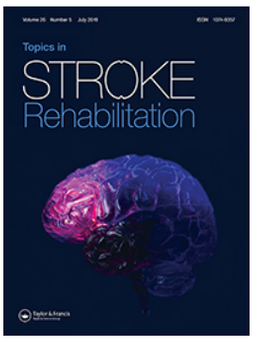

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ARTICLE

Validity and interrater/intrarater reliability of the Turkish version of the postural assessment scale for stroke patients (PASS-Turk)

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ABSTRACT

Background: There is no Turkish version of the Postural Assessment Scale for Stroke patients (PASS).

Objectives: To translate and make the cross-cultural adaptation of the PASS into the Turkish language and evaluate the reliability and validity of the Turkish version (PASS-Turk).

Methods: Sixty patients with stroke who had survived the three-week acute period were included in the study. The first researcher applied the scale to the participants twice with 5-day intervals. The second researcher applied the scale once at the same time with the first researcher. The reliability of PASS-Turk and its subsections was evaluated using Cronbach's alpha coefficient. In addition, item-total correlation and test-retest reliability were calculated. The interobserver agreement was assessed using the intraclass correlation coefficient. The construct validity of PASS-Turk was assessed using Pearson's product-moment correlation and principal component analyses. The Berg Balance Scale (BBS) and motor subscale of the Functional Independence Measure (FIM) were used for validity.

Results: The Cronbach's alpha coefficients of the PASS-Turk scale were 0.903 for the subsection of "maintaining posture," 0.940 for the subsection of "changing a posture," and 0.953 for the total PASS-Turk scale. The first and second researcher evaluations were perfectly consistent with each other in terms of PASS-Turk total scores (ICC = 0.999, 95% CI: 0.998–0.999, and $p < .001$). A strong positive correlation was found between PASS-Turk and BBS and the motor subscale of FIM.

Conclusion: PASS-Turk is a valid and reliable scale for the evaluation of posture and balance of patients with stroke.

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KEYWORDS
Cerebrovascular disorders; posture; postural balance; reproducibility of results

Introduction

Balance is the ability to control the center of gravity on the base surface within the stability limits. In the literature, balance reactions, posture, postural reactions, and postural control terms are used to define balance.[1] After a stroke, balance may be affected due to muscle weakness, abnormal muscle tone, deep sensory impairment, and vestibular mechanism impairments.[2] It is stated that among all the sensorimotor outcomes of stroke, loss of postural control has importance because of its great effect on activities of daily living and walking.[3–6] Besides, it is reported that the loss of balance and postural control after stroke causes falls, social isolation, and decreased quality of life.[7] Therefore, the evaluation of balance in patients with stroke and knowledge of factors that affect balance are important in terms of determining rehabilitation goals.[1,8,9]

Several scales have been developed to evaluate posture and balance in the field of rehabilitation.[8,10] One of these scales is the Postural Assessment Scale for Stroke patients (PASS). PASS is a posture and balance assessment scale developed for patients with stroke by Benaim et al. in 1999, adapted from the Fugl-Meyer (FM) assessment.[11] This scale, which is easy to use because of its short evaluation time and non-requirement for equipment, has been translated into English, Spanish, Norwegian, Swedish and Brazilian.[11–15]

The aim of this study was to translate and make the cross-cultural adaptation of the Postural Assessment Scale for Stroke Patients into Turkish and evaluate the reliability and validity of the Turkish version (PASS-Turk).

Materials and methods

Translation and cross-cultural adaptation

The translation was started after obtaining approval from the local ethics committee. The translation was performed in accordance with the recommended procedures in the literature.[16–19] In the first stage, the scale was translated

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into Turkish by two bilingual translators whose native language was Turkish. One of the translators was familiar with the study, but the other was not. These translations were compared by an expert committe, and for each item, the expression that was considered to be the best representation of that item was determined. At this stage, cross-cultural adaptation was done also. However, because the application of this scale was based solely on physical examination and did not require the use of any tools, there was no need for a significant change of the items during the cross-cultural adaptation study. In the second stage, the Turkish version was back-translated to English by translators whose native language was English and were not familiar with the original scale. In the third stage, these two versions were compared with the original scale. The differences between translated versions were evaluated, and a satisfactory compliance with the original scale was achieved by consensus of the translators and authors. A final version was established and named as PASS-Turk (Appendix 1).

