

Reliability, validity and adaptability of the Hindi version of Berg Balance Scale in patients with impaired balance having neurological illness

Confiabilidade, validade e adaptabilidade da versão em hindi da Escala de Equilíbrio de Berg em pacientes com equilíbrio prejudicado e doenças neurológicas

Manpreet Kaur¹ Nidhi Sharma² ¹Corresponding contact. Institute of Allied Health and Science, Chandigarh University (Mohali). Punjab, India. priyuarora8427@gmail.com²Amity Institute of Allied Health and Sciences, Amity University (Noida). Uttar Pradesh, India.

ABSTRACT | BACKGROUND: As the Berg Balance Scale (BBS) is the most widely adaptable tool for quantifying the balance and different translated versions of this scale are available among several nations worldwide, a cross-cultural adaptation of the Hindi version of BBS (H-BBS) was necessary to establish it as an appropriate tool in Indian culture also. **METHODS:** According to international guidelines, the pre-final H-BBS was obtained after forward and backward translations of the original version (O-BBS) were performed by bilingual independent translators and physiotherapists blinded to the original version, followed by a content validation phase. Further, the study recruited 356 patients, out of which 122 patients participated in pilot study and 234 patients in psychometric evaluation. **RESULTS:** The H-BBS exhibited an excellent total content validation index (0.984), a good to excellent inter-evaluator reliability for the individual domain (ranging from 0.761 to 1) and computed score (0.719), a good to excellent intra-evaluator reliability of the individual domain (ranging from 0.848 to 1) and computed score (0.994), an excellent total internal consistency of all items (0.913), an excellent criterion validity with O-BBS (0.993), MiniBESTest (0.894) and TUG (-0.946). **CONCLUSION:** The H-BBS is an adapted tool for quantifying balance among different neurological deficits.

KEYWORDS: Cross-cultural Comparison. Patients. Physical Therapists. Pilot Projects. Psychometrics. Reliability.

RESUMO | CONTEXTO: Como a Escala de Equilíbrio de Berg (BBS) é a ferramenta mais amplamente adaptável para quantificar o equilíbrio e existem diferentes versões traduzidas dessa escala disponíveis em diversos países ao redor do mundo, uma adaptação transcultural da versão hindi da BBS (H-BBS) foi necessária para estabelecê-la como uma ferramenta apropriada também na cultura indiana. **MÉTODOS:** De acordo com as diretrizes internacionais, a versão pré-final da H-BBS foi obtida após traduções diretas e retradução da versão original (O-BBS), realizadas por tradutores bilíngues independentes e fisioterapeutas cegos para a versão original. Além disso, o estudo recrutou 356 pacientes, dos quais 122 participaram do estudo piloto e 234 da avaliação psicométrica. **RESULTADOS:** A H-BBS apresentou um excelente índice de validação de conteúdo total (0,984), uma confiabilidade inter-avaliador de boa a excelente para o domínio individual (variando de 0,761 a 1) e para o escore computado (0,719), uma confiabilidade intra-avaliador de boa a excelente para o domínio individual (variando de 0,848 a 1) e para o escore computado (0,994), uma excelente consistência interna total de todos os itens (0,913), uma excelente validade de critério com O-BBS (0,993), MiniBESTest (0,894) e TUG (-0,946). **CONCLUSÃO:** A H-BBS é uma ferramenta adaptada para quantificar o equilíbrio em pacientes com diferentes déficits neurológicos.

PALAVRAS-CHAVE: Comparação Transcultural. Pacientes. Fisioterapeutas. Projetos Piloto. Psicometria. Confiabilidade.

1. Introduction

Postural stability is a potential to discipline the alignment of gravity line in the horizontal stride width during double-support phase with least experience of postural sway which can be categorized into static equilibrium and dynamic equilibrium^{1,2}. The occurrence of falls among geriatric population varied from 10% to 53% in India³. Moreover, 13% and 46% of the population aging from 65 to 69 and 85 or more self-report balance disturbances, respectively that affect the quality of life among them⁴⁻⁶. Accordingly, simple procedures are required for the evaluation of the same^{7,8}. Although there is an availability of various scales for the balance assessment, the BBS has abundant demand of being an easy, secure and promptly evaluation test unaccompanied by the requirement of any exclusive training and peculiar materials⁹⁻¹¹. It was introduced in 1989 by Katherine Berg and validated in 1992 in a survey study¹²⁻¹⁵. This ordinal scale (14 items) incorporating manoeuvrability actions for an assessment of static and dynamic balance¹². On the basis of accomplishment of tasks performed by an individual, each element has graded from 0 to 4 which are added to attain computed score ranging from 0 {worst performance} to 56 {best performance}¹⁶.

Nowadays, it is broadly used in various neurological disorders (52) such as Alzheimer disease, Stroke, Traumatic brain injury, Cerebellar ataxia, Disseminated sclerosis, Spinal cord injury, Parkinson's disorder etc. for evaluating balance after thoroughly evaluation of its psychometric properties among different nations like Italy, Brazil, Norway, Iran, Spanish, Japanese and Turkey in their native versions of translation¹⁷⁻²².

As in India, Hindi is native language as well as patients and some medical professionals are not proficient in English due to non-native background of English create difficulties in developing effective communication among them²³. In context of that, due to unavailability of any Hindi version of balance measure, this study was designed to provide an adapted tool to reduce the risks of inaccurate practices. The null hypothesis of the study was that H-BBS was not a reliable, valid and adaptable to evaluate the balance, while the alternative hypothesis was that the H-BBS was a reliable, valid and adaptable for the same.

2. Methodology

2.1 Study design

The Ethical Review of Research and Student Project Committee of Institution (IEC-1732) approved this cross-cultural adaptation and single-centred study in March 2020. This study was done in conformation with the Helsinki Declaration (Revised in 2013) and National ethical guidelines for biomedical and health research associated with human participant's guidelines laid out by the Council of Medical Research (ICMR -2017) and registered in the Clinical Trials Registry, CTRI/2020/08/027266) on 20 August 2020. The H-BBS was copyrighted with reference no. (L-94030/2020) on 24 Sep 2020 ([Appendices and attachment](#)). Before taking consent from the patients, the procedure of the study, associated benefits and risks were explained to them. The study was undertaken from September 2020 to March 2023.

2.2 Study participants

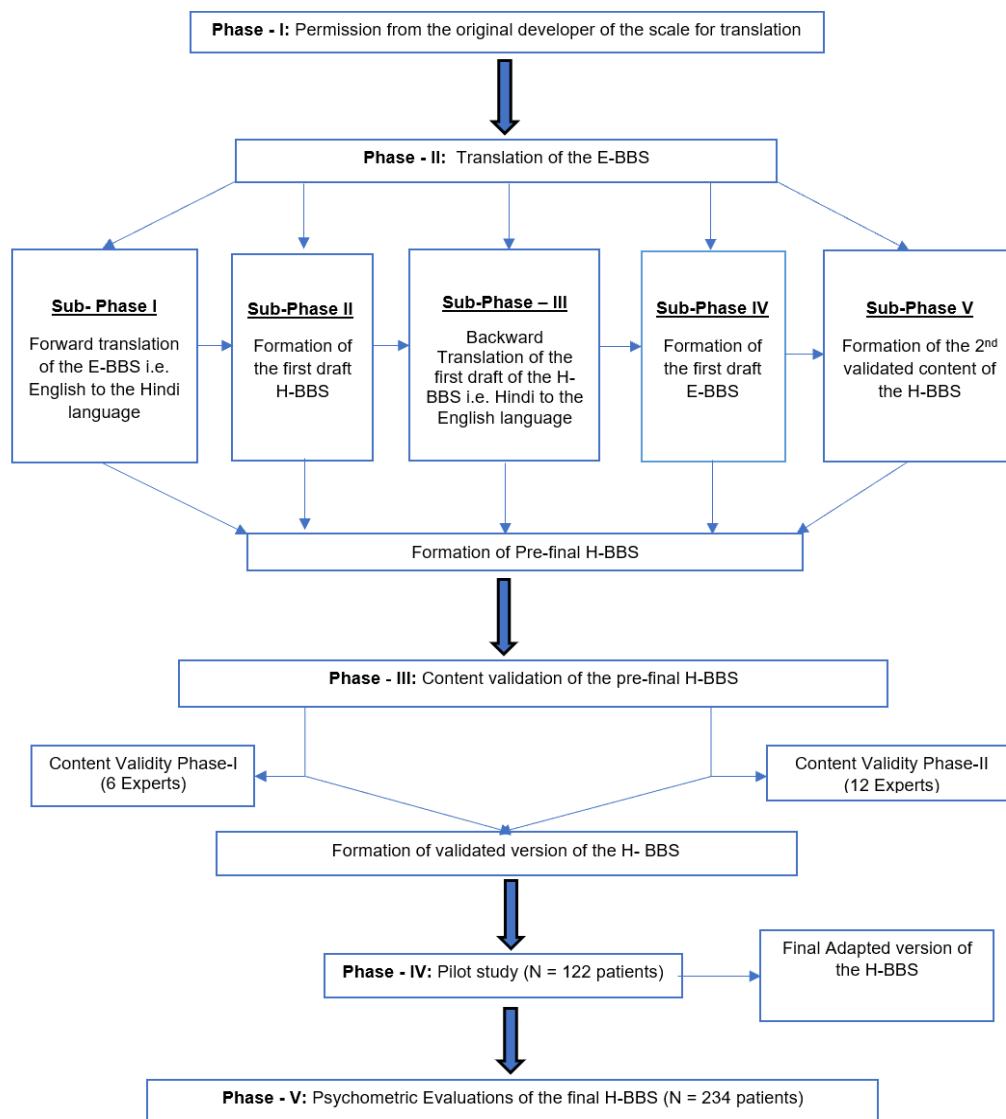
Total 356 patients from inpatients and outpatients department were enrolled in the study through convenience sampling divided into 122 patients for the pilot study and 234 patients as sample size (i.e. 230) was estimated through G power software (3.1.9.2) by assuming power of study (90%), alpha (5%) and taking effect size i.e. 0.54 for psychometric evaluation.²⁴ They were recruited with age criteria between 40 to 70 years, suspecting to have balance impairments due to neurological deficits, Mini Mental Score Examination (MMSE) score ≥ 15 , Tinetti Gait and Balance Assessment Tool Score (only Balance section) $\geq 10/16$, ability to walk at 6 m distance (either by walking or using assistive devices) and follow verbal commands. During inclusion, patients with severe type of cognitive impairment, history of seizures, hearing deficits and musculoskeletal impairments of lower limbs (i.e. Hip and knee amputation and lower limb prosthesis conditions) were excluded from the study.

