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Comparative Evaluation of the Mini-Balance Evaluation Systems Test and Berg Balance Scale for Postural Control in Stroke Survivors: A Retrospective Exploratory Study in Lahore

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Abstract

Background: Post-stroke balance impairment can limit mobility, independence, and rehabilitation outcomes. The Berg Balance Scale (BBS) is widely used, whereas the Mini-Balance Evaluation Systems Test (Mini-BESTest) was developed to capture several dynamic balance systems. **Objective:** To compare the documented measurement performance of the Mini-BESTest and BBS in stroke survivors and examine their relevance to walking-related functional status. **Design:** Retrospective exploratory study. **Methods:** Twenty-six stroke survivors aged 45–65 years were assessed at Lahore General Hospital and Sheikh Zaid Hospital, Lahore. The thesis dataset included Mini-BESTest and BBS item-level scores and ordinal walking-speed categories. Data were analyzed in SPSS 27 using descriptive statistics, an independent-samples t-test for two documented slow-walking subgroups, and an overall internal-consistency analysis. **Results:** The thesis dataset contained 26 valid cases. Mini-BESTest item means ranged from 1.65 to 2.00 on the thesis coding scale, while documented BBS item means ranged from 1.23 to 2.04 on a 0–4 scale. The overall 36-item dataset showed high internal consistency (Cronbach's α = .873; standardized α = .860). The two documented slow-walking subgroups did not differ significantly in their coded walking-speed values ($t(15) = -0.489$, $p = .632$). **Conclusions:** Both instruments provided clinically relevant balance information, but the Mini-BESTest offered broader coverage of anticipatory, reactive, sensory, and dynamic balance domains. The findings support its use as a complementary or preferred assessment when dynamic balance deficits are clinically important. Because the available thesis output did not provide instrument-specific reliability coefficients or continuous gait-speed correlations, claims of superiority should be interpreted cautiously.

Keywords: Stroke; postural control; Mini-BESTest; Berg Balance Scale; balance assessment; gait; rehabilitation

Introduction

Stroke is a major cause of long-term disability and loss of functional independence. Recovery after stroke is heterogeneous and may remain incomplete even when acute treatment has been optimized. Balance impairment is a particularly important contributor to mobility limitation because successful walking requires the integration of anticipatory adjustments, postural reactions, sensory information, and dynamic gait control [1,2].

Clinical balance assessment therefore has two complementary purposes: identifying the presence and severity of balance impairment and providing information that can guide rehabilitation planning. The Berg Balance Scale (BBS) remains one of the most widely used clinical measures of balance in stroke rehabilitation. Its 14 tasks cover functional activities such as transfers, standing, reaching, turning, and single-leg stance, with each task scored from 0 to 4 for a maximum of 56 points [3,4]. Evidence supports its reliability and validity, although ceiling effects and limited coverage of reactive and dynamic gait components have been reported [5,6].

The Mini-BESTest was developed as a shorter, system-oriented balance measure derived from the Balance Evaluation Systems Test. It contains 14 items addressing anticipatory postural adjustments, reactive postural control, sensory orientation, and stability in gait [7]. Psychometric investigations have generally reported strong reliability and validity, and several studies have found that the Mini-BESTest may provide a broader distribution of scores and better responsiveness than the BBS in selected neurological populations [8–10]. Comparisons in stroke populations have also suggested a stronger relationship between the Mini-BESTest and walking performance in some stages of recovery [11,12].

However, the available evidence is not uniform across clinical stages and populations. Godi et al. found broadly comparable performance of the two measures while noting a lower ceiling effect and slightly higher reliability for the Mini-BESTest [8]. Madhavan and Bishnoi reported stronger discrimination of slow and fast walkers using the Mini-BESTest in chronic stroke [11]. Miyata et al. similarly reported favorable measurement properties and responsiveness of the Mini-BESTest in ambulatory people with subacute stroke [12]. These findings suggest that the relative usefulness of the two scales may depend on the functional characteristics of the patient group. Comparative evidence from Parkinson's disease also reports strong agreement between the two measures while showing less ceiling compression with the Mini-BESTest, and work in subacute stroke has demonstrated strong convergent validity of the broader BESTest family with the BBS and Mini-BESTest [15,16].