Study design and setting

Participants were informed about the study, and their oral and written informed consents were taken. This study was conducted in accordance with the Declaration of Helsinki. Sixty consecutive patients with stroke who had survived the three-week acute period and who had accepted to participate were included in the study. Participants: (1) with severe cognitive pathologies who could not understand the instructions; (2) whose native language was not Turkish; (3) who had other diseases that could cause balance problems (e.g. vision problems, hearing problems, vestibular problems, other neurologic diseases); (4) with recurrent stroke; (5) with lower or upper extremity amputation; (6) with malignancy; (7) with decompensated systemic disease, and (8) with arthritis and/or joint contracture that limited joint movements were excluded from the study (Figure 1).

Data collection

The participants were evaluated by two researchers. The first researcher applied the scale to the participants twice with 5-day intervals. The second researcher applied the scale once at the same time with the first researcher's first assessment. The Berg Balance Scale (BBS) and motor subscale of the Functional Independence Measure (FIM) were also applied by the first researcher (Figure 1).

Postural assessment scale for stroke patients (PASS)

PASS was developed to evaluate postural control and balance in patients with stroke.[11] The scale includes 12 items with increasing difficulty. It consists of a 4-point scale in which "0" is the lowest and "3" the highest score. Total scoring ranges from 0 to 36. There are two subscales entitled "maintaining posture" and "changing a posture." In the "maintaining posture" section: "sitting without support, standing with/without support, standing on the nonparetic/paretic leg" functions are evaluated. In the "changing a posture" section: supine to paretic/nonparetic side lateral, supine to sitting up on the edge of the table, sitting on the edge of the table to supine, sitting to standing up, standing up to sitting down, standing, and picking up a pencil from the floor functions are evaluated. Both sections are scored separately, and the sum of these scores gives the total score.[11]

PASS is advantageous in that it is extensive, sensitive to assessing changes in patients, and can be used even in those with low physical capacity.[11] PASS was found to be sufficiently compatible with postural stability measured by the device.[20] The scale can be completed in a very short time (about 10 minutes) with no equipment.[11,21]

Berg balance scale (BBS)

The BBS was developed to assess balance performance in the geriatric population.[22] It is often used in clinical trials to assess postural control and to estimate fall risk. Subsequent studies have shown that this test is also suitable for the assessment of balance in patients with stroke.[2,8,23,24] The BBS comprises 14 items. It consists of a 5-point scale in which 0 indicates the lowest level of function and 4 the highest level of function. Total scoring ranges from 0 to 56. The BBS evaluates balance, both statically and dynamically. In clinics, it can be applied with minimal equipment (chair, measuring tape, step-board, chronometer), but the BBS is a little more complicated than PASS and therefore less well adapted to patients in the first few weeks after stroke. The Turkish version of the BBS is a valid and reliable scale.[23,24]

Functional independence measure (FIM)

FIM assesses the degree of independence of the individual in basic physical and cognitive activities in daily life. FIM consists of 18 items and basically measures 2 parameters: motor function and cognitive function. Each item consists of a 7-point scale in which 1 indicates total assistance and 7 shows complete independence. The "motor function" section consists of self-care, sphincter, transfer, and locomotion subsections, and the total scoring ranges from 13 to 91. The "cognitive function" section consists of communication and social cognition sub-sections, and the total scoring ranges from 5 to 35. Total scoring of FIM ranges from 18 to 126. High scores in the scale indicate that the patient's independence is high. In medical rehabilitation, FIM is the most preferred activity scale around the world. The validity and reliability of the Turkish FIM is well established.[25] In this study, only the "motor function" section was used.

Other data collection

The age and sex of the participants and the duration, etiology, and side of stroke were recorded.

This manuscript conforms to the STARD Guidelines.