2.3 Study procedures

The study procedure comprised of five phases i.e.

1. Consent
2. Translation
3. Content validation
4. Pilot Study
5. Psychometric evaluation (**Figure 1**).

Figure 1. Representing the phases of the study



Source: the authors (2023).

2.3.1 Phase-I

In consent phase, permission to translate the O-BBS was taken from Dr Katherine Berg via email method on 28 January 2020.

2.3.2 Phase-II

In Translation phase, two types of translations were carried out i.e. (forward and backward) of the O-BBS to obtain the pre-final H-BBS as per the international guidelines²⁴. To begin with, the O-BBS was forward translated (i.e. English to Hindi language) by two individual Hindi translators to obtain the two translated H-BBS. The third Hindi translator compared both versions under the supervision of a blinded physiotherapist and provided the first draft of H-BBS. The respective draft was further backward translated (i.e. Hindi to English language) by the two individual English translators to obtain the two translated English version of the BBS (E-BBS). The third English translator compared both versions under the supervision of a blinded physiotherapist and formed the first draft of E-BBS. At the end, the first draft of E-BBS was compared with the O-BBS to form the pre-final H-BBS.

Three Hindi translators possessed MPhil (Hindi), M.A., B.Ed. (Hindi) and M.A., B.Ed. (Hindi) degree along with 9, 10 and 11 years of teaching experience, respectively. Three English translators possessed M.A., MPhil (English), M.A. (English) and M.A. B.Ed. (English) along with 27, 7 and 24 years of teaching experience, respectively. Two blinded physiotherapists possessed BPT, MPT (Neurological Physiotherapy) along with clinical experience > 10 years.

All the translators were native speakers of Hindi language with expertise in their lingual subjects but unacquainted with the balance concept, O-BBS, methodology and aim of the study. While, both the blinded physiotherapists were acquainted with the balance concept, O-BBS, methodology and aim of the study. The translators were instructed to focus on conceptual translation rather than literal translation and resolve the discrepancies and ambiguities along

with the blinded physiotherapists by establishing a greater degree of concordance among them

2.3.3 Phase-III

This content validation phase consisted of Part-I and Part-II conducted via the Google form method. Both Google forms were made up of five sections incorporating questions to collect the:

- (a) experts' demographic details
- (b) experts' advice related to the description of the scale
- (c) experts' advice related to the instructions part of the scale
- (d) experts' advice related to the individual domains of the scale
- (e) experts' advice related to the overall intelligibility of the scale.

All sections except (a) consisted of polar questions with a suggestion box. In Part-I, the Google form link for pre-final H-BBS was shared among 6 experts with clinical experience of 2 to 5 years resulted in the modified pre-final H-BBS. In Part-II, the Google form link for modified pre-final H-BBS was shared among 12 experts with clinical experience ≥ 7 years. Part-II was conducted due to the failure of getting responses < 80% (as already decided) in the 4th and 6th domains of the scale (66.7% in part-I) which raised the requirements to make the amendments. These amendments were made by considering experts' suggestions and obtained first modified pre-final H-BBS. In part-II, all the responses were > 80% and eventuated the validated H-BBS.

2.3.4 Phase-IV

Pilot study was conducted by recruiting 122 patients (80 males and 42 females) to check the adaptability of the validated H-BBS. Deliberately, a questionnaire was formed (questions of each domain with grades "1" and "0"- if they are able to understand OR not, respectively). They were instructed to report about the unintelligible and incomprehensible words/phrases or sentences in dictation process.

2.3.5 Phase-V

In this phase, 234 patients (121 males and 113 females) were recruited to evaluate the psychometric properties. Three evaluators (A, B and C) were involved in the assessment procedure (i.e. grading score of the H-BBS). Evaluator A assessed the score on adapted H-BBS (two times within 24 hour difference), while on MiniBESTest Scale and TUG test on second day (one time). Evaluator B assessed the score on adapted H-BBS on the same day (as Evaluator A had assessed) but at a different time interval. Evaluator C assessed the same on the third day. They were strictly instructed not to discuss the scoring of any patients. The primary outcome measure was H-BBS, while the secondary outcome measures were O-BBS, MiniBESTest Scale and TUG test.

2.4 Statistical Analysis

The data was analysed with SPSS (2020) program. The Content Validity Index for Individual (CVI – I) was calculated by dividing no. of agreements for each question with total no. of experts while, the content validity index for Total (CVI – T) was calculated by dividing no. of agreements for all the questions with total no. of experts in Part-II²⁵. The adaptability was calculated by dividing the no. of positive responses with total no. of patients where values > 80% of the responses for each domain were considered²¹. The inter-rater reliability was calculated by kappa coefficient (k) where values < 0.40, 0.41 to 0.75

and ≥ 0.75 signified poor, adequate and extremely good inter-evaluator reliability, respectively^{10,26,27}. The intra-rater reliability was evaluated by the Intra-class correlation coefficient (ICC) where values ≤ 0.59 , 0.60 to 0.79 and ≥ 0.80 indicated poor, adequate and extremely good intra-evaluator reliability, respectively^{10,27}. The internal consistency was calculated by the Cronbach's alpha (α) where values < 0.69, 0.70 to 0.80 and ≥ 0.80 indicated poor, good and extremely good internal consistency, respectively²⁸. Both (Intra-evaluator reliability and internal consistency) were evaluated by applying a Two-way mixed model with single measures^{10,26,27}. The criterion validity was calculated by the Spearman's correlation coefficient where values $\leq \pm 0.25$, ± 0.26 to ± 0.50 , ± 0.51 to ± 0.70 , ± 0.71 to ± 0.90 and ± 0.91 to ± 1 interpreted very weak, weak, adequate, strong and very strong positive/negative association, respectively²⁹. The inter-term correlation matrix between each domain and the computed score of the H-BBS was calculated by Spearman's correlation coefficient where values ≥ 0.4 were considered²⁶. Responsiveness of the H-BBS was measured as the ratio of the mean differences of the computed scores to the standard deviation among fallers and non-fallers where values 0.20 to 0.49, 0.50 to 0.79 and > 0.80 interpreted minimum, adequate and maximum effect size, respectively. Top and bottom scores of the scales represented the floor and ceiling effects where values < 15% were regarded as satisfactory^{26,28}.