The present study was undertaken in Lahore using the dataset generated for the thesis titled "Comparison of Psychometric Properties of Mini-BesTest and Berg Balance Scale in Relation to Postural Control and Motor Recovery Post Stroke." The purpose of the present article is narrower than the original thesis: it synthesizes the documented quantitative results to compare the item-level performance and internal consistency of the balance measures and to examine the available walking-speed classification data. The study also provides a clinically focused interpretation of the findings in the context of previous research.

Methods

Study design and setting. A retrospective exploratory quantitative design was used. Data were collected from Lahore General Hospital and Sheikh Zaid Hospital, Lahore, over the study period described in the thesis. The source thesis reports that participants were assessed for postural control and motor recovery using the Mini-BESTest and BBS [13].

Participants. The planned sample comprised adults aged 45–65 years, of either sex, with ischemic or hemorrhagic stroke and a post-stroke interval of approximately 2 months to 1 year. The thesis states that recurrent stroke, spinal cord injury, space-occupying lesions, sensory neuropathies, and acute-stage stroke were excluded. Although the thesis describes convenient sampling in the methods, its abstract refers to random sampling; the present manuscript therefore reports the detailed methods section and identifies the sampling approach as convenience sampling rather than resolving this internal inconsistency by assumption [13].

Sample-size planning. An a priori calculation in G*Power 3.1.9.2 was based on a two-sided independent-samples t test, α = .05, power = .95, effect size d = 1.2406448, and equal allocation, producing a minimum total sample of 26 participants. The final analytical dataset contained 26 valid cases [13].

Measures. The Mini-BESTest was used to assess dynamic balance, including tasks related to anticipatory control, single-leg stance, compensatory stepping, and sensory orientation. The BBS was used to assess functional static and dynamic balance through activities such as sit-to-stand, unsupported standing, transfers, reaching, turning, and single-leg stance. The thesis dataset records the BBS using its conventional 0–4 item scale. The Mini-BESTest variables in the statistical output are coded from 1 to 3; this coding is retained in the present article to avoid altering the source data.

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Walking-speed variables. The source dataset contains ordinally coded walking-speed categories. The inferential output available in the thesis compares two slow-walking categories (0.2–0.3 m/s and 0.3–0.4 m/s). Because the source output does not provide a continuous walking-speed variable or a complete correlation matrix between each balance scale and gait speed, no new correlation coefficient, ROC curve, sensitivity, specificity, or cut-off value has been inferred in this manuscript.

Statistical analysis. Descriptive statistics were used to summarize the item-level balance variables. Internal consistency was examined using Cronbach's alpha for the 36 variables retained in the thesis reliability analysis. The independent-samples t test was used to compare the two documented slow-walking subgroups. Statistical significance was set at $p < .05$. Importantly, the reported $\alpha = .873$ is an overall coefficient for the 36-item dataset and should not be interpreted as an instrument-specific Cronbach's alpha for either the Mini-BESTest or BBS.

Ethical considerations. The thesis includes an ethical committee form and a research completion certificate among its annexes. The accessible thesis text does not state an approval number or date; these details should therefore be inserted from the original ethics documentation before journal submission [13].

Results

Participant and dataset characteristics. The thesis statistical output included 26 valid observations for the descriptive analysis. The study population was restricted to adults aged 45–65 years with stroke, and both ischemic and hemorrhagic stroke were eligible. The source output also contained coded variables for sex, stroke duration, stroke type, perceived health status, and other background characteristics; because the coding key is not provided in the thesis, these numerical codes are not converted into demographic categories in this article.