Statistical analysis

All statistical analyses were performed using the IBM SPSS Statistics 17.0 package program (IBM Corporation, Armonk, NY, USA). Whether the distributions of each scale and subscale scores were normal was determined using the

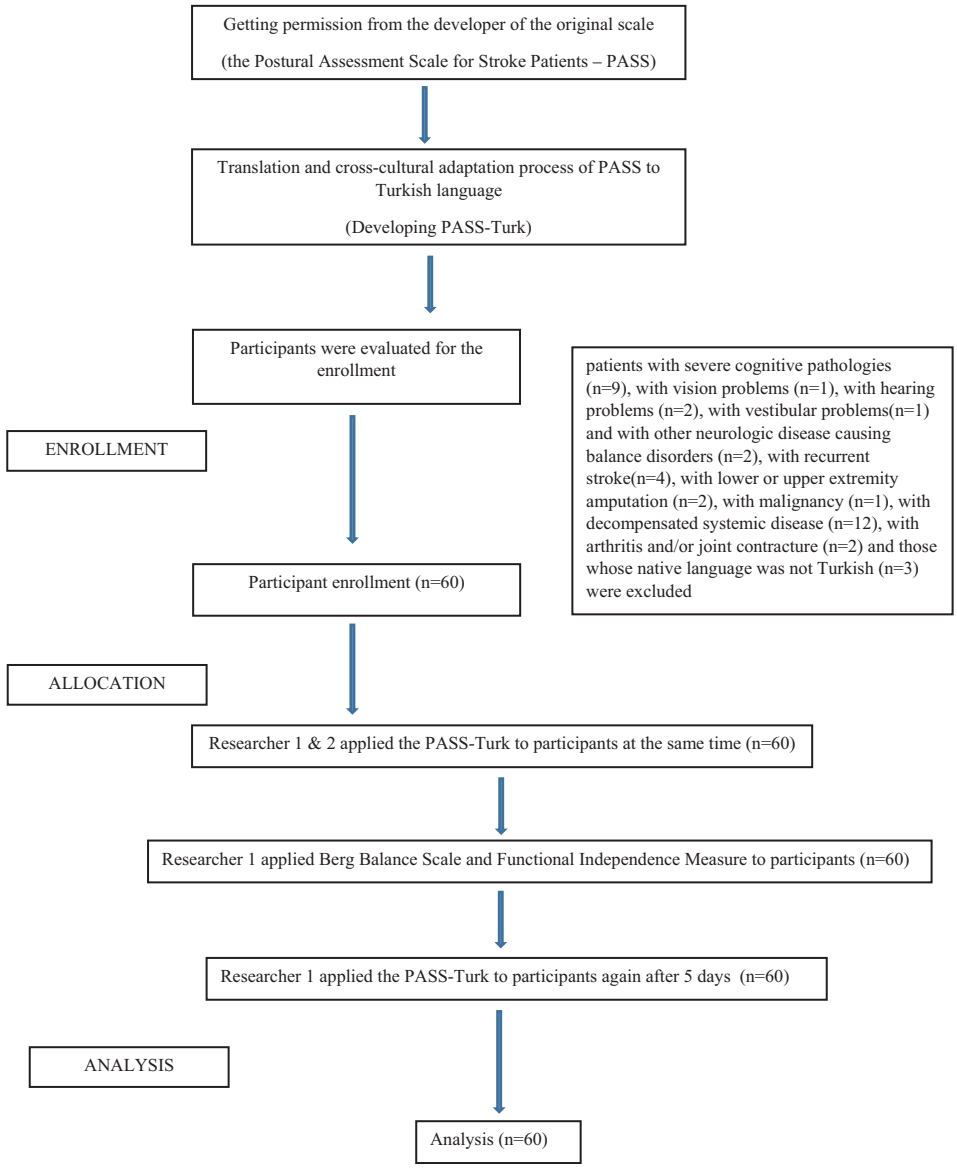

Figure 1. Flowchart of the study.

Kolmogorov-Smirnov test. Descriptive statistics were shown as mean±standard deviation or number of observations and percentage (%).

The reliability of PASS-Turk and its subsections was evaluated using Cronbach's alpha coefficient. In addition, the item-total correlation and test-retest reliability were calculated. The interobserver compliance was assessed using the intraclass correlation coefficient (ICC) and 95% confidence intervals (CI). Bland-Altman analyses were also performed to determine reliability for PASS-Turk. The amount of bias and 95% CI for agreement levels were calculated. The construct validity of PASS-Turk was assessed with both principal component analysis (PCA) and Pearson's product-moment correlation analyses.

The appropriateness of factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test. The appropriateness of the correlation coefficients for factor analysis was evaluated using the KMO test. The Bartlett test of sphericity showed that the correlation matrix was different from the identity matrix. Pearson's product-moment correlation coefficient was used to evaluate the strength and direction of the relationship among scores of PASS-Turk, BBS, and the motor subscale of FIM. The correlation coefficient varies between −1 and 1, and correlations of absolute value 0.7 or larger are considered strong associations in many contexts.[26] A p-value less than 0.05 was considered as statistically significant.