3. Results

Table 1. Modifications required during each phase of the study to obtain the final adapted H-BBS

Translation Procedure	Words/Phrases that needed attention/modification (in respective section)	Final Wording (in respective section)
Sub-phase I	"(a) Standard deviation (Table) (b) Confidential interval (Table) (c) Pivot transfer (in 5th domain)"	"(a) मानक वचिलन (Table) (b) आत्मवशिवास का अंतराल (Table) (c) स्थानांतरण (in 5th domain)"
Sub-phase II	(a) मानक वचिलन (Table)	(a) माध्य वचिलन (Table)
Sub-phase III	"(a) माध्य वचिलन (Table) (b) सुग्राहता (in the description section of the scale) (c) विशिष्टता (in the description section of the scale) (d) सूत्री कर्मकि (in the description section of the scale)"	"(a) Standard deviation (Table) (b) Sensitivity (in the description section of the scale) (c) Specificity (in the description section of the scale) (d) Numeric Rating scale or (in the description section of the scale)"
Sub-phase IV	(a) Rating scale (in description section of the scale)	(a) An ordinal scale (in the description section of the scale)
Sub-phase V	No modifications	—
Content Validity Phase - I	"(a) उतरान (in the 4th domain) (b) खड़े होने में सकषम है। (in the 6th domain)"	"(a) संतुलन (in the 4th domain) (b) खड़े रहने में सकषम है। (in the 6th domain)"
Content Validity Phase - II	"(a) बना सहारे के खड़े होने की स्थिति सटप या सटूल परअदल बदल कर पैर रखे। (in the 12th domain) (b) अवस्थिति की चौड़ाई (in the 13th domain)"	"(a) बना सहारे के खड़े होने की स्थिति में सटप या सटूल परअदल बदल कर पैर रखे। (in the 12th domain) (b) पैर के रुख की चौड़ाई (in the 13th domain)"
Pilot study testing	All words were cleared and comprehensive	No more modifications required
Psychometric Evaluation of the H-BBS	—	—

Source: the authors (2023).

Abbreviations: (A) H-BBS – Hindi version of the Berg Balance Scale.

3.1 Content validity and adaptability

The (CVI-I) and (CVI-T) ranging from 0.92 to 1 and 0.984 indicated excellent content Validity of the scale. The adaptability of the scale was checked by the intelligibility test of each domain and overall scale ranging from 91 to 100% indicated excellent adaptability **shown in Table 2.**

Table 2. Total percentage of the responses given by patients included in pilot study for the content validity and adaptability of each domain and overall H-BBS

S No.	Domains of the H - BBS	Positive responses (n=12)	Negative responses (n=12)	Total
1.	बैठने की स्थितिसे खड़े होना। (Sitting to standing)	12	0	100%
2.	बना सहारे के खड़े होना। (Standing unsupported)	12	0	100%
3.	बना सहारे के बैठे रहना लेकिन पैर फर्श या स्टूल पर टक़े हों। (Sitting with back unsupported but feet supported on the floor or on a stool)	12	0	100%
4.	खड़े होने की स्थितिसे बैठना। (Standing to sitting)	12	0	100%
5.	स्थानांतरण। (Transfers)	11	1	91%
6.	बना सहारे के आँखें बंद करके खड़े रहना। (Standing unsupported with eyes closed)	12	0	100%
7.	बना सहारे के पैरों को साथ जोड़कर खड़े रहना। (Standing unsupported with feet together)	11	0	91%
8.	खड़े रहते हुए भुजाएँ आगे की ओर फैलाना। (Reaching forward with outstretched arm while standing)	12	0	100%
9.	खड़े होकर फर्श से कोई वस्तु उठाना। (Picking up object from the floor from a standing position)	12	0	100%
10.	खड़े रहकर बाएँ और दाएँ कंधे के ऊपर से पीछे देखना। (Turning to look behind over left and right shoulders while standing)	11	1	91%
11.	360 डिग्री पर मुड़ना। (Turn 360 degrees)	12	0	100%
12.	बना सहारे के खड़े रहते हुए स्टेप या स्टूल पर बारी-बारी से पैर रखना। (Placing alternate foot on a step or stool while standing unsupported)	11	1	91%
13.	बना सहारे के खड़े रहते हुए एक पैर को दूसरे के आगे रखना। (Standing unsupported with one foot in front)	11	1	91%
14.	एक पैर पर खड़े रहना। (Standing on one leg)	12	0	100%

Source: the authors (2023).

Abbreviations: (A) H-BBS – Hindi version of the Berg Balance Scale.

The demographic characteristics details of the sample including no. of falls among them were **expressed in Table 3.**

Table 3. Demographic characteristics of the sample of the population

Characteristics	Number (%)	Mean $\pm$ SD
Age (in years)	234	54.7 $\pm$ 10.5
40 – 50	92 (39.1%)	-
50 – 60	61 (26.1%)	-
60 – 70	81 (34.8%)	-
Gender		
Male	121 (51.7 %)	-
Female	113 (48.2 %)	-
Other measures		
Weight (in kgs)	-	71.69 $\pm$ 8.78
Height (in meters)	-	1.67 $\pm$ 0.073
BMI (kg/m ²)	-	25.77 $\pm$ 1.88
Falls (over last year)		
0 = No fall at all	163 (69.6%)	-
1 = 1 fall over last year	71 (30.4%)	-
≥ 1 = More than 1 Fall)	0 (0 %)	-
Other scales		
MMSE	-	22.09 $\pm$ 3.97
Tinetti Balance Score	-	11.83 $\pm$ 1.74

Source: the authors (2023).
Abbreviations: (A) BMI – Body Mass Inde.

3.2 Inter-rater reliability, Intra-rater reliability and internal consistency

All the calculations related to the inter-evaluator reliability i.e. kappa values for each domain and the computed score of the scale ranging from 0.76 to 1 and > 0.70 , respectively; the intra-evaluator reliability i.e. ICC values for the same ranging from 0.84 to 1 and > 0.90 , respectively; and the internal consistency i.e. Cronbach's alpha values for the same ranging from 0.90 to 1 and > 0.90 , respectively were **expressed in Table 4**. The total internal consistency of the H-BBS was **extremely good i.e. 0.913**. The scattered plots of the inter-evaluator and intra-evaluator reliability were **depicted in Figure 2**.

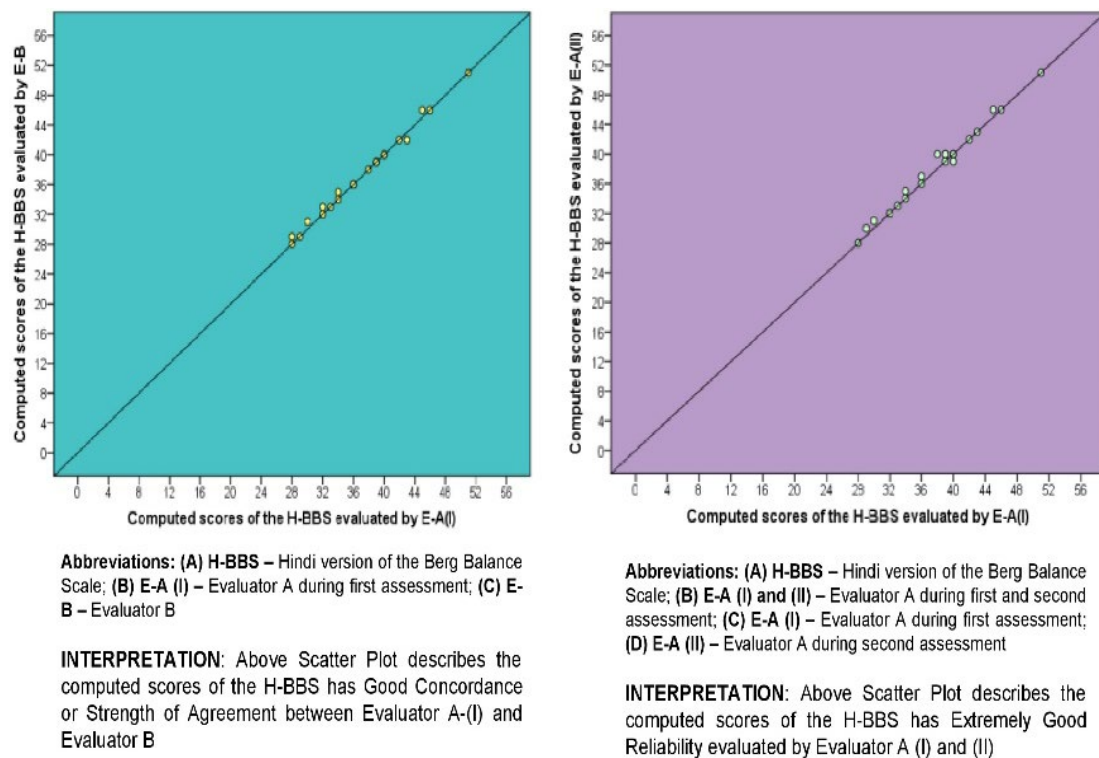
Table 4. Intra-evaluator reliability, internal consistency and inter-evaluator reliability of the H-BBS