Table 1: *Study characteristics documented in the thesis. The table deliberately avoids converting uncoded categorical variables into assumed demographic categories.*

Characteristic	Source value	Interpretation
Analytical sample	26 valid cases	Final descriptive dataset
Age	45–65 years	Eligibility range
Stroke type	Ischemic or hemorrhagic	Both types eligible
Post-stroke interval	2 months–1 year	Eligibility range in methods
Study setting	Lahore General Hospital; Sheikh Zaid Hospital	Two Lahore hospitals

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Sampling	Convenience sampling in methods	Abstract uses different wording; not reconciled

Table 1 summarizes the study characteristics that can be stated without reconstructing missing coding definitions. The thesis confirms 26 valid cases and an eligibility age range of 45–65 years [13].

Mini-BESTest item performance. As shown in Table 2 and Figure 1, mean item scores on the thesis-coded Mini-BESTest variables ranged from 1.65 to 2.00. The highest documented means were observed for first-trial left-leg stance and first-trial right-leg stance (2.00), while the second right-leg stance and backward compensatory stepping showed the lowest means (1.65). The relatively lower scores for repeated single-leg stance and backward stepping suggest that tasks requiring sustained postural control and reactive recovery were more challenging in this sample.

Table 2: *Item-level descriptive statistics for the Mini-BESTest variables documented in the thesis (n = 26).*

Mini-BESTest item	Mean	SD
Sit to stand	1.96	0.82
Rise to toes	1.81	0.75
Stand on left leg, 1st trial	2.00	0.80
Stand on left leg, 2nd trial	1.81	0.80
Stand on right leg, 1st trial	2.00	0.69
Stand on right leg, 2nd trial	1.65	0.80
Compensatory stepping—forward	1.88	0.71
Compensatory stepping—backward	1.65	0.75
Compensatory stepping—lateral left	1.81	0.80
Compensatory stepping—lateral right	1.92	0.89
Eyes open, firm surface	1.96	0.92
Eyes closed, foam surface	1.96	0.72

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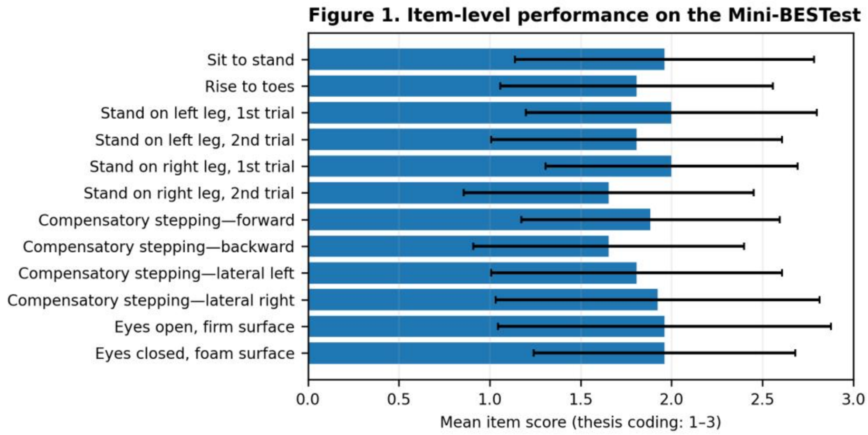

Figure 1. Item-level performance on the Mini-BESTest. Error bars represent the standard deviation reported in the thesis output. The source thesis documents 12 Mini-BESTest variables in the final descriptive table; no undocumented item was reconstructed.

Berg Balance Scale performance. The 13 BBS variables documented in the thesis descriptive output are presented in Table 3 and Figure 2. Mean scores ranged from 1.23 for sit-to-stand to 2.04 for standing on one leg. The largest standard deviations were observed for unsupported sitting, standing with eyes closed, reaching, turning, and single-leg tasks, indicating substantial between-participant variability. The source output does not contain a 14th BBS item in the final descriptive table; therefore, it has not been fabricated or estimated.