Results

The mean age of the participants was 66.48 ± 7.67 years. Thirty-two (53.3%) participants were male, and 28 (46.7%) were female. The mean time after stroke was 10.03 ± 3.75 weeks. The etiology of stroke was ischemic cerebrovascular disease in 41 (68.3%) participants and hemorrhagic cerebrovascular disease in 19 (31.7%) participants. The affected side was left in 28 (46.7%) participants and right in 32 (53.3%).

Frequency distributions and percentages of the participant's scores for each item are shown in Table 1.

The reliability of the PASS-Turk scale is shown in Table 2. In the table, mean scores, standard deviation, corrected item-total correlation coefficients, and Cronbach's alpha coefficient for each item are shown. The corrected item-total correlation coefficients were higher than 0.50 for each item. Regardless of which item was deleted, the internal consistency coefficients (Cronbach's alpha) with the remaining items were always higher than 0.80. The Cronbach's alpha coefficients of the PASS-Turk scale were 0.903 for the section "maintaining posture," 0.940 for the section "changing a posture," and 0.953 for the total PASS-Turk scale.

The mean scores of the "maintaining posture" section applied by the first researcher were calculated as 7.25 ± 4.53 in the first evaluation and 7.12 ± 4.38 in the second evaluation. The test-retest reliability for the "maintaining posture" section was found as 0.999. The mean scores of the "changing a posture" section applied by the first researcher were calculated as 10.45 ± 6.05 in the first evaluation and 10.22 ± 5.93 in the second evaluation. The test-retest reliability for the "maintaining posture" section was found as 0.998. The total PASS-Turk scores applied by the first researcher were calculated as 17.70 ± 10.08 in the first evaluation and 17.33 ± 9.81 in the second evaluation. The test-retest reliability for PASS-Turk was found as 0.999.

The mean scores of the participants for the "maintaining posture" section were 7.25 ± 4.53 and 7.23 ± 4.53 for first and second researchers, respectively. The first and second researcher evaluations were perfectly consistent with each other in terms of the "maintaining posture" section (ICC = 1.000, 95% CI: 0.999–1.000, $p < .001$). The mean scores of the participants for the "changing posture" section were 10.45 ± 6.05 and 10.20 ± 5.97 for first and second researchers, respectively. The first and second researcher evaluations were perfectly consistent with each other in terms of the "changing a posture" section (ICC = 0.997, 95% CI: 0.995–0.998, $p < .001$). The mean scores of the participants for the PASS-Turk were 17.70 ± 10.08 and 17.43 ± 10.00 for first and second researchers, respectively. The first and second researcher evaluations were perfectly consistent with each other in terms of total PASS-Turk scores (ICC = 0.999, 95% CI: 0.998–0.999, $p < .001$).

Sample size, correlation coefficients, and partial correlation coefficients were found to be appropriate for factor analysis (KMO = 0.864). Besides, the Bartlett test of sphericity showed that the correlation matrix was different from the identity ($p < .001$).

The PCA showed that the two-dimensional structure consisting of 12 items could explain 82.45% of the total variations in the posture assessment. The factor loadings of the items varied from 0.733 to 0.966 according to the PCA. According to the results, it was seen that the factor loadings of the items were quite high.

Bland-Altman analyses were also performed to determine reliability for PASS-Turk. The mean bias was found as 0.13 ± 0.34 for the "maintaining posture" subscale. The lower and upper limits for 95% agreement levels were calculated as −0.54 and 0.80, respectively. The mean bias was found as 0.23 ± 0.53 for the "changing a posture" subscale. The lower and upper limits for 95% agreement levels were calculated as −0.81 and 1.28, respectively. The mean bias was found as 0.37 ± 0.69 for the overall scale. The lower and upper limits for 95% agreement levels were calculated as −0.98 and 1.71, respectively.

The scores of PASS-Turk, BBS, and FIM-motor scales are shown in Table 3. In the evaluation of validity, it was found that as the BBS score increased, the "maintaining posture" section score, "changing a posture" section score, and PASS-Turk total score were significantly increased (Table 4). It was also found that as the motor subscale of the FIM score increased, the "maintaining posture" section score, "changing a posture" section score, and PASS-Turk total score were significantly increased (Table 4).