S No.	Domains of the H-BBS	ICC	Cronbach's alpha	Intra-evaluator reliability and internal consistency	Kappa value (K-score)	Inter-evaluator reliability
1.	बैठने की स्थिति से खड़े होना। (Sitting to standing)	1	1	Extremely Good Reliability and internal consistency	1	Extremely Good Concordance
2.	बना सहारे के खड़े होना। (Standing unsupported)	0.848	0.917	Extremely Good Reliability and internal consistency	0.76	Extremely Good Concordance
3.	बना सहारे के बैठे रहना लेकिन पैर फर्श या सटूल पर टकें हों। (Sitting with back unsupported but feet supported on the floor or on a stool)	0.867	0.929	Extremely Good Reliability and internal consistency	1	Extremely Good Concordance
4.	खड़े होने की स्थिति से बैठना। (Standing to sitting)	0.897	0.946	Extremely Good Reliability and internal consistency	1	Extremely Good Concordance
5.	स्थानांतरण। (Transfers)	0.874	0.933	Extremely Good Reliability and internal consistency	0.901	Extremely Good Concordance
6.	बना सहारे के आँखें बंद करके खड़े रहना। (Standing unsupported with eyes closed)	1	1	Extremely Good Reliability and internal consistency	0.924	Extremely Good Concordance
7.	बना सहारे के पैरों को साथ जोड़कर खड़े रहना। (Standing unsupported with feet together)	0.915	0.955	Extremely Good Reliability and internal consistency	1	Extremely Good Concordance
8.	खड़े रहते हुए भुजाएँ आगे की ओर फैलाना। (Reaching forward with outstretched arm while standing)	1	1	Extremely Good Reliability and internal consistency	0.919	Extremely Good Concordance
9.	खड़े होकर फर्श से कोई वस्तु उठाना। (Picking up object from the floor from a standing position)	0.971	0.985	Extremely Good Reliability and internal consistency	0.936	Extremely Good Concordance
10.	खड़े रहकर बाएँ और दाएँ कंधे के ऊपर से पीछे देखना। (Turning to look behind over left and right shoulders while standing)	1	1	Extremely Good Reliability and internal consistency	0.929	Extremely Good Concordance
11.	360 डिग्री पर मुड़ना। (Turn 360 degrees)	0.951	0.975	Extremely Good Reliability and internal consistency	1	Extremely Good Concordance
12.	बना सहारे के खड़े रहते हुए सटेप या सटूल पर बारी-बारी से पैर रखना। (Placing alternate foot on a step or stool while standing unsupported)	1	1	Extremely Good Reliability and internal consistency	1	Extremely Good Concordance
13.	बना सहारे के खड़े रहते हुए एक पैर को दूसरे के आगे रखना। (Standing unsupported with one foot in front)	1	1	Extremely Good Reliability and internal consistency	0.918	Extremely Good Concordance
14.	एक पैर पर खड़े रहना। (Standing on one leg)	1	1	Extremely Good Reliability and internal consistency	0.929	Extremely Good Concordance
कुल स्कोर (Total score)		0.994	0.997	Extremely Good Reliability and internal consistency	0.719	Good Concordance

Source: the authors (2023).

Abbreviations: (A) H-BBS – Hindi version of the Berg Balance Scale.

Figure 2. Inter-rater reliability and Intra-rater reliability of the H-BBS



Source: the authors (2023).

3.3 Criterion validity with other balance measures

To find out if the H-BBS could measure balance at a lower, equal, or higher level than other tests like the O-BBS, MiniBESTest, and TUG test, the author looked at test validity. They assessed the criterion validity of a measure by contrasting it with a concurrently measured external standard. The H-BBS meets the criteria for validity compared to the O-BBS, MiniBESTest, and TUG test, with Spearman's correlation coefficient (r) values of 0.993, 0.894, and -0.946, in that order. **The values in Table 5** indicated a strong correlation in criteria validity between the H-BBS and the O-BBS, MiniBESTest, and TUG test. The negative number revealed that H-BBS is inversely proportional to the TUG test, suggesting contrary conclusions. For example, if patients take longer to cover an 8-meter distance, their H-BBS score will be lower, and vice versa. Conversely, the positive numbers showed that the H-BBS value is directly proportional to the TUG test results, which also demonstrated the same outcomes. A patient would have the lowest H-BBS score, for instance, if they received the lowest scores on the MiniBESTest and O-BBS. The scatter plots of criterion validity for the chosen balance test are **shown in Figure 3**. They show that there were strong correlations between H-BBS scores and O-BBS, MiniBESTest, and TUG tests, but these correlations were different for each older adult. A significant drawback of this method is that both tests may display measurement errors, complicating the assessment of the reliability of any test.

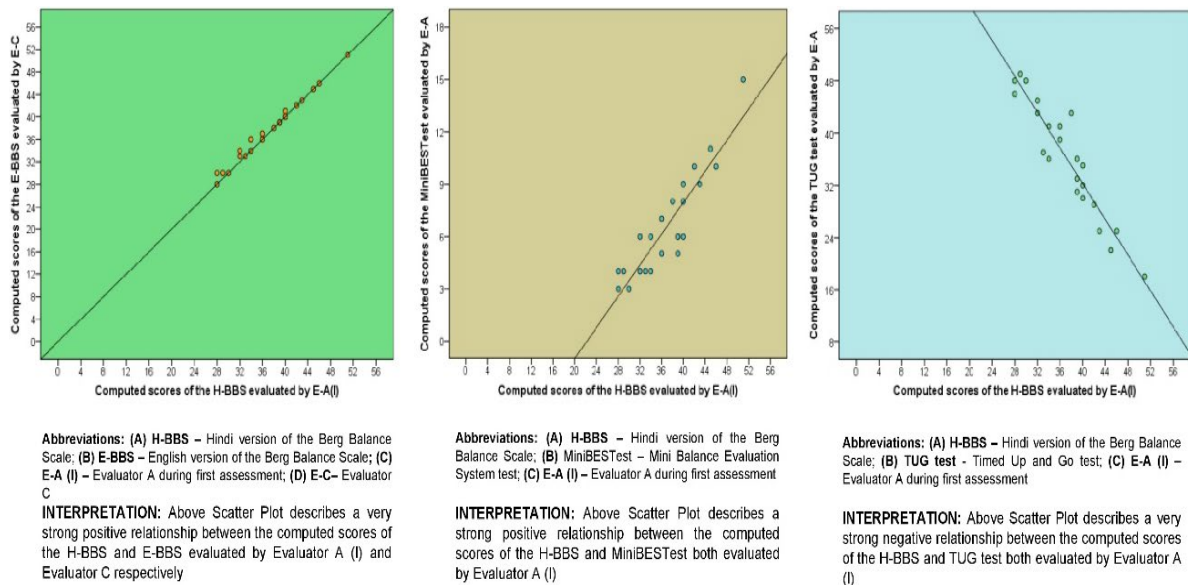
Table 5. Criterion Validity of the H-BBS evaluated with the other balance measures by E-A (I)

S No.	Other balance measures	Spearman's correlation coefficient (r)	Interpretation
1.	E-BBS	0.993	Very Strong Association
2.	MiniBESTest	0.894	Strong Association
3.	TUG	-0.946	Very Strong Association

Source: the authors (2023).

Abbreviations: (A) H-BBS – Hindi version of the Berg Balance Scale; (B) E-A (I) – Evaluator A during first assessment;
(C) TUG – Timed Up and Go test; (D) MiniBESTest – Mini Balance Evaluation System test.

Figure 3. Criterion validity of the H-BBS with (a) E-BBS (b) MiniBESTest (c) TUG test



Source: the authors (2023).

3.4 Correlation matrix

The inter-term correlation matrix relationship among all the domains with each other and the computed score of the scale were **shown in Table 6**. A correlation matrix is a tabular representation of the correlation coefficients among various variables. Each column in the matrix indicates the correlation between the following two factors, spanning from -1 to 1. Where 1 represents a perfect positive correlation, which means that as one variable increases, so does the other. The symbol -1 represents a perfect negative correlation, meaning that as one variable increases, the other variable decreases. No correlation is indicated by a value of 0, meaning that changes in one variable do not predict changes in the other.