Table 3: *Item-level descriptive statistics for the BBS variables documented in the thesis (n = 26).*

BBS item documented	Mean	SD
Sit to stand	1.23	1.18
Standing unsupported	1.69	1.29
Sitting unsupported	1.88	1.48
Standing to sitting	1.65	1.20
Transfers	1.85	1.32
Standing, eyes closed	1.73	1.43
Forward reach	1.88	1.34
Pick up object from floor	1.69	1.35
Look behind over shoulders	1.62	1.36
Turn 360°	1.92	1.26
Alternate foot on step	1.73	1.34
One foot in front	1.77	1.18

Standing on one leg	2.04	1.40

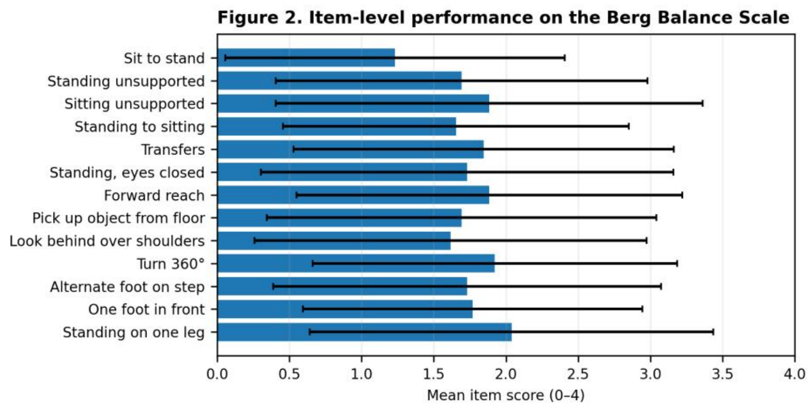

Figure 2. Item-level performance on the BBS. Error bars represent the standard deviation reported in the thesis output.

Internal consistency. The reliability analysis included 36 variables and 26 valid cases, with 12 cases excluded from the reliability computation. Cronbach's alpha was .873 and the standardized-item alpha was .860 (Table 4). The coefficient indicates high internal consistency for the combined 36-variable dataset. However, because the 36 variables include demographic, health-status, Mini-BESTest, BBS, and walking-category variables, this coefficient cannot validly be presented as a separate psychometric coefficient for either instrument.

Table 4: *Internal-consistency output reproduced from the thesis reliability analysis.*

Analysis	Valid N	Excluded N	Coefficient
Overall 36-variable reliability	26	12	Cronbach's α = .873; standardized α = .860

Item-total statistics also showed considerable heterogeneity. Several BBS items had relatively high corrected item-total correlations, including unsupported sitting (.880), transfers (.874), turning 360° (.870), and standing one foot in front (.877). In contrast, several Mini-BESTest variables had low or negative corrected item-total correlations. This pattern reinforces the need to avoid treating the overall α as evidence that one instrument is intrinsically more reliable than the other.

Walking-speed subgroup analysis. The thesis compared two documented slow-walking categories: 0.2–0.3 m/s ($n = 9$) and 0.3–0.4 m/s ($n = 8$). Mean coded values were 2.56 (SD 1.33) and 2.88 (SD 1.36), respectively. Levene's test indicated no evidence of unequal variances ($F = .016$, $p = .900$), and the independent-samples t test showed no statistically significant difference, $t(15) = -0.489$, $p = .632$ (Table 5; Figure 3).