Discussion

PASS is a specific scale for assessing postural control and balance of patients with stroke. The scale examines postural control and balance, even in patients with very low physical performance, and it is fast, and easy to understand and apply. In their study of the validity of PASS, Benaim et al., evaluated the correlation between PASS and FIM and found a high correlation.[11] Lesser et al. concluded that acute care therapists could use PASS when determining "acute care discharge recommendations" for patients with stroke.[27] Huang et al. showed that PASS had a predictive value in showing the level of ambulation in patients undergoing rehabilitation.[21] Mao et al. evaluated the characteristics of PASS, the BBS, and the balance subscale of the FM in patients who were followed up to the 6th month after stroke. The authors showed that all three scales had strong validity, reliability, and responsiveness. They also stated that the psychometric properties of PASS were slightly better than the other two scales.[28] In the literature, PASS was used in patients with chronic stroke, and the reliability was shown.[29,30] In other words, this scale helps in the detailed evaluation of postural control and balance, prediction of prognosis, and in the evaluation of development in patients with stroke in the acute and chronic period. In this study, PASS was translated into Turkish and named PASS-Turk, and the reliability and validity study of PASS-Turk was performed.

When the reliability analysis results of PASS-Turk are examined, corrected item-total correlations were found to be greater than 0.50 for each item. Corrected item-total correlation, which is one of the reliability indicators of a scale, is expected to be greater than 0.30. In some sources, it is said that this value should be greater than 0.50.[31] It was shown that corrected item-total correlations of PASS-Turk were higher than 0.50 for each item.

When the "alpha" values in the last column in Table 2 are considered, it is seen that the internal consistency coefficients were always higher than 0.80 if items were deleted, regardless of which item in the PASS-Turk was deleted. Items that do not perform well enough in a scale have an increasing or a significant decreasing effect on the alpha coefficient. The correlation coefficients of good items have an increasing

Table 1. Frequency distributions and percentages of the participants by item scores.

	1st Researcher 1st Evaluation		2nd Researcher		1st Researcher 2nd Evaluation	
	n	%	*n*	%	*n*	%
Maintaining Posture						
Sitting without support						
Score 0	6	10.0	6	10.0	6	10.0
Score 1	10	16.7	10	16.7	10	16.7
Score 2	19	31.7	20	33.3	19	31.7
Score 3	25	41.7	24	40.0	25	41.7
Standing with support						
Score 0	10	16.7	10	16.7	10	16.7
Score 1	8	13.3	8	13.3	8	13.3
Score 2	14	23.3	14	23.3	15	25.0
Score 3	28	46.7	28	46.7	27	45.0
Standing without support						
Score 0	19	31.7	19	31.7	19	31.7
Score 1	16	26.7	16	26.7	17	28.3
Score 2	7	11.7	7	11.7	6	10.0
Score 3	18	30.0	18	30.0	18	30.0
Standing on the nonparetic leg						
Score 0	23	38.3	23	38.3	23	38.3
Score 1	15	25.0	15	25.0	16	26.7
Score 2	16	26.7	16	26.7	16	26.7
Score 3	6	10.0	6	10.0	5	8.3
Standing on the paretic leg						
Score 0	31	51.7	31	51.7	31	51.7
Score 1	20	33.3	20	33.3	22	36.7
Score 2	4	6.7	4	6.7	4	6.7
Score 3	5	8.3	5	8.3	3	5.0
Changing a Posture						
Supine to affected side lateral						
Score 0	6	10.0	6	10.0	6	10.0
Score 1	3	5.0	5	8.3	4	6.7
Score 2	29	48.3	27	45.0	29	48.3
Score 3	22	36.7	22	36.7	21	35.0
Supine to nonaffected side lateral						
Score 0	20	33.3	20	33.3	20	33.3
Score 1	12	20.0	15	25.0	14	23.3
Score 2	12	20.0	9	15.0	10	16.7
Score 3	16	26.7	16	26.7	16	26.7
Supine to sitting up on the edge of the table						
Score 0	6	10.0	6	10.0	6	10.0
Score 1	12	20.0	16	26.7	14	23.3
Score 2	31	51.7	27	45.0	29	48.3
Score 3	11	18.3	11	18.3	11	18.3
Sitting on the edge of the table to supine						
Score 0	6	10.0	6	10.0	6	10.0
Score 1	12	20.0	14	23.3	13	21.7
Score 2	31	51.7	29	48.3	31	51.7
Score 3	11	18.3	11	18.3	10	16.7
Sitting to standing up						
Score 0	12	20.0	12	20.0	12	20.0
Score 1	25	41.7	27	45.0	26	43.3
Score 2	13	21.7	11	18.3	13	21.7
Score 3	10	16.7	10	16.7	9	15.0
Standing up to sitting down						
Score 0	16	26.7	16	26.7	16	26.7
Score 1	17	28.3	19	31.7	20	33.3
Score 2	17	28.3	15	25.0	15	25.0
Score 3	10	16.7	10	16.7	9	15.0
Standing, picking up a pencil from the floor						
Score 0	41	68.3	41	68.3	41	68.3
Score 1	7	11.7	7	11.7	7	11.7
Score 2	3	5.0	3	5.0	3	5.0
Score 3	9	15.0	9	15.0	9	15.0