Table 6. Correlation coefficient Matrix i.e. Inter-item relationship or degree of correlation among all the domains and the computed score of the H-BBS evaluated by the E-A (I)

DOMAINS OF SCALE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL
1.	1														
2.	0.53	1													
3.	0.41	0.64	1												
4.	0.19	0.02	0.31	1											
5.	0.48	0.39	0.15	0.25	1										
6.	0.39	0.21	0.26	-0.06	0.39	1									
7.	0.55	0.34	0.21	0.20	0.44	0.22	1								
8.	0.29	0.39	0.18	0	0.54	0.34	0.45	1							
9.	0.44	0.60	0.48	0.14	0.48	0.43	0.44	0.38	1						
10.	0.45	0.30	0.16	0.25	0.64	0.43	0.60	0.55	0.60	1					
11.	0.38	0.45	0.41	0.16	0.54	0.53	0.53	0.52	0.54	0.59	1				
12.	0.55	0.62	-0.48	0.04	0.41	0.32	0.60	0.59	0.74	0.58	0.67	1			
13.	0.58	0.47	0.08	-0.09	0.37	0.45	0.56	0.50	0.41	0.35	0.41	0.60	1		
14.	0.44	0.56	0.31	0.04	0.64	0.54	0.56	0.71	0.71	0.64	0.68	0.79	0.55	1	
TOTAL	0.64	0.71	0.53	0.19	0.72	0.55	0.65	0.67	0.81	0.78	0.76	0.84	0.63	0.87	1

Source: the authors (2023).

Abbreviations: (A) H-BBS – Hindi version of the Berg Balance Scale; (B) E-A (I) – Evaluator A during first assessment.

3.5 Floor and ceiling effects and responsiveness of the scale

A floor effect unfolds when a substantial proportion of patients attain scores on H-BBS at or near the minimum attainable value on an assessment. This can make it difficult to notice changes or variances since the measurement is not sufficiently sensitive to detect fluctuations in performance or ability. For instance, if a test is excessively straightforward, numerous patients may achieve the minimum score, which complicates the identification of those who possess inferior capability levels. A ceiling effect occurs when a significant proportion of patients achieve scores at or near the maximum attainable score. This circumstance can likewise conceal distinctions among patients with intact balance, as the metric does not encompass their complete spectrum of capabilities. If a test is excessively challenging and the majority of patients achieve the highest score, it becomes difficult to discern those who beyond that threshold. The Floor and Ceiling effects of the outcome measures are 0% indicating that the scale can detect minimum alteration in balance and did not restrict its sensitivity. Higher responsiveness of the scale was showed among fallers and non-fallers group as an effect size was 0.94.

4. Discussion

The BBS is a widely accepted clinical tool to quantify the balance in various neurological disorders. However, existing literature assigning its reliability and validity in individual condition. But the present study includes patients with different neurological conditions (a noteworthy point that make it different from the existing researches), 6 translators (3 males and 3 females), 2 blinded-physiotherapists and 3 evaluators, 18 experts (13 males and 5 females). The patients in the psychometric phase were with the diagnosis of Migraine (1), Traumatic Brain Injury (3), Lumbar Canal Stenosis (4), Intracranial Haemorrhage (5) and Diabetic Neuropathy (10). The difficulties encountered by the translators and amendments required to be made in each phase are already **discussed in Table 1.**

The difficulties in translating the phrase "Pivot transfer" is evident in the existing researches i.e. the Brazilian and Turkish versions of BBS as the respective translators found difficulties in the same^{20,30}. In the Turkish version of BBS, the phrase "Pivot transfer" was translated in the Turkish language as meaning "to be transferred" resembled with the word "स्थानांतरण" conveying same meaning in the Hindi language³⁰. Moreover, the word did not clear the positioning of the chairs because they could be placed in two ways (either in front or perpendicular to each other). Another discrepancy in the sentence i.e. "खड़े होने में सक्षम है" was not conveying the correct information regarding the task assessed in the O-BBS. The same sentence in O-BBS quantifies one's ability to hold a standing position with eye closed. But in H-BBS, this sentence was conveying the information related to ability of standing with eyes closed instead of providing the holding time for the same. In the context, the sentence "खड़े होने में सक्षम है" was replaced by the sentence "खड़े रहने में सक्षम है". An expert had drawn attention to add the conjunction "में" to the phrase "बना सहारे के खड़े होने की स्थिति सटप या सटूल पर अदल बदल कर पैर रखें" to formulate the proper sentence i.e. "बना सहारे के खड़े होने की स्थिति में सटप या सटूल पर अदल बदल कर पैर रखें." Furthermore, in the previous literature, the required amendments were made by face-to-face interactions and panel method that could be the fact for unavailability of the supporting results for content validity.

The Brazilian version of the BBS used the consensus method to check the adaptability of the translated content²⁰. The frequency distributions of scorings among all the evaluators showed minor differences (Supplementary material B). The percentages of grades 0,1,2,3 and 4 evaluated by the Evaluator A (during first assessment) were 0.62%, 6.83%, 36.75% 38.50% and 17.39%, and (during second assessment) were 0.62%, 6.83%, 36.02% 37.26% and 19.25%, Evaluator B were 0.62%, 6.83%, 35.71% 39.13% and 17.70% and Evaluator C were 0.62%, 6.21%, 36.34% 37.89% and 18.94%, respectively. A total of 1288 times of scorings {(23 patients into 14 domains = 322 for each evaluator) into 4 assessments} were noted by all the evaluators. The differences in the grading occurred on 14, 17 and 16 occasions by Evaluator A (during the second assessment), Evaluator B and Evaluator C, respectively. The total frequency distribution for grade 0 and 1 were same among Evaluator A and Evaluator B (i.e. 2 and 22) but different for Evaluator C (i.e. 2 and 20). In contrast, grade 2, 3 and 4 were showing variations for the same ranging from 115-118, 122-124 and 52-61 scorings, respectively. These distributions highlighted the interesting fact that the patients were not aware of the tasks earlier but as the same assessments were taken repeatedly, it hastens them to memorise the tasks and improve their grades in proceeding assessments.

In the H-BBS, 73% of the patients scored grade 3 in 1st and 4th domains while 56% and 82% of the patients scored grade 4 in 2nd and 3rd domains, respectively indicating easier tasks for them. Respective findings were consistent with results of the Japanese, Persian and Norwegian versions of BBS^{21,23,31}. Additionally, it was exposed that the evaluators were failed to discriminate whether the patients were making definite use of hands (3) or minor use of hands (4) for standing in 1st domain. The percentage of patients scored grade 3 in the 5th domain was 60% unsupported by Norwegian, Japanese, Iranian, and Persian versions of the BBS and supported by only the Italian version BBS^{7,21,23,28,29,31,32}. These contradictory results pointing to the fact that the evaluators were confused to differentiate whether the patients were making definite use of hands (3) or minor use of hands (4) for transferring activity.

The 86% and 95% of the patients scored grade 2 and 3 in 6th and 7th domains, respectively in all assessments indicating that these tasks were consisted of sensory-motor assessment which could not be improvised by memorising only. Furthermore, the higher percentage of patients scored grade 2 in 8th domain indicated their difficulties in performing relative tasks whereas 73% of the patients scored grade 2 and 3 in 9th domain exposed their ability of bending forward with control descent. While 60% of the patients scored grade 3 in 10th domain indicated that a static domain associated with less fear of fall. The higher percentage of patients scored grade 2 in 11th, 12th, 13th and 14th domains consisting the findings of the Iranian and Italian versions of BBS revealed their difficulties in maintaining balance required for the respective tasks^{29,31,32}.

The Inter-evaluator reliability of the individual domain and computed score of the H-BBS was consistent with the calculations of kappa values in Iranian, Persian, Norwegian, and Arabic (ranging from 0.70 to 0.99) versions of the BBS^{23,24,28,29,31,33}. But in this study, the values were above 0.90 for all the domains except 2nd domain (0.76) justified that this domain experienced variations among frequency distributions between grade 3 and 4 because of the difference in the intellectual understanding of the evaluators as they were unable to discriminate whether the patients require supervision or not for safe standing. The Intra-evaluator reliability of the individual domain and computed score of the H-BBS was consistent with the ICC values for the same in Spanish, Arabic, Persian, Korean, Brazil, Japanese, Greek, Italian, Iranian, Arabic, and Turkish versions of the BBS (ranging from 0.70 to 0.99)^{7,19,20-22,24,28-32,34}. The Internal consistency for the same and total internal consistency among all the domains and computed score calculated by Cronbach's alpha value were further supported by the Japanese (ranging from 0.94 to 0.96), Arabic, Persian, Greek Italian and Iranian versions of BBS^{19,21,24,28,29,31,32}.