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Table 5: *Comparison of the two slow-walking subgroups documented in the thesis.*

Walking-speed category	n	Mean coded value	SD	Comparison
0.2–0.3 m/s	9	2.56	1.33	
0.3–0.4 m/s	8	2.88	1.36	
Independent-samples t test				t(15) = −0.489, p = .632

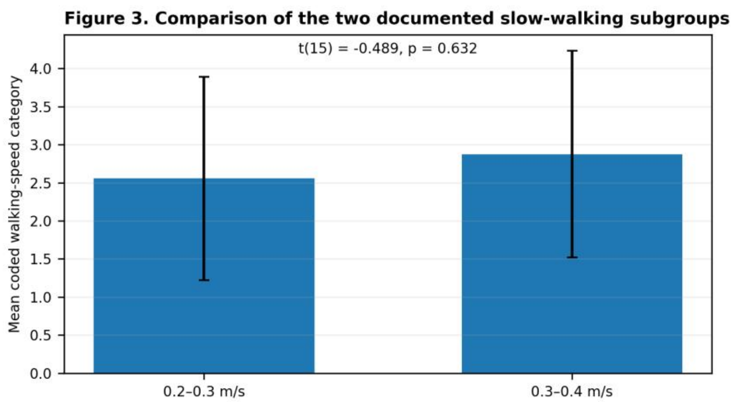

Figure 3. Mean coded walking-speed category values for the two slow-walking subgroups. Error bars represent standard deviation.

Discussion

The principal finding of this exploratory analysis is that both balance instruments captured clinically meaningful variability in stroke survivors, while the Mini-BESTest provided a broader representation of dynamic balance tasks. The source thesis concluded that the Mini-BESTest was preferable to the BBS for the study population; the present article reaches a more cautious interpretation because the available statistical output does not contain instrument-specific reliability coefficients, direct Mini-BESTest–BBS correlations, or continuous gait-speed associations.

The pattern of Mini-BESTest scores is clinically informative. Lower performance was observed for repeated single-leg stance and backward compensatory stepping, whereas several other tasks approached the upper end of the thesis coding scale. These tasks challenge the ability to maintain or recover stability rather than simply sustain a static posture. The emphasis on reactive postural control and dynamic gait is a central conceptual distinction between the Mini-BESTest and the BBS [7,8].

The BBS results showed substantial variability across functional tasks. Sit-to-stand had the lowest mean score, while single-leg stance had the highest mean among the documented BBS items. Nevertheless, the relatively large standard deviations for several BBS tasks indicate that participants were heterogeneous in their functional balance. This

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is consistent with the established role of the BBS as a broad functional balance measure while also highlighting why ceiling effects can become important in people with better recovery [5,6].

Previous comparative studies provide a useful framework for interpreting these findings. Godi et al. reported similar overall behavior of the two scales but a lower ceiling effect and slightly higher reliability for the Mini-BESTest [8]. Madhavan and Bishnoi found that the Mini-BESTest was more strongly associated with walking speed than the BBS and better discriminated slow from fast walkers in chronic stroke [11]. Miyata et al. reported favorable distributional properties and responsiveness of the Mini-BESTest in ambulatory individuals with subacute stroke [12]. These studies support the clinical plausibility of the thesis conclusion, but their stronger analyses should not be attributed to the present dataset.

The overall Cronbach's alpha of .873 should be interpreted particularly carefully. The reliability output in the thesis contains 36 variables, including demographic and walking variables in addition to balance items. Consequently, the coefficient is evidence of internal consistency within the combined coded dataset, not proof of the internal consistency of either balance scale. This distinction is important for publication because psychometric claims require scale-specific analyses that match the construct being measured. Existing literature has demonstrated strong instrument-specific reliability for both the Mini-BESTest and BBS, but those published coefficients come from independent samples and cannot be transferred to the present sample as if they were newly estimated here [5,8–10,13].

The walking-speed analysis likewise requires a restrained interpretation. The thesis provides two slow-walking categories and a nonsignificant t test between them. The absence of a statistically significant difference does not demonstrate absence of a relationship between balance and gait. Instead, it indicates that the particular coded comparison available in the dataset did not distinguish the two slow-walking groups. Studies using continuous gait speed or clinically defined fast/slow thresholds have produced stronger evidence of the relationship between balance and gait after stroke [11,12].