effect on reliability.[32] In scales comprising fewer items, large decreases can be observed in the alpha coefficient (reliability level). For example, if the average correlation of items on a sub-scale of 4 items was 0.50, and the alpha coefficient was 0.80, when the number of items was decreased to 3 the alpha coefficient could be reduced to 0.75, even if the correlation level stayed as 0.50. On another subscale of 5 items with the same mean correlation, the alpha coefficient can be up to 0.83. In addition, the very high Cronbach's alpha values indicate the reliability of the scale and the structural validity.[33] According to the Cronbach's alpha coefficient of PASS-Turk, the scale is quite reliable. The Cronbach's alpha

Table 2. The reliability of the PASS-Turk scale.

	Mean	Standard deviation	Corrected Item-Total Correlation*	Cronbach's Alpha-if Item Deleted**
Sitting without support	2.05	1.00	0.793	0.949
Standing with support	2.00	1.13	0.771	0.950
Standing without support	1.40	1.22	0.746	0.951
Standing on the nonparetic leg	1.08	1.03	0.759	0.950
Standing on the paretic leg	0.72	0.92	0.702	0.951
Supine to affected side lateral	2.12	0.90	0.700	0.952
Supine to the nonaffected side lateral	1.40	1.21	0.680	0.953
Supine to sitting up on the edge of the table	1.78	0.87	0.950	0.945
Sitting on the edge of the table to supine	1.78	0.87	0.950	0.945
Sitting to standing up	1.35	0.99	0.851	0.947
Standing up to sitting down	1.35	1.05	0.824	0.948
Standing, picking up a pencil from the floor	0.67	1.11	0.698	0.952

*Pearson's product-moment correlation analyses.
**The level of internal consistency when the particular item is deleted.

coefficient of the original PASS was 0.95, quite similar to PASS-Turk.[11]

One of the other reliability analyses of a scale is the test-retest method. The similarity of the measurement results performed at different times shows the consistency of a test or scale. The correlation coefficient of the values obtained from the two measurements is the reliability coefficient of the scale.[34–36] The test-retest reliability for the both subsections and PASS-Turk total scores indicate that the scale is quite reliable.

In the present study, the interobserver agreement was assessed using the ICC and 95% CI. For the scores of the subscales of PASS-Turk and for the total score, the measurements of the first and second researchers were found to be perfectly consistent with each other. The original PASS has interrater and intrarater agreements of $r = 0.98$ and $r = 0.99$, which are comparable to PASS-Turk.[11]Bland-Altman analyses to determine the reliability of PASS-Turk was also performed and the results supported the previous analysis for the reliability.

In the present study, floor and ceiling effects were also assessed. Only 10% of cases (n = 6) got the minimum score of 0 for PASS-Turk. While the potential maximum score for subscales is 36, the highest subscale score was as much less as 21. Therefore the floor and ceiling effects were accepted as insignificant.

Validity is the degree to which a scale can accurately measure a characteristic without confusing it with any other characteristic. The validity of a scale indicates how much of the variability in measurements comes from real differences between individuals.[32,34–36] One of the validity assessments is the evaluation of the structural validity of the scale. Factor analysis can be used for this. Factor analysis is a structure validation technique used to determine whether there is a certain order between the responses to the items in the scale.[32,34] The structural validity of PASS was evaluated using principal components analysis. The appropriateness of the correlation coefficients for factor analysis was evaluated using the KMO, which is an index that compares partial correlation coefficients with observed correlation coefficients. The KMO test should be over 0.5. High KMO indicates that the data set is suitable for factor analysis.[33] In the present

Table 3. The scores of PASS-Turk*, BBS** and FIM-motor*** scales.

