were used.

First-level analysis measured the construct validity and reliability. For validity, correlations of the FOG-Q scores and clinical assessments (UPDRS, H/Y, BBS, FES, TUG, FTSST) were calculated using Spearman's coefficient. The strength of the correlations was classified as follows: <40 = weak, 0.41-0.60 = moderate, 0.61-0.80 = strong, and 0.81-1.00 = very strong (29).

The intraclass correlation coefficient (ICC) two-way mixed model on absolute agreement was used to analyze the measurements for intra-rater and inter-rater reliability, and 95% confidence intervals. Intraclass correlation coefficient values range from 0 to 1, with a higher value indicating better reliability. An ICC value less than 0.40 is considered poor, 0.40-0.59 fair, 0.60-0.74 good, and 0.75-1.00 is excellent.

In the second-level analysis, the FOG-Q scores were compared among groups, which were divided according to subtype of

PD; disease severity (mild = 1-1.5 mH/Y; moderate = 2-2.5 mH/Y; severe = 3-4 mH/Y); and FOF based on the Mann–Whitney U test and Kruskal–Wallis test. The FOF was determined using the FES score. A total score greater than 70 indicates that the participant has FOF (25). Following the Kruskal–Wallis test, the Mann–Whitney U test was performed to test the significance of pairwise differences using Bonferroni correction to adjust for multiple comparisons. The level of statistical significance was set at p< 0.05.

Finally, we assessed whether the reliability of the FOG-Q was affected by the severity of PD, FOF or different subtypes of PD. Thus, we re-calculated the Spearman's coefficient.

RESULTS

View of translators and responders
The translators thought that the items were easy to translate and the translated version was understandable and practical. The responders found the items clear. They stated that the questionnaire reflected their clinical status.

Participant Characteristics
Of the total 48 patients, 65% (n=31) were male and 35% (n=17) were female. The demographic and clinical features of the participants are presented in Table 1. The total FOG-Q score ranged between 0 and 15 with a mean (SD) of 4.44 (5.3) and a median (q1–q3) of 2 (0–15). No patients reached the maximum score of 24, and thirteen participants scored 0.

Construct Validity
The correlation coefficients between the FOG-Q and the other clinical assessments are summarized in Table 1. Positive correlations were found between the FOG-Q score and other clinical assessments, except for the BBS score. The BBS score negatively correlated with FOG-Q score and the correlation level was strong (r_s= -0.643). The scores of the FOG-Q correlated strongest with FES, TUG, and UPDRS total score, respectively. Among the UPDRS parts, part II (activities of daily living) had stronger correlation than part III (motor), and part I (mood) and IV (dyskinesia) had moderate and weak correlation, respectively.

Moderate correlations were observed between the FOG-Q score, the disease severity, and the FTSST score (Table 1).

Inter-Rater and Intra-Rater Reliability
The ICC values and 95% confidence interval are given in Table 2. The Turkish version of FOG-Q showed excellent reliability for both inter and intra-rater measurements (ICC = 0.849-0.943).

When the reliability of the FOG-Q was investigated in different conditions, it was observed that reliability was at an acceptable level (ICC=0.725-0.951) (Table 3).

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Table 1. Participant characteristics and clinical features (n=48)

	Median, q1-q3	Min.-max.	Correlations (rs) with FOG-Q
Age (years)	71, 67- 76	47-84	0.085
Duration of PD (years)	4, 2-7	1-13	0.315*
Modified Hoehn and Yahr Stage (1-5)	1.5, 1-2	1-4	0.557**
UPDRS, total (0-170)	18.5, 9-33	3-71	0.649**
UPDRS, part 1 (0-16)	0, 0-1	0-4	0.448**
UPDRS, part 2 (0-52)	4, 2-10	0-27	0.613**
UPDRS, part 3 (0-56)	12.5, 6-23	3-46	0.603**
UPDRS, part 4 (0-23)	0, 0-0	0-3	0.329*
BBS (0-56)	48, 42-52.8	6-56	-0.643**
FES (10-100)	28, 15-64.5	10-100	0.693**
TUG (s)	15.5, 12.7-20.9	6.5-77.2	0.657**
FTSST (s)	17.6, 13.9-21.7	8.1-110.6	0.579**

BBS: Berg balance scale; FES: falls efficacy scale; FOG-Q: freezing of gait questionnaire; FTSST: five time sit to stand; PD: Parkinson disease; rs: Spearman's correlation coefficient; TUG: timed up and go test; UPDRS: unified Parkinson's disease rating scale; min: minimum; max: maximum
*: p<0.05; **: p<0.01

Table 2. Inter-rater and intra-rater reliability of Turkish version of FOG-Q

Measurements	ICC	95% CI
Interrater measurement	0.914	0.847-0.952
Intrarater-1 measurement	0.943	0.898-0.968
Intrarater-2 measurement	0.849	0.730-0.915

CI; confidence interval; FOG-Q: freezing of gait questionnaire; ICC: intraclass correlation coefficient

Table 3. Results of the Turkish version of the FOG-Q scores and its reliability, presented in groups divided according to subtype of PD, Hoehn and Yahr stage and FOF

	n (%)	FOG-Q scores: median, q1–q3 (min–max)	p	ICCa
Subtype of PD			<0.001b	
PIGD	22 (46)	6, 2-13.3 (1-15)		0.848, 0.911
Tremor dominant	26 (54)	0.5, 0-2.3 (0-15)		0.977, 0.951
Hoehn and Yahr Stage			0.001c	
Mild	25 (52)	1, 0-2 (0-9)		0.725, 0.934
Moderate	15 (31)	4, 2-14 (0-15)		0.953, 0.942
Severe	8 (17)	11, 2-14.8 (1-15)		0.862, 0.908
FOF			0.002b	
Yes	11 (23)	12, 4-15 (0-15)		0.871, 0.910
No	37 (77)	1, 0-3.5 (0-15)		0.905, 0.934

FOG-Q: freezing of gait questionnaire; ICC: intraclass correlation coefficient; PD: Parkinson disease; PIGD: postural instability and gait difficulty; min: minimum; max: maximum
a: ICC values are given as interrater and intrarater reliability, respectively; b: p value was calculated with Mann-Whitney U test; c: p value was calculated with Kruskal-Wallis test

FOG-Q scores among the Groups

The analysis to determine the difference in FOG-Q scores between the groups, which were divided based on subtype of PD, disease severity, and FOF, showed that FOG-Q scores increased with disease progression and FOF (p<0.05). Patients with tremor-dominant PD had lower FOG-Q scores than patients with the postural instability and gait difficulty (PIGD) subtype (p<0.05) (Table 3).

DISCUSSION

The FOG-Q is recommended for use in patients with PD because it is a reliable and valid tool to assess the severity of FOG (18). Therefore, it was translated into Turkish according to guidelines for the process of cross-cultural adaptation of self-report measures (16). In the present study, we demonstrated that the Turkish version of the FOG-Q had good psychometric properties, and could be used to quantify FOG in patients with PD who were native Turkish speakers.

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The construct validity was determined with the amount of association between two measures of the same construct using Spearman's correlation coefficient. We showed that the Turkish version of FOG-Q had good construct validity as in previous validation studies (6, 13-15, 30). We found that the score of the FOG-Q correlated with UPDRS total score, and also each part of the UPDRS. Nilsson and Hagell, and Giladi et al. also showed the relationship between the UPDRS motor scale and FOG-Q (6, 30). However, this relationship was not observed in other validated studies (13-15). In this study, the strength of the correlation was found to be stronger than previous studies. This result may be due to our participants having fewer symptoms related with a shorter disease duration, early stage, and motor complications. Furthermore, based on the same reasons, the correlation of FOG-Q with both UPDRS part I and UPDRS part II may be reduced because we know that the incidence of motor complications, cognitive problems, and the occurrence of FOG increases with disease progression (4).

The FOG-Q assesses different types of FOG (starting or turning hesitation, freezing in narrow place or before the destination). Consequently, the validity of the FOG-Q should be addressed in depth by measurement tools of the same construct. Tan et al. reported that FOG primarily negatively affected primary mobility and caused difficulty in community walking in PD (31). As a result of these problems, the levels of activity limitation increase in PD. The TUG and FTSST tests, which were used in our study, are used as distinctive assessment tools to define mobility problems (28). Nilsson and Hagell, Tambasco et al., and Giladi et al. found moderate relationships between the TUG test and the FOG-Q (6, 14, 30). Our results suggest that FOG-Q scores also correlate more strongly with the TUG and FTSST tests in PD, with those who have higher FOG-Q scores, taking a longer time to perform the timed performance tests. This result could be explained by the early-stage PD of our patients. Moreover, the TUG test showed better construct validity with the FOG-Q in the present study. This result may explain why the TUG test is chosen to determine FOG using the instrumental method (9, 10). This is because the TUG test includes different tasks such as sitting to standing, walking, turning 180°, and sitting back in the chair, and these tasks, especially turning, may trigger FOG. Schaafsma et al. reported that turn hesitations were more frequent than start hesitations (32). Based on this reason, evaluation methods that include a turning component should be used to investigate the validity of the FOG-Q.

Freezing of gait can also be seen as start hesitation (31). Considering this possibility, we established a relationship between FOG and the FTSST test, which evaluates the patient in a repetitive framework, from sitting to standing. It is known that the FTSST test and the FOG-Q evaluate different aspects of mobility, both of which may influence participation in PD (33). In addition to previous studies, we first used the FTSST test to assess the validity, so this study is more extensive compared with previous studies. However, we did not examine the association between the FTSST test and FOG-Q item 5 to determine start hesitation during the FTSST test. This issue can be investigated in future studies.