None of the previous studies had assessed the Criterion Validity of the O-BBS using the translated version of the BBS. The criterion validity of the calculated H-BBS score with the MiniBESTest and the TUG test was highly consistent with the findings reported in the French, Persian, and Greek versions

of the BBS (Spearman's correlation values ranging from -0.70 to -0.85)¹⁹. The item correlation matrix showed that the calculated total score of the scale was highly correlated with each H-BBS domain, except for the 3rd domain (lowest acceptance value). Approximately 90% of the patients scored 4, which accounted for the lack of variation in that domain, a finding consistent with the results reported in the Persian and Norwegian versions of the BBS^{23,28}.

The Floor and Ceiling effects related to all outcome measures were 0% supported with the results of the Persian and the Greek versions of BBS^{19,28}. Besides the findings of approximately 15 translated versions of BBS and other balance measures like Functional reach test (FRT) and Fall Efficacy scale showed compatibility with other measurements like the Unified Parkinson Disease Rating (motor components) and Hoehn and Yahr scale (negative correlation) and ADLs scale (positive correlation) in available researches.

4.1 Limitations and future recommendations

This research study has excellent findings but not without limitations. A small sample size in the study lead to the limited variations among the scorings and homogeneity on various occasions. Consequently, a large sample size is needed to estimate the extent of responsiveness after incorporating different intervention protocols in different conditions. As the H-BBS is an adaptive tool, it can be recommended for further evaluation to establish it as a self-evaluation tool.

5. Conclusion

In a nut shell, the H-BBS is a highly reliable, valid and adaptable tool with a vast property to differentiate among fallers and non-fallers. It could be used in different clinical setups among the Indian population with different neurological conditions.

Data availability statement

The data that support the findings of this research are openly available in Mendeley Data. <https://doi.org/10.17632/cd963486mw.1>

Authors' contributions

The authors declared that they have made substantial contributions to the work in terms of the conception or design of the research; the acquisition, analysis or interpretation of data for the work; and the writing or critical review for relevant intellectual content. All authors approved the final version to be published and agreed to take public responsibility for all aspects of the study.

Competing interests

No financial, legal, or political conflicts involving third parties (government, private companies, and foundations, etc.) were declared for any aspect of the submitted work (including but not limited to grants and funding, advisory board participation, study design, manuscript preparation, statistical analysis, etc.).

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Appendices and attachment

Appendix A. Hindi version of Berg Balance Scale

बर्ग संतुलन पैमाना (ब. सं. पै)

विवरण

14-आइटम के पैमाने को चिकित्सीय व्यवस्था में वृद्ध वयस्कों के संतुलन को मापने के लिए डिज़ाइन किया गया है।

आवश्यक उपकरण

- यारडस्टिक।
- 2 मानक कूरसियाँ (एक हथुथे के साथ और एक हथुथे के बिना)
- फुटस्टूल / चरण-पीठ / पाँव रखने की चौकी या स्टेप
- तपिआई / चौकी
- स्टॉपवॉच / वरिम घड़ी या कलाई घड़ी
- 15 फीट का पैदल मार्ग

समंकन

एक पाँच सूत्री क्रमिक पैमाने पर, 0-4 तक, 0 सबसे कम फंक्शन और 4 उच्चतम फंक्शन को इंगित करता है। सबसे कम प्रदर्शन को स्कोर करें।

कुल अंक = 56

व्याख्या

- 41-56 = चलने के लिए स्वतंत्र है।
- 21-40 = सहायता के साथ चलने की जरूरत है।
- 0-20 = वहीलचेयर बाध्य है।

कट ऑफ स्कोर

- < 45 अंक इंगित करता है कि वयस्कों को गरिने का अधिक जोखिम हो सकता है।
- गरिने का इतिहास है और ब.सं.पै अंक < 51 है, या गरिने का कोई इतिहास नहीं है और ब.सं.पै अंक < 42 है तो यह गरिने का भविष्य सूचक है। (91% संवेदनशीलता, 82% विशिष्टता)
- ब.सं.पै अंक < 40 है, लगभग 100% गरिवट के जोखिम से जुड़ा है।

टपिपणियाँ

उच्च स्तर के रोगियों के साथ संभावित उच्चतम सीमा प्रभाव। पैमाने में चाल की इकाईयां शामिल नहीं हैं।

न्यूनतम पता लगाने योग्य परिवर्तन

- 45-56 के भीतर अंक: 4 अंकों के परिवर्तन की आवश्यकता
- 35-44 के भीतर अंक: 5 अंकों के परिवर्तन की आवश्यकता
- 25-34 के भीतर अंक: 7 अंकों के परिवर्तन की आवश्यकता
- 0-24 के भीतर अंक: 5 अंकों के परिवर्तन की आवश्यकता

उम्र	समूह	n	माध्य	माध्य वचिलन	वशिवास्यता का अंतराल
60-69	पुरुष	1	51.0		35.3 - 66.7
	महिला	5	54.6	0.5	47.6 - 61.6
	समस्त	6	54.0	1.5	52.4 - 55.6
70-79	पुरुष	9	53.6	1.5	48.7 - 59.1
	महिला	10	51.6	2.6	46.6 - 56.6
	समस्त	19	52.7	2.4	51.5 - 53.8
80-89	पुरुष	10	41.8	12.2	36.8 - 46.8
	महिला	24	42.1	8.0	38.9 - 45.3
	उपकरण नहीं	24	46.3	4.2	44.1 - 48.5
	उपकरण	10	31.7	10.0	28.3 - 35.1
	समस्त	34	42.0	9.2	38.8 - 45.3
90-101	पुरुष	2	40.0	1.4	28.9 - 51.1
	महिला	15	36.9	9.7	32.8 - 40.9
	उपकरण नहीं	10	45	4.2	40.9 - 49.1
	उपकरण	7	31.8	7.6	28.4 - 35.2
	समस्त	17	37.2	9.1	32.5 - 41.9

रोगी विवरण

नाम:

तारीख:

स्थान:

मूल्यांकनकर्ता:

बर्ग बैलेस पैमाना

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13. बिना सहारे के खड़े होने की स्थिति में एक पैर सामने की ओर रखें
14. एक टांग पर खड़े होना

कुल अंक =

सामान्य निर्देश

- कृपया प्रत्येक कार्य को दस्तावेज करें और/या लिखित रूप में निर्देश दें।
- समकन करते समय, न्यूनतम प्रतिक्रिया की श्रेणी दर्ज करें।
- अधिकांश आइटम में, व्यक्ति को दिए गए समय के लिए स्थिति बनाए रखने के लिए कहा जाता है।
- समय या दूरी की आवश्यकताओं को पूरा नहीं करने पर अंक घटाएं।
- व्यक्ति निरीक्षण की आवश्यकता होने पर या बाहरी सहायता लेने पर अंक घटाएं।
- व्यक्ति को कार्य करते समय संतुलन बनाए रखना चाहिए।
- किस टांग पर खड़े होना या कतिनी दूर पहुंचना, व्यक्ति के वकिल पर छोड़ दें।
- खराब निर्णय और प्रदर्शन समकन पर नकारात्मक प्रभाव डालेंगे।
- परीक्षण के लिए आवश्यक उपकरण: स्टॉपवॉच/घड़ी, पैमाना या संकेतक 2, 5 और 10 इंच।
- कुरसियाँ उचित ऊँचाई की हों।
- इकाई 12 के लिए स्टैप या औसत ऊँचाई का स्टूल इस्तेमाल किया जा सकता है।

बर्ग बैलेंस पैमाना

1. बैठने की स्थिति से खड़े होना।

निर्देश: कृपया खड़े हो जाओ। सहारे के लिए अपने हाथ का उपयोग न करने का प्रयास करें।

- (4) हाथों का उपयोग किए बिना खड़े होने और स्वतंत्र रूप से स्थिर रहने में सक्षम है।
- (3) हाथों का उपयोग करके स्वतंत्र रूप से खड़े होने में सक्षम है।
- (2) कई कोशिशों के बाद हाथों का उपयोग करके खड़े होने में सक्षम है।
- (1) खड़े होने या स्थिर रहने के लिए न्यूनतम सहायता की आवश्यकता है।
- (0) खड़े होने के लिए मध्यम या अधिकतम सहायता की आवश्यकता है।

2. बिना सहारे के खड़े होना।

निर्देश: कृपया दो मिनट तक बिना पकड़े खड़े होने की स्थिति में बने रहें।

- (4) 2 मिनट के तक सुरुक्षति रूप से खड़े रहने में सक्षम है।
- (3) 2 मिनट तक निरीक्षण के साथ खड़े रहने में सक्षम है।
- (2) 30 सेकंड तक बिना सहारे के खड़े रहने में सक्षम है।
- (1) 30 सेकंड तक बिना सहारे खड़े होने के लिए कई कोशिशों की आवश्यकता है।
- (0) 30 सेकंड तक बिना सहारे खड़े रहने में असक्षम है।

3. बिना सहारे के बैठे।

निर्देश: कृपया 2 मिनट तक बाजू मोड़ कर बैठें।

- (4) 2 मिनट तक स्थिर और सुरुक्षति रूप से बैठने में सक्षम है।
- (3) 2 मिनट तक निरीक्षण के साथ बैठने में सक्षम है।
- (2) 30 सेकंड तक बैठने में सक्षम है।
- (1) 10 सेकंड तक बैठने में सक्षम है।
- (0) 10 सेकंड तक बिना सहारे के बैठने में असक्षम है।

4. खड़े होने की स्थिति से बैठना।

निर्देश: कृपया बैठ जाएं।

- (4) हाथों के न्यूनतम उपयोग के साथ सुरुक्षति रूप से बैठने में सक्षम है।
- (3) संतुलन को नियंत्रित करने के लिए हाथों के उपयोग की आवश्यकता है।
- (2) संतुलन को नियंत्रित करने के लिए टांगों के पछिले हिस्से को कुरसी के सहारे उपयोग करता है।
- (1) स्वतंत्र रूप से बैठने में सक्षम है, लेकिन संतुलन अनियंत्रित है।
- (0) बैठने के लिए सहायता की आवश्यकता है।

5. स्थानांतरण।

निर्देश: धुरी अंतरण (स्थानांतरण) के लिए कुरसी अथवा कुरसियों की व्यवस्था करें। व्यक्ति को कहे एक तरफ वह हतथे वाली सीट की ओर स्थानांतरण करें और एक तरफ बिना हतथे वाली सीट की ओर स्थानांतरण करें।

- (4) हाथों के न्यूनतम उपयोग के साथ सुरुक्षति रूप से स्थानांतरित करने में सक्षम है।
- (3) हाथों का निश्चित उपयोग के साथ स्थानांतरित करने में सक्षम है।
- (2) मौखिक संकेत या निरीक्षण के साथ स्थानांतरित करने में सक्षम है।
- (1) स्थानांतरित करने के लिए 1 व्यक्ति की सहायता की आवश्यकता है।
- (0) स्थानांतरण करते समय सुरुक्षति रहने के लिए निरीक्षण के साथ 2 व्यक्तियों की सहायता या निरीक्षण की आवश्यकता है।

6. बिना सहारे के आँख बंद करके खड़े होना।

निर्देश: कृपया अपनी आँखें बंद करें और 10 सेकंड तक स्थिर खड़े रहें।

- (4) 10 सेकंड तक सुरुक्षति रूप से खड़े रहने में सक्षम है।
- (3) 10 सेकंड तक निरीक्षण के साथ खड़े रहने में सक्षम है।
- (2) 3 सेकंड तक रहने में सक्षम है।
- (1) 3 सेकंड तक आँखें बंद रखने में असक्षम लेकिन सुरुक्षति खड़े रहने में सक्षम है।
- (0) गरिने से बचाव के लिए सहायता की आवश्यकता है।

7. बिना सहारे के पैरों को एक साथ जोड़ कर खड़े होना।

निर्देश: अपने पैरों को साथ जोड़ कर बिना पकड़े खड़े रहें।

- (4) पैरों को स्वतंत्र रूप से एक साथ जोड़ कर रखने में और 1 मिनट तक सुरुक्षति खड़े रहने में सक्षम है।
- (3) पैरों को स्वतंत्र रूप से एक साथ जोड़ कर रखने में और निरीक्षण के साथ 1 मिनट तक सुरुक्षति खड़े रहने में सक्षम है।
- (2) पैरों को स्वतंत्र रूप से एक साथ जोड़ कर रखने में सक्षम लेकिन 30 सेकंड तक रुकने में असक्षम है।
- (1) बिना सहारे के खड़े होने की स्थिति को प्राप्त करने में सहायता की आवश्यकता है लेकिन 15 सेकंड तक पैरों को साथ जोड़ कर खड़े होने में सक्षम है।
- (0) बिना सहारे के खड़े होने की स्थिति को प्राप्त करने में सहायता की आवश्यकता है और 15 सेकंड तक रुकने में असक्षम है।

8. खड़े होने की स्थिति में भुजाएँ फैला कर आगे की ओर आना।

निर्देश: भुजा को 90 डिग्री पर उठाएँ। अपनी उँगलियों को बाहर की तरफ खींचें और आगे की ओर लेकर जाए जहाँ तक आप पहुँच सकते हैं।

- (4) आत्मविश्वास से 25 सेमी (10 इंच) तक आगे की ओर पहुँच सकता है।
- (3) 12 सेमी (5 इंच) तक आगे की ओर आने में सक्षम है।
- (2) 5 सेमी (2 इंच) तक आगे की ओर आने में सक्षम है।
- (1) आगे की ओर आने के लिए निरीक्षण की आवश्यकता है।
- (0) आगे की ओर आने के लिए कोशिश करते समय संतुलन खो देता है या बाहरी सहारे की आवश्यकता है।

9. खड़े होने की स्थिति से फर्श पर पड़ी हुई वस्तु उठाएँ।

निर्देश: जूता/चप्पल उठाएँ, जो आपके पैरों के सामने है।

- (4) सुरुक्षति और आसानी से जूता/चप्पल उठाने में सक्षम है।
- (3) जूता/चप्पल उठाने में सक्षम है, लेकिन निरीक्षण की आवश्यकता है।
- (2) जूता/चप्पल उठाने में असक्षम लेकिन जूता/चप्पल से 2-5 सेमी (1-2 इंच) तक पहुँच जाता है और स्वतंत्र रूप से संतुलन बनाए रखने में सक्षम है।
- (1) जूता/चप्पल उठाने में असक्षम और कोशिश करते समय निरीक्षण की आवश्यकता है।
- (0) कोशिश करने में असक्षम और संतुलन खोने या गरिने से बचाने के लिए सहायता की आवश्यकता है।

10. खड़े रह कर बाएँ और दाएँ कंधे के पीछे देखने के लिए मुड़ें।

नरिदेश: बाएँ कंधे के ठीक पीछे देखने के लिए मुड़ें। दाएँ कंधे के लिए दोहराएँ।

- (4) दोनों तरफ से पीछे देखता है और वजन अच्छी तरह से स्थानांतरित करता है।
- (3) केवल एक तरफ पीछे देखता है और दूसरी तरफ वजन स्थानांतरित कम दिखाता है।
- (2) केवल बगल में मुड़ता है, लेकिन संतुलन बनाए रखता है।
- (1) मुड़ते समय नरीक्षण की आवश्यकता होती है।
- (0) संतुलन खोने या गरिने से बचाने के लिए सहायता की आवश्यकता है।

11. 360 डिग्री पर मुड़ें।

नरिदेश: एक पूरा चक्र में पूरी तरह से चारों ओर मुड़ें और रूकें। फिर दूसरी दिशा में एक पूरा चक्र में मुड़ें।

- (4) 4 सेकंड या उससे कम समय में 360 डिग्री पर सुरक्षित रूप से मुड़ने में सक्षम है।
- (3) 4 सेकंड या उससे कम समय में 360 डिग्री पर सुरक्षित रूप से एक तरफ मुड़ने में सक्षम है।
- (2) 360 डिग्री पर सुरक्षित लेकिन धीरे-धीरे मुड़ने में सक्षम है।
- (1) 360 डिग्री पर मुड़ने के लिए नरीक्षण या मौखिक संकेत की आवश्यकता है।
- (0) 360 डिग्री पर मुड़ने के लिए सहायता की आवश्यकता है।

12. बनी सहारे के खड़े होने की स्थिति में स्टैप या सटूल पर अदल बदल कर पैर रखें।

नरिदेश: स्टैप पर कर अदल बदल कर प्रत्येक पैर रखें। तब तक जारी रखें जब तक कप्रित्येक पैर चार बार स्टैप या सटूल को न छूले (कुल 8 कदम)।

- (4) स्वतंत्र और सुरक्षित रूप से खड़े होने और 20 सेकंड में 8 कदम पूरा करने में सक्षम है।
- (3) स्वतंत्र रूप से खड़े होने और > 20 सेकंड में 8 कदम पूरा करने में सक्षम है।
- (2) नरीक्षण के साथ 4 कदम बनी सहायता के पूरा करने में सक्षम है।
- (1) > 2 कदम पूरा करने के लिए न्यूनतम सहायता की आवश्यकता है।
- (0) कोशिश करने में असक्षम और गरिने से बचाव के लिए सहायता की आवश्यकता है।