	Mean	Standard Deviation	Minumum	Maximum
"Maintaining posture" score	7.25	4.53	0	15
"Changing a posture" score	10.45	6.05	0	21
PASS-Turk total score	17.70	10.08	0	36
BBS	26.55	16.25	0	56
FIM-motor	48.23	23.83	13	91

*PASS-Turk: Turkish version of the The Postural Assessment Scale for Stroke Patients
**BBS: Berg Balance Scale
***FIM-motor: Motor subscale of Functional Independence Measure

Table 4. The correlation between PASS-Turk* scores and the BBS** and FIM-motor*** subsection scores.

	Correlation coefficient (r)	p value****
BBS		
"Maintaining posture" score	0.893	**<0.001**
"Changing a posture" score	0.798	**<0.001**
PASS-Turk total score	0.880	**<0.001**
FIM-motor		
"Maintaining posture" score	0.857	**<0.001**
"Changing a posture" score	0.797	**<0.001**
PASS-Turk total score	0.863	**<0.001**

*PASS-Turk: Turkish version of the The Postural Assessment Scale for Stroke Patients
**BBS: Berg Balance Scale
***FIM-motor: Motor subscale of Functional Independence Measure
****Pearson's product-moment correlation analyses.

study, sample size, correlation coefficients, and partial correlation coefficients were found to be appropriate for factor analysis. In addition, the Bartlett test of sphericity showed that the correlation matrix was different from the identity.

The principal components analysis showed that the two-dimensional structure consisting of 12 items could explain 82.45% of the total variations in the posture assessment. The factor loadings of the items vary between 0.733 and 0.966 according to the principal components analysis. Some researchers consider that item factor loads should be 0.40 and above. Some researchers interpreted the factor load of more than 0.50 as "very meaningful." According to the results in this study, the factor loadings of the items were quite high.

The content validity of a scale indicates how appropriate the total scale and each item are for the purpose. The content validity of a scale is evaluated with a standard scale, which was previously developed and accepted in the same field, and a newly developed scale. The correlation coefficient between these two scales is calculated.[32,34–36] To evaluate the validity of the PASS-Turk scale, the total scores and sub-section scores of the scale were compared with BBS scores and the motor subscale of FIM scores. Pearson's product-moment correlation was used for comparison, and the validity of the scale was shown. Similarly, strong correlations between the original PASS and transferring/locomotion sections of the FIM were found, as well as with motricity, sensibility, and spatial neglect scores.[11]

Conclusion

As a result, it can be concluded that the reliability and validity of the translated and cross-culturally adapted form of PASS to the Turkish language (PASS-Turk) has been shown. It can be usedfor the evaluation of posture and balance in patients with stroke who speak the Turkish language.

Author Disclosures

This manuscript describes original work and is not under consideration by any other journal. The authors declare that they have no competing interests and they approved the manuscript and this submission. This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