Fear of falling has been shown to be another predictor for community walking (34). When we compared the FOG-Q scores between the groups, which were divided based on the FES score, we showed that the FOF increases with FOG severity. Additionally, similar to Lambirti et al., we demonstrated that FOG severity increased with disease progression and PIGD subtype (35).

In the present study, reliability was determined as inter-rater and intra-rater reliability using Cronbach's α coefficient. The inter-rater reliability of the Turkish version of the FOG-Q was excellent. Inter-rater reliability was also investigated in all previous studies and ranged between 0.83 and 0.95, similar to the present study (6, 13-15, 30). Intra-rater or test–retest reliability was assessed over a 2-week period by two independent researchers, and the Turkish version of the FOG-Q was shown to be strongly reproducible in our study. Among previous studies, intra-rater reliability was evaluated one week apart by only Baggio et al. who reported that the ICC value was 0.78 (13). In our study, the intra-rater-1 reliability and intra-rater-2 reliability were 0.943 and 0.849, respectively. These results show that the Turkish version is able to provide similar results in repeated measurements and is also consistent for different experience levels (rater 1 and 2). Moreover, we showed that reliability was at an acceptable level in different conditions, depending on the severity of the disease, the FOF and the subtype of PD (ICC=0.725-0.977). The presence of the PIGD subtype PD, having mild severity (HY 1-1.5), and FOF (FES score >70), reduced the reliability relatively, but it was still at an acceptable level. Further analysis suggests that the Turkish version is a reliable tool for assessing FOG in the above-mentioned conditions.

The primary limitation of this study was that the FOG-Q relies on patients' subjective feelings and perceptions to quantify FOG. Although instrumental methods were developed to objectively assess freezing, the authors reported some difficulty dealing with video recording and the interpretation of the results (11). Another limitation is that the FOG-Q and other clinical assessments were administered only in the ON-period. All assessments in the ON-period may be repeated after the withdrawal of medication effect. We know that the OFF-period exacerbates the difficulty with mobility (36). Schaafsma et al. reported that 95% of patients experienced freezing in the "off" period, but only 32% experienced freezing in the "on" period (32). The last limitation of the present study is the fact that our population mainly consisted of patients who had mild severity PD (52%). As a result, the present results cannot be generalized to all stages of PD. We recommend that it should be used in patients with PD who are in different disease stages with the same distribution in the future.

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In conclusion, we developed a Turkish version of the FOG-Q, and then demonstrated that it was a reliable and valid tool for assessing FOG in patients with PD. The Turkish translated version was found to be understandable by the participants and practical by the assessors. The new Turkish version of FOG-Q could be used to quantify FOG in PD. Moreover, it could also be used in experimental research to determine the best treatment method for improvement of FOG in native Turkish-speaking patients with PD.

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APPENDIX
YÜRÜRKEN DONMA ÖLÇEĞİ (YDÖ)

B.1. En kötü haliniz sırasında-yürüyüşünüz?

0   Normal bir şekilde
1   Neredeyse normal-biraz yavaş
2   Yavaş ama tamamen bağımsız
3   Yardıma veya yardımcı bir araca ihtiyaç var
4   Yürümek mümkün değil

B.2. Yürüme güçlükleriniz günlük aktivitelerinizi ve bağımsızlığınızı etkiliyor mu?

0   Hiç
1   Biraz
2   Kısmen
3   Şiddetli bir şekilde
4   Yürümek mümkün değil

B.3. Yürürken, dönerken veya yürümeye başlarken; ayaklarınız yere yapışmış gibi hissediyor musunuz (donma)?

0   Asla
1   Nadiren-yaklaşık ayda bir
2   Ara sıra-yaklaşık haftada bir
3   Sıklıkla- yaklaşık günde bir
4   Her zaman- Her yürümede

B.4. En uzun donmanız ne kadar sürüyor?

0   Hiç olmadı
1   1-2 s
2   3-10 s
3   11-30 s
4   30 s'den fazla

B.5. Tipik başlama tereddütünüz ne kadar sürüyor (ilk adımı atarken donma)?

0   Hiç
1   Yürümeye başlamak 1 s'den uzun sürüyor
2   Yürümeye başlamak 3 s'den uzun sürüyor
3   Yürümeye başlamak 10 s'den uzun sürüyor
4   Yürümeye başlamak 30 s'den uzun sürüyor

B.6. Tipik dönme tereddütünüz ne kadar sürüyor (dönerken donma)?

0   Hiç
1   1-2 s içinde dönmeye devam ediyor
2   3-10s içinde dönmeye devam ediyor
3   11-30 s içinde dönmeye devam ediyor
4   30 s'den fazla dönmeye devam edemiyor