From a clinical perspective, the findings support using the Mini-BESTest when the clinician needs information about dynamic and reactive balance systems, particularly when single-leg control, compensatory stepping, or sensory orientation are important. The BBS remains useful because it captures functional tasks that are familiar, relatively straightforward to administer, and relevant to basic mobility. Published evidence also indicates that choice of balance measure should depend on the level of impairment, purpose of assessment, and available clinical time [14].

Several limitations should be acknowledged. First, the sample was small (n = 26) and drawn from two hospitals in Lahore, limiting generalizability. Second, the study was retrospective and exploratory. Third, the thesis contains internal inconsistencies in the description of sampling and in the available statistical outputs. Fourth, the final descriptive table documents 12 Mini-BESTest variables and 13 BBS variables rather than a complete 14-item set for each instrument. Fifth, the walking-speed variable is available in coded categories rather than as a continuous measure. Finally, the overall reliability analysis combines variables that do not necessarily represent a single latent construct. These limitations mean that the present article should be considered an exploratory clinical report rather than a definitive validation study.

Future studies in Pakistani stroke populations should use larger prospective samples, preserve the original scoring structure of each instrument, report scale-level totals, estimate separate internal consistency for each scale, and examine test-retest and inter-rater reliability. Continuous comfortable walking speed should be recorded using a standardized distance and timing procedure, allowing Pearson or Spearman correlation, group discrimination, and ROC analysis where appropriate. Such a design would permit a more definitive comparison of the two measures.

Conclusions

The present retrospective exploratory analysis indicates that both the Mini-BESTest and BBS captured substantial variation in post-stroke balance performance. The Mini-BESTest showed particularly informative performance differences in tasks involving single-leg control, compensatory stepping, and sensory orientation, supporting its clinical value when dynamic balance is a priority. The BBS also demonstrated broad variability across functional balance tasks. The thesis dataset showed high overall internal consistency (α = .873), but because this coefficient was calculated across a mixed 36-variable dataset, it should not be interpreted as scale-specific reliability. The available walking-speed comparison was not statistically significant. Overall, the findings support the Mini-BESTest as a valuable balance assessment option in stroke rehabilitation, while emphasizing that stronger prospective psychometric and gait-related analyses are required before claiming definitive superiority over the BBS.

Declarations

Ethics approval and consent to participate: The thesis contains an ethical committee form and research completion certificate. The approval number/date are not visible in the accessible manuscript text and should be inserted from the original ethics documentation before submission. The article should retain the ethics wording required by the target journal.

Consent for publication: To be confirmed by the author before submission. If any identifiable participant information or images are submitted, written permission for publication must be documented.

Availability of data and materials: The study data are derived from the thesis research dataset. The author should confirm the applicable institutional/data-sharing restrictions before submission and state whether a de-identified dataset can be made available.

Competing interests: To be confirmed by the author. Suggested wording if accurate: The author declares that there are no competing interests.

Funding: No external funding statement is reported in the accessible thesis text. To be confirmed by the author before submission.

Author contributions: H.M. conceived and conducted the thesis research, collected/compiled the study data, performed the analysis reported in the thesis, and drafted the original thesis. The present article was prepared from that work.

Previous publication / simultaneous submission: Author declaration to be confirmed before submission: This submission has not been previously published, nor is it before another journal for consideration.

Permission for materials: Author declaration to be confirmed before submission: Permission has been obtained to publish all photographs, datasets, and other material provided with this submission, where such permission is required.

References

1. Thrift AG, Thayabaranathan T, Howard G, Howard VJ, Rothwell PM, Feigin VL, et al. Global stroke statistics. International Journal of Stroke. 2017;12(1):13–32.
2. Grefkes C, Fink GR. Recovery from stroke: current concepts and future perspectives. Neurological Research and Practice. 2020;2(1):1–10.
3. Berg KO, Maki BE, Williams JI, Holliday PJ, Wood-Dauphinee SL. Clinical and laboratory measures of postural balance in an elderly population. Archives of Physical Medicine and Rehabilitation. 1992;73(11):1073–1080.
4. Horak FB, Wrisley DM, Frank J. The Balance Evaluation Systems Test (BESTest) to differentiate balance deficits. Physical Therapy. 2009;89(5):484–498.
5. Kudlac M, Sabol J, Kaiser K, Kane C, Phillips RS. Reliability and validity of the Berg Balance Scale in the stroke population: a systematic review. Physical & Occupational Therapy in Geriatrics. 2019;37(3):196–221. doi:10.1080/02703181.2019.1631423.

6. Blum L, Korner-Bitensky N. Usefulness of the Berg Balance Scale in stroke rehabilitation: a systematic review. Physical Therapy. 2008;88(5):559–566.
7. Franchignoni F, Horak F, Godi M, Nardone A, Giordano A. Using psychometric techniques to improve the Balance Evaluation Systems Test: the mini-BESTest. Journal of Rehabilitation Medicine. 2010;42(4):323–331. doi:10.2340/16501977-0537.
8. Godi M, Franchignoni F, Caligari M, Giordano A, Turcato AM, Nardone A. Comparison of reliability, validity, and responsiveness of the Mini-BESTest and Berg Balance Scale in patients with balance disorders. Physical Therapy. 2013;93(2):158–167. doi:10.2522/ptj.20120171.
9. Tsang CS, Liao LR, Chung RC, Pang MY. Psychometric properties of the Mini-Balance Evaluation Systems Test (Mini-BESTest) in community-dwelling individuals with chronic stroke. Physical Therapy. 2013;93(8):1102–1115. doi:10.2522/ptj.20120454.
10. Di Carlo S, Bravini E, Vercelli S, Massazza G, Ferriero G. The Mini-BESTest: a review of psychometric properties. International Journal of Rehabilitation Research. 2016;39(2):97–105. doi:10.1097/MRR.0000000000000153.
11. Madhavan S, Bishnoi A. Comparison of the Mini-Balance Evaluation Systems Test with the Berg Balance Scale in relationship to walking speed and motor recovery post stroke. Topics in Stroke Rehabilitation. 2017;24(8):579–584. doi:10.1080/10749357.2017.1366097.
12. Miyata K, Hasegawa S, Iwamoto H, Otani T, Kaizu Y, Shinohara T, et al. Comparing the measurement properties and relationship to gait speed recovery of the Mini-Balance Evaluation Systems Test and the Berg Balance Scale in ambulatory individuals with subacute stroke. Physical Therapy Research. 2020;23(1):72–78. doi:10.1298/ptr.E10004.
13. Mushrraf H. Comparison of psychometric properties of MiniBesTest and Berg Balance Scale in relation to postural control and motor recovery post stroke. MS thesis. Riphah International University; 2021.
14. Marques A, Almeida S, Carvalho J, Cruz J, Oliveira A, Jácome C. Reliability, validity, and ability to identify fall status of the Balance Evaluation Systems Test, Mini-Balance Evaluation Systems Test, and Brief-Balance Evaluation Systems Test in older people living in the community. Archives of Physical Medicine and Rehabilitation. 2016;97(12):2166–2173.e1. doi:10.1016/j.apmr.2016.07.011.
15. King LA, Priest KC, Salarian A, Pierce D, Horak FB. Comparing the Mini-BESTest with the Berg Balance Scale to evaluate balance disorders in Parkinson's disease. Parkinson's Disease. 2012;2012:375419. doi:10.1155/2012/375419.

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
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Print ISSN 3007-2379

16. Chinsongkram B, Chaikeeree N, Saengsirisuwan V, Viriyatharakij N, Horak FB, Boonsinsukh R. Reliability and validity of the Balance Evaluation Systems Test (BESTest) in people with subacute stroke. Physical Therapy. 2014;94(11):1632–1643. doi:10.2522/ptj.20130558.