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Ethics approval

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References

1. Tyson SF, Hanley M, Chillala J, Selley A, Tallis RC. Balance disability after stroke. *Phys Ther*. 2006;86(1):30–38. doi:10.1093/ptj/86.1.30.
2. Kurt EE, Ünsal Delialioğlu S, Özel S. Assessment of balance in patients with stroke. *Turk J Phys Med Rehab*. 2010;56:56–61. doi:10.4274/tftr.56.56.
3. Lee KB, Lim SH, Ko EH, Kim YS, Lee KS, Hwang BY. Factors related to community ambulation in patients with chronic stroke. *Top Stroke Rehabil*. 2015;22(1):63–71. doi:10.1179/1074935714Z.0000000001.
4. Bohannon RW, Leary KM. Standing balance and function over the course of acute rehabilitation. *Arch Phys Med Rehabil*. 1995;76(11):994–996. doi:10.1016/S0003-9993(95)81035-8.
5. Sandin KJ, Smith BS. The measure of balance in sitting in stroke rehabilitation prognosis. *Stroke*. 1990;21(1):82–86. doi:10.1161/01.STR.21.1.82.
6. Aaslund MK, Moe-Nilssen R, Gjelsvik BB, et al. A longitudinal study investigating how stroke severity, disability, and physical function the first week post-stroke are associated with walking speed six months post-stroke. *Physiother Theory Pract*. 2017;33(12):932–942. doi:10.1080/09593985.2017.1360424.
7. Batchelor FA, Mackintosh SF, Said CM, Hill KD. Falls after stroke. *Int J Stroke*. 2012;7(6):482–490. doi:10.1111/j.1747-4949.2012.00796.x.
8. Kurt EE, Ünsal Delialioğlu S, Özel S. Balance in stroke and scales of balance assessment. *J PMR Sci*. 2010;13:112–118.
9. Winstein CJ, Stein J, Arena R, et al. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2016;47(6):e98–e169. doi:10.1161/STR.0000000000000098.
10. Yelnik A, Bonan I. Clinical tools for assessing balance disorders. *Neurophysiol Clin-Clin Neurophysiol*. 2008;38(6):439–445. doi:10.1016/j.neucli.2008.09.008.
11. Benaim C, Perennou DA, Villy J, Rousseaux M, Pelissier JY. Validation of a standardized assessment of postural control in stroke patients: the postural assessment scale for stroke patients (PASS). *Stroke*. 1999;30(9):1862–1868. doi:10.1161/01.STR.30.9.1862.
12. Cabanas-Valdes R, Girabent-Farres M, Canovas-Verge D, Caballero-Gomez FM, German-Romero A, Bagur-Calafat C. Spanish translation and validation of the Postural Assessment Scale for Stroke Patients (PASS) to assess balance and postural control in adult post-stroke patients. *Rev Neurol*. 2015;60:151–158.
13. Breistein K, Gjelsvik BEB, The Postural JL. Assessment Scale for Stroke Patients: translation into Norwegian, cultural adaptation, and examination of reliability. *Eur J Physiother*. 2017;19(4):207–214. doi:10.1080/21679169.2017.1334817.
14. Persson CU, Linder A, Hagell P. Measurement properties of the Swedish modified version of the postural assessment scale for stroke patients (SwePASS) using Rasch analysis. *Eur J Phys Rehabil Med*. 2017;53:848–855.
15. Yoneyama SM, de Melo Roiz R, Oliveira TM, Oberg TD, Lima NMFV. Validation of the brazilian version of the postural assessment scale for stroke patients. *Acta Fisiatr*. 2008;15:96–100.
16. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila Pa 1976)*. 2000;25:3186–3191.
17. Guillemin F, Bombardier C, Beaton D. Cross-culturel adaptation of the health related quality of life measures: literature review and proposed guidelines. *J Clin Epidemiol*. 1993;46(12):1417–1432. doi:10.1016/0895-4356(93)90142-N.
18. Organization WH. Process of translation and adaptation of instruments. https://www.who.int/substance_abuse/research_tools/translation/en/. Accessed 24 March 2019, 2019.
19. Capık C, Gözüm S, Aksayan S. Intercultural scale adaptation stages, language and culture adaptation: updated guideline. *Florence Nightingale J Nurs*. 2018;26:199–210.
20. Chien CW, Hu MH, Tang PF, Sheu CF, Hsieh CL. A comparison of psychometric properties of the smart balance master system and

the postural assessment scale for stroke in people who have had mild stroke. *Arch Phys Med Rehabil*. 2007;88(3):374–380. doi:10.1016/j.apmr.2006.11.019.
21. Huang YC, Wang WT, Liou TH, Liao CD, Lin LF, Huang SW. Postural assessment scale for stroke patients scores as a predictor of stroke patient ambulation at discharge from the rehabilitation ward. *J Rehabil Med*. 2016;48(3):259–264. doi:10.2340/16501977-2046.
22. Berg KO, Wood-Dauphinee SL, Williams JI, Maki B. Measuring balance in the elderly: validation of an instrument. *Can J Public Health = Revue Can De Sante Publique*. 1992;83:S7–11.
23. Sahin F, Buyukavci R, Sag S, Dogu B, Reliability KB. Validity of the Turkish version of the Berg balance scale in patients with stroke. *Turk Fiz Tip Rehab D*. 2013;59:170–175.
24. Sahin F, Yilmaz F, Ozmaden A, Kotevolu N, Sahin T, Kuran B. Reliability and validity of the Turkish version of the Berg Balance Scale. *J Geriatr Phys Ther*. 2008;31(1):32–37. doi:10.1519/00139143-200831010-00006.
25. Kucukdeveci AA, Yevuzer G, Elhan AