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ORIGINAL ARTICLE

Reliability and Validity of Urdu Version of the Dynamic Gait Index in Pakistani Geriatric Population

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ABSTRACT

OBJECTIVE: To translate DGI into Urdu and examine its reliability and validity in the Pakistani geriatric population.
METHODOLOGY: This cross-sectional study was conducted in Faisalabad from April to September 2021. The English version of DGI was translated into Urdu and culturally adapted. The DGI-U was administered by convenience sampling; a sample size of 56 geriatric patients enrolled based on predefined inclusion criteria. Participants with an age minimum of 65 years, walking without aids for at least 6 meters, falling at least once in the last year, and subjectively examining balance disorder were included. Patients who could not understand the DGI instructions, had lower limb injuries/had undergone knee/hip reconstruction during the past three months were excluded. Test-retest reliability was determined by administering the DGI-U twice, and inter-rater reliability was determined by administering it alone on the same day by two raters. Internal consistency was reported using Cronbach's alpha. Pearson's correlation analysis was used to examine the concurrent validity of the Urdu version of the DGI with the TUG and Berg Balance Scale (BBS).
RESULTS: Internal consistency (Cronbach's alpha = 0.97) of the Urdu version of DGI was excellent. DGI-U reflected high inter-rater reliability (ICC=0.959; 95% Cl (0.931-0.976) and intra-rater reliability (ICC=0.952 95% Cl (0.915-0.973). The DGI-U was correlated positive moderate with TUG (r = .716, p .0001) and BBS (r = 0.692, p .0001)
CONCLUSION: The study provided adequate evidence for the validity and reliability of the Urdu version of DGI for use in the elderly Pakistani population.

KEYWORDS: dynamic gait index, geriatric, reliability, validity, balance, Urdu speaking

INTRODUCTION

The consequences of fractures and falls include significant morbidity, impaired quality of life, and high healthcare costs[1]. The prevalence of gait and balance problems increases with age[2]. The number of older adults in Pakistan is currently 12.13 million, and it is predicted to increase to 17.53 million by 2025. Falling and losing balance are common causes of injury in older people, with a global prevalence of 17.2-33.1% and a recurrence rate of 5.7- 15.2% [3]. The risk of falling increases with age, with one in three people over 65 falling at least once a year. Falls can result in injury, physical impairment, morbidity, cognitive impairment, or even physical disability[2].

Gait and balance problems are mainly the reason for fall in the elderly population, resulting in injury, loss of independence, disability and a reduced quality of life. Gait and balance problems are typically multi-factorial and must be treated after a thorough evaluation to identify all possible causes, followed by targeted management[2]. To assess[3] the gait task and to determine their risk of falling, Shumway-Cook and Woolworth created the Dynamic Gait Index (DGI). The DGI contains objects, such as going through and around obstacles while shifting speeds and turning the head, walking with turns around, and standing up[4].

The DGI evaluates a person's capacity to regulate gait in reaction to converting venture needs of required conditions. The eight talents assessed are: steady-state on foot, on foot while changing gait speed, on foot whilst transferring the load vertically and horizontally, on foot whilst walking over and round barrier, on foot, pivoting for the length, and climbing stairs. The DGI consists of eight different tasks, each scored on a 4-point ordinal scale, ranging from 0-3. "0" indicates the lowest function level and "3" is the highest. The cumulative score is calculated by adding the scores for each task, resulting in a total score ranging from 0 to 24. Those with a score of 19/24 are at risk of falls in older adults, while those with a score of > 22/24 are considered safe ambulators[5].

The DGI has been translated and validated in several languages, including Persian, Brazilian, Danish and Arabic. DGI has high inter and intra-rater reliability in a variety of groups, including stroke[10], brain traumatic injury[11], multiple sclerosis[12], vestibular[13] and geriatric patient[14]. However, the Urdu version of the DGI has not yet been translated and assessed for validity and reliability. Looking at the increased frequency of fall in the Pakistani population there is a need to translate DGI into Urdu language and gather valid and reliable evidence of the Urdu version. This study aims to evaluate the reliability and validity of the Urdu version of the DGI in Pakistani geriatrics.

METHODOLOGY

The cross-sectional study using convenience sampling was conducted among the Pakistani Geriatric population with balance impairment. The data was collected from hospitals and community-dwelling older people (outpatient rehabilitation) in Faisalabad. The sample size of 56 older adults of both genders was included based on inclusion criteria. The participants were 65 years of age minimum, walking without walking aids for a distance of 6 meters, had a history of one or more falls in the last year and subjectively examined balance disorders observed during the early activity (Timed Up and Go test, Morse Fall Scale). Participants who could not understand the DGI instructions had experience with the DGI acute disease in the last six months, or had lower limb injury or reconstruction of knee or hip in the previous three months, were excluded from the study. The ethical review committee at Riphah College of Rehabilitation & Allied Health Sciences, Riphah International University approved the study (Ref. No. REC-FSD-00262), and the study is registered with ClinicalTrials.gov Identifier: NCT04867486. Informed consent was obtained from all participants, and they were free to withdraw from the research using the Urdu version of DGI.

Dynamic Gait Index (DGI), Timed Up and Go (TUGT), and Berg Balance Scale (BBS) were used as measuring tools in the current study. The translation of the DGI scale was conducted through 6 steps following previously mentioned studies and COSMIN guideline[6]. The approval to translate DGI into Urdu was taken from the original developer of the instrument.

The following steps were taken for the study.

STEP 1: **Initial Translation**: Two experienced translators spoke Urdu as their first language; one was a physiotherapist, and the second was an Urdu translation expert, and the original English version of the DGI was translated into Urdu. The aim of the study was explained to both translators by the Principal Investigator.

STEP 2: **Synthesis of Translation**: The original scale version and translations 1 (T1) and 2 (T2) were synthesized in this step to generate a common translation version (T-12). The translation was then composed according to the DGI English version. Words were translated into Urdu with comprehensible meanings to simplify understanding. The full Urdu translation of DGI (T-12) was completed during this stage.

STEP 3: **Back Translation:** The Urdu-translated version was back-translated into English during this stage. Two bilingual translators were consulted for this purpose. Both translators were native Pakistanis and had an excellent command of Urdu and English, with English as their mother tongue. They did not know the purpose of this study or the original English version of DGI. After completing the back translation, the translators provided the resultant copies, referred to as "BT1" and "BT2".

STEP 4: **Expert Committee:** Expert committees evaluated the difference between a translated version and an original by comparing, updating, and editing. (Supervisor, translator, two independent physiotherapists and researcher). Expert committee members were responsible for consolidating all questionnaire versions and creating a pre-final version for field testing. The committee had access to the original questionnaire and all translations (T1, T2, T12, BT1, and BT2). Knowing the purpose of the study, the committee compared both versions. After comparing the Urdu and English versions, committee members updated and edited the scale.

STEP 5: **Pre-final version testing:** The pre-final version of Urdu and English dynamic gate index was tested. The patient was requested to perform a questionnaire. After that, the survey was discussed with the patients individually. Then, researchers asked the patient to explain what they knew about each query. Also, examine their capacity to complete the questionnaire on their

own. Patients were also asked to report any issues with the questionnaire's grammar, guidelines or arrangement. The expert committee reviewed all of the findings from this process.

Step 6: **Submission and Appraisal of All the Written Reports by Developers/Committee:** A final report and all reports on cross-cultural adaptation were submitted to the committee. After the DGI was translated into Urdu, the survey was conducted with the final version.

DGI is the main scale used for impairment in the evaluation of balance. This scale was initially developed to measure the risk of falls and is considered the gold standard in the clinical balance measurement tool. The Berg scale objectively evaluates the balance results of 14 items to daily routines. The scale's 14 elements assess healthy sitting and standing posture and unintentional control during regular tasks, including transfers, turning, and picking up objects from the floor. It is a 14-item scale that rates 0 to 4 (unable to normal performance) for each item. TUG evaluate the time a participant takes rising from a chair, walking 3 meters, turning around, heading back to the chair, and sit quietly. The time spent on this assignment was measured in seconds. The test was performed with a chair, a cone and a stopwatch[7].

The DGI-U was used by two physical therapists, assessors (A) and (B), to assess each enrolled patient. Assessor (A) conducted the examination first, and assessor (B) assessed the participants one hour later on the same day to determine DGI-U inter-rater reliability to measure the intra-rater reliability of DGI-U, patients were assessed twice by one assessor (i.e., assessor A) on the first day. In addition, the DGI-U test-retest reliability was assessed two weeks after the first examination.

Data Analysis

The data obtained through the survey was analyzed by using SPSS version 24. For the evaluation of demographic measures, descriptive analysis was performed (Mean, Median, Standard deviation). Two follow-ups of each scale were taken on different days to establish intra-rater reliability. Both intra-rater and intra-class reliability were measured using Cronbach's alpha and intraclass correlation coefficient (ICC). The interclass reliability of each DGI-U scale item was evaluated using the kappa coefficient. ICC was calculated using test-retest reliability of each item measure taken at a specific time gap. The correlation coefficient of each item score with the total DGI-U scale score was found using bivariant correlation. Concurrent validity was done by checking the Spearman correlation of DGI-Urdu with BBS and TUGT, assuming a 95% confidence interval and $P \leq 0.05$ as significant.

RESULTS

This study included 56 participants, among whom 30 were male and 26 were female. Their age ranged from 65 to 85 years (71.5±5.6) with a mean BMI of 23.7±4.2. Berg Balance Scale has average scores of 36.32±12.20, the time up and go test was 17.2±8.5, and DGI-U averaged 14.1±5.4 among participants (**Table I**). The current study showed intra-rater 0.952(0.915-0.973) and inter-rater with values 0.959(0.931-0.976) reliability of DGI-U scores of participants. The kappa coefficient (Inter-rater reliability) for each item of the DGI-U shows inter-rater reliability between two measurements taken by two observers simultaneously, ranging from excellent 0.902 to 0.752. (**Table II**)

The study's findings showed moderate to excellent test-retest reliability of each item of DGI-U between two measurements taken by one observer at a different time gap with a total DGI score of 0.952(0.915-0.973). (**Table IV**). The correlation coefficient of each item of DGI-U with total points shows the significant correlation of each item of DGI-U with total points. **Spearman's rank correlation coefficient (rs)** shows an acceptable correlation between the time Up and Go Test and BBS with the Dynamic Gait Index-U scale. However, no correlation was found between demographic variables and DGI-U. (**Tables III & IV**)

Table I: Demographics and clinical characteristics of the study subjects (n=56)

Variables	Frequency	Mean±SD
Gender		
Male	30	
Female	26	
Age (years)		71.5±5.6
BMI		23.7±4.2
Education		
Illiterate	9	
primary	20	
elementary	7	
matric	10	
higher	10	
Lifestyle (sedentary, active)		
Sedentary	30	
Active	26	
Marital status		
Married	27	
Widowed	21	
Divorced	8	
Berg Balance Scale (BBS)		36.32±12.20
Time up and Go test (TUG)		17.2±8.5
DGI-U		14.1±5.4

Figure I: Plot presenting agreement between the two visits for taking DGI-U scores

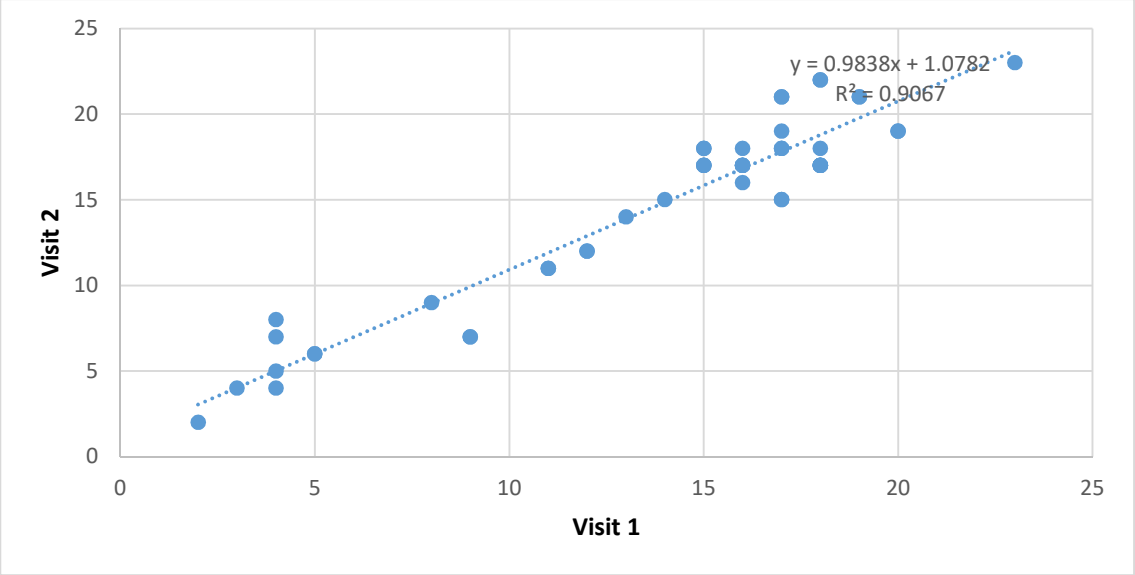

Table II: Intra-rater & Interrater, test-retest reliability and Kappa coefficient (Inter-rater reliability) for each item of the DGI-U (n = 56)

Inter-rater & Intra-rater reliability		
	Intraclass (95% confidence interval)	
Inter-rater	0.959(0.931-0.976)	
Intra-rater	0.952(0.915-0.973)	
Test-retest Reliability		
DGI-U1	.780(.638-.870)	
DGI-U2	.633(.438-.776)	
DGI-U3	.801(.67-.880)	
DGI-U4	.844 (0.760-0.918)	
DGI-U5	.766(.617-.861)	
DGI-U6	.815(.692-.892)	
DGI-U7	.752(.596-.853)	
DGIU-8	.840(.715-.911)	
DGI-U Total	0.952(0.915-0.973)	
Inter-rater reliability		
Items	**Kappa**	**Strength of agreement**
DGIS-U1	0.825	Very Good
DGIS-U2	0.809	Very Good
DGIS-U3	0.752	Good
DGIS-U4	0.777	Good
DGIS-U5	0.862	Excellent
DGIS-U6	0.902	Excellent
DGIS-U7	0.936	Excellent
DGIS-U8	0.776	Good

Table III: Correlation coefficient of each item of DGI-U with total points

Item No	Statement	p	r
DGI-U1	Gait level surface	<.001	0.748**
DGI-U2	Change in gait speed	<.001	0.860**
DGI-U3	Gait with horizontal head turns	<.001	0.808**
DGI-U4	Gait with vertical head turns	<.001	0.745**
DGI-U5	Gait and pivot turn	<.001	0.871**
DGI-U6	Step over obstacle	<.001	0.808**
DGI-U7	Step around obstacle	<.001	0.847**
DGIU-8	Steps	<.001	0.679**

Table IV: Spearman's rank correlation coefficient (rs) and p-value between demographic, clinical variables, and DGI-U

Variables	rs	p	Classification
Gender (Male/Female)	-0.171	0.209	No correlation
Age (years)	-0.143	0.294	No correlation
BMI	0.006	0.036	Low correlation
BBS	.692**	<0.001	Moderate correlation
TUGT	.716**	<0.001	Moderate correlation

DISCUSSION

DGI was translated into Urdu to make it easier for the Pakistani geriatric population to understand. According to the current study, DGI, the Urdu version, demonstrated high reliability and validity in the Urdu Version. Intra-rater and interrater reliability of DGI-U scores of this study are similar to the previous ones[8]. The interclass coefficient shows excellent reliability 0.959 (0.931 +0.976). It means both observers agree on the total scoring of DGI-U. In addition, the inter-rater eight items of DGI-U are individually analyzed to check the agreement of both observers on a single question. These statistics of the Kappa coefficient show that both raters have a moderate to excellent level of agreement on single questions, too. In the current study, Assessor (A) conducted the examination first, and Assessor (B) assessed the participants one hour later on the same day to determine DGI-U inter-rater reliability. The intra-rater coefficient showed excellent reliability of 0.952 (0.915-0.973), similar to the previous findings of DGI scores[9,10].

In the current study, Assessor (A) conducted the examination first, and Assessor (B) assessed the participants one hour later on the same day to determine DGI-U inter-rater reliability. The patients' scores at two visits are in excellent agreement. The results of this study were similar to those of the previous research[7]. It agrees with the high reliability of DGI-U to use on the Pakistani geriatric population.

Suppose the systemic differences within the observer are not seen. In that case, this shows that DGI-U is a very reliable instrument for checking the balance between the Pakistani geriatric population. Other translations of DGI also show excellent reliability for their respective populations[11,12,13]. Now, it comes to the validity of DGI-U to prospect whether it is a valid scale to check the balance in Pakistani geriatric populations with balance impairments. For this purpose, we researched several studies showing a significant DGI correlation with other balance assessment scales.

The current study reported a moderate to good concurrent validity of the dynamic gait index with a balanced Berg scale (Spearman correlation statistics p= 0.67-0.83) in older people[14]. Also, previous literature reported an excellent concurrent validity dynamic gait index and balance very scale in chronic diseases like multiple sclerosis[10] and vestibular impairments[15,16]. When considering chronic stroke patients, their balance impairments are also a concern for rehabilitation. Several studies check the function scales for assessing balance in chronic stroke patients[17]. These studies also support the validity of the dynamic gait index scale with the Berg balance scale[9]. We also check its validity with a test that focuses on balance during the state of movement. It was the Time UP and Go test. The previous literature also supports the concurrent validity of TUG with DGI[18].

Our study found that the time up and go test correlates well with the Urdu version of the dynamic gait index (spearman correlation = 0.715 with P= <0.001). So, we found that the Urdu version of the dynamic gait index has a good validity index with other measurement scales to check balance impairments in older adults. Talia et al. 2009 researched 278 older adults to evaluate the dynamic gait index and its relation with fall, stress, nervousness and different measures of movements and stability. Measures covered the DGI, BBS, TUG, MMSE, motor component of UPDRS, ABC scale and the range of yearly falls. The BBS (r = 0.53; p 0.001), the TUG (r = 0.42; p 0.001), and the ABC (r = 0.49; p 0.001) were all equally correlated with the DGI. Unlike non-fallers, fallers score worse on the DGI (p = 0.029). Men's DGI scores were similar to the best (23.3 1.2), but there was a slight but noticeable decrease (p 0.001) in women's DGI scores (22.5 1.6). Women's DGI ratings are lower than men's because they prefer to walk while gripping the handrail (65%),

compared to 39% of men. Men and women scored similarly on the BBS, the TUG, the UPDRS, and the MMSE. On the other hand, the ABC ratings and fall records had been different. These results suggest that the DGI at risk of ceiling effects seems to be the perfect device for assessing characteristics in healthful older adults [19].

Previous research was carried out to determine the DGI's test-retest and interrater reliability for dynamic balance in chronic stroke patients and the DGI's concurrent construct validity. A cohort study was carried out at rehabilitation centres in their ambulatory departments. No interference was used to verify the reliability of the dynamic gait index. In addition, the analysis included a group of twenty-five people who were at least three months post-stroke and could walk at least 10 meters with or without assistance. Correlating responses to the BBS, the timed walking test, the TUG scale, and the ABC Scale are used to test concurrent construct validity. The test-retest and integrate reliability of overall ratings were good (.96, respectively), while single-item reliability was moderate to good (range, .55.93). The concurrent construct validity hypothesis was proven with all measurements (range, .68.83). The DGI was found to be highly reliable and valid when compared to other balancing measures[20].

The study aimed to differentiate the results of two functional balance grades in patients with multiple sclerosis to assess the BBS and DGI's concurrent and convergent validity(7). De Castro conducted a recent study in the Rehab for the vestibular system that studies the Post-Graduation Program's line in Neuro-motor Rehabilitation at the UNIBAN, published in 2015. In their research, seventy-one old-age people were linked from UNIFESP/ EPM's outpatient ward from Neuroethology and Geriatrics, all of whom were sixty-five years old of both sexes, who were subjected to test the DGI. This research accompanied the approach evolved through Guillemin et al. (1993) to evaluate the reliability and carry out cultural adaptation of the DGI. This study used Wilcoxon's test to compare intra and interobserver scores, and the Spearman rank coefficient was utilized to equate them. The Cronbach alpha coefficient was also used to assess internal consistency. According to their findings, the ratings for intra and inter-observer tests for all items (p0.001) were graded as fair to high correlations (r=0.655 to r=0.951). The scale showed internal solid consistency in the assessment of intra and interobserver ($\propto$=0.820 to $\propto$=0.894, respectively). DGI cultural variation and its reliability evaluation completed with inside research may also contribute to Brazil's clinical community for medical and destiny studies initiatives related to frame stability and mobility [13]. Walking speed varies from person to person. Some walk faster, while others walk slower. Taking observations presented that challenge to our researcher. Additionally, patients with other co-morbid conditions experience variations in task performance. Other studies have also reported similar problems[21,22].

Therefore, further research on this topic should be conducted to overcome our study's limitations and improve the use of DGI-U scoring in clinical settings. The use of DGI can help the therapist to assess the balance not only in the geriatric population but also in neurological disorders. The availability of a reliable and valid DGI-U facilitates its use by therapists of Urdu origin in their clinical practice, enriching the rehabilitation process to evaluate the balance in the Pakistani geriatric population.

CONCLUSION

This study concluded that the Urdu version of the Dynamic Index Scale can be used to measure balance impairment in the geriatric population of Pakistan. The DGI Urdu version possesses high inter-rater and intra-rater reliability and good validity in terms of the properties and characteristics of the original version.

Ethical Permission: Riphah College of Rehabilitation and Allied Sciences, Riphah International University Faisalabad Campus, ERC letter No. REC/FSD/00262
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Data Sharing Statement: The data supporting this study's findings are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

AUTHOR CONTRIBUTIONS:

Waheed A: Conception & design, interpretation of data, Drafting and revising it critically, Final approval
Kashif M: Interpretation of data, Drafting, Final approval of the version
Tamjeed G: Data Acquisition, analysis and Drafting, Final approval of the version
Khalid M: Interpretation of data, revising it critically, Final approval of the version
Afzal S: Interpretation of data, Final approval of the version
Asif R: Design, Drafting, and Final approval of the version

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