13. बनी सहारे के एक पैर आगे कर के खड़े होना।

नरिदेश: (व्यक्ति को दिखाएँ) एक पैर को सीधे दूसरे पैर के सामने रखें। यदि आपको लगता है कि आप अपने पैर को सीधे सामने नहीं रख सकते हैं तो उतनी आगे तक कदम बढ़ाने की कोशिश करें ताकि आगे वाले पैर की एडी दूसरे पैर के अंगूठे के सामने हो।

- (4) स्वतंत्र रूप से पैर को एक के पीछे एक रखने और 30 सेकंड तक रूकने में सक्षम है।
- (3) स्वतंत्र रूप से पैर आगे रखने में और >30 सेकंड तक रूकने में सक्षम है।
- (2) स्वतंत्र रूप से छोटे कदम रखने में और >30 सेकंड तक रूकने में सक्षम है।
- (1) कदम बढ़ाने के लिए सहायता की आवश्यकता है लेकिन 15 सेकंड तक रूकने में सक्षम है।
- (0) कदम बढ़ाते या खड़े होते समय संतुलन खो देता है।

14. एक पैर पर खड़े होना।

नरिदेश: एक पैर पर खड़े हो जाए जब तक बनी पकड़े खड़े हो सकते हैं।

- (4) स्वतंत्र रूप से पैर उठाने में सक्षम और > 10 सेकंड तक रूक सकते हैं।
- (3) पैर को स्वतंत्र रूप से उठाने में सक्षम और > 5-10 सेकंड तक रूक सकते हैं।
- (2) पैर को स्वतंत्र रूप से उठाने में सक्षम और > 3 सेकंड तक रूक सकते हैं।
- (1) पैर को उठाने की कोशिश करता है और 3 सेकंड तक रूकने में असक्षम है लेकिन स्वतंत्र रूप से खड़े रहने में सक्षम है।
- (0) गिरावट को रोकने के लिए कोशिश करने में असक्षम और गरिने से बचाव के लिए सहायता की आवश्यकता है।

Source: the authors (2023).

Appendix B. Frequency distributions related to grading scores of each domain of the H-BBS taken by the E-A (I), E-A (II), E-B and E-C

S No.	Domains of the BBS	E-A (I)					E-A (II)					E-B					E-C					Total Grading scores taken by all the evaluators
	Grading score	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	
1.	Sit to Stand	0	0	3	17	3	0	0	3	17	3	0	0	3	17	3	0	0	3	15	5	92
2.	Standing unsupported	0	0	2	8	13	0	0	2	9	12	0	0	1	8	14	0	0	1	9	13	92
3.	Sitting unsupported	0	0	0	4	19	0	0	0	5	18	0	0	0	5	18	0	0	0	5	18	92
4.	Stand to sit	0	0	0	16	7	0	0	0	17	6	0	0	0	17	6	0	0	0	16	7	92
5.	Transfers	0	0	2	14	7	0	0	2	16	5	0	0	2	17	4	0	0	2	15	6	92
6.	Standing with eyes closed	0	2	7	13	1	0	2	7	13	1	0	1	8	13	1	0	1	8	13	1	92
7.	Standing with feet together	0	1	16	6	0	0	1	17	5	0	0	1	17	5	0	0	1	17	5	0	92
8.	Reaching forward while standing	0	4	15	4	0	0	4	15	4	0	0	4	14	5	0	0	3	16	4	0	92
9.	Retrieving object from the floor	0	1	8	8	6	0	1	8	9	5	0	1	9	8	5	0	1	8	9	5	92
10.	Turning to look behind over shoulders	0	0	8	11	4	0	0	8	11	4	0	0	7	12	4	0	0	7	12	4	92
11.	Turning 360 degree	0	0	13	8	2	0	0	14	7	2	0	0	14	7	2	0	0	13	8	2	92
12.	Placing Alternate foot on stool	0	5	14	4	0	0	5	14	4	0	0	5	14	4	0	0	5	14	4	0	92
13.	Placing one foot in front of other	0	3	15	5	0	0	3	15	5	0	0	3	14	6	0	0	3	15	5	0	92
14.	Standing on one leg	2	6	13	2	0	2	6	13	2	0	2	7	12	2	0	2	6	13	2	0	92
Total		2	22	116	120	62	2	22	118	124	56	2	22	115	126	57	2	20	117	122	61	1288

Source: the authors (2023).

Abbreviations: (A) H-BBS – Hindi version of the Berg Balance Scale; (B) E-A (I) – Evaluator A during first assessment;
(C) E-A (II) – Evaluator A during second assessment; (D) E-B – Evaluator B and (E) E-C – Evaluator C.

Interpretation: This table shows that the frequency distribution of the grading 0,1,2,3 and 4 scored by the patients in different domains of the scale where grade 3 was achieved more frequently by them in most of the tasks.

Appendix C. The Lowest and Highest score range and median scores and IQR values for each domain and the computed score for the balance performance by E-A (I) and A (II), E-B and E-C

S No.	Domains of the H-BBS	EA (I) (L – H score)	E-A (I) Score $\pm$ IQR	EA (II) (L – H score)	E-A (II) Score $\pm$ IQR	E-B (L – H score)	E-B Score $\pm$ IQR	E-C (L – H score)	E-C Score $\pm$ IQR
1.	Sit to stand	(2 – 4)	3 $\pm$ 0	(2 – 4)	3 $\pm$ 0	(2 – 4)	3 $\pm$ 0	(2 – 4)	3 $\pm$ 0
2.	Standing unsupported	(2 – 4)	4 $\pm$ 1	(2 – 4)	4 $\pm$ 1	(2 – 4)	4 $\pm$ 1	(2 – 4)	4 $\pm$ 1
3.	Sitting unsupported	(3 – 4)	4 $\pm$ 0	(3 – 4)	4 $\pm$ 0	(3 – 4)	4 $\pm$ 0	(3 – 4)	4 $\pm$ 0
4.	Stand to sit	(3 – 4)	3 $\pm$ 1	(3 – 4)	3 $\pm$ 1	(3 – 4)	3 $\pm$ 1	(3 – 4)	3 $\pm$ 1
5.	Transfers	(2 – 4)	3 $\pm$ 0	(2 – 4)	3 $\pm$ 1	(2 – 4)	3 $\pm$ 0	(2 – 4)	3 $\pm$ 1
6.	Standing with eyes closed	(1 – 4)	3 $\pm$ 1	(1 – 4)	3 $\pm$ 1	(1 – 4)	3 $\pm$ 1	(1 – 4)	3 $\pm$ 1
7.	Standing with feet together	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 1	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 0
8.	Reaching forward while standing	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 0
9.	Retrieving object from the floor	(1 – 4)	3 $\pm$ 1	(1 – 4)	3 $\pm$ 2	(1 – 4)	3 $\pm$ 1	(1 – 4)	3 $\pm$ 1
10.	Turning to look behind over shoulders	(2 – 4)	3 $\pm$ 1	(2 – 4)	3 $\pm$ 1	(2 – 4)	3 $\pm$ 1	(2 – 4)	3 $\pm$ 1
11.	Turning 360 degree	(2 – 4)	2 $\pm$ 1	(2 – 4)	2 $\pm$ 1	(2 – 4)	2 $\pm$ 1	(2 – 4)	2 $\pm$ 1
12.	Placing Alternate foot on stool	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 0
13.	Placing one foot in front of other	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 0	(1 – 3)	2 $\pm$ 1	(1 – 3)	2 $\pm$ 0
14.	Standing on one leg	(0 – 3)	2 $\pm$ 1	(0 – 3)	2 $\pm$ 1	(0 – 3)	2 $\pm$ 1	(0 – 3)	2 $\pm$ 1
Computed Score		(28 – 51)	38 $\pm$ 8	(28 – 51)	39 $\pm$ 8	(28 – 51)	38 $\pm$ 7	(28 – 51)	38 $\pm$ 8

Source: the authors (2023).

Abbreviations: (A) H-BBS – Hindi version of the Berg Balance Scale; (B) E-A (I) – Evaluator A during first assessment; (C) E-A (II) – Evaluator A during second assessment; (D) E-B – Evaluator B; (E) E-C – Evaluator C; (F) L-H – Lowest to Highest score; (G) IQR – Inter-quartile range.

Interpretation: This table shows that lowest and Highest scores of individual domain along with the median scores and IQR values for each domain and the computed score of the scale are ranging from (2 to 4 $\pm$ 0 to 2) and (38 to 39 and 7 $\pm$ 8) respectively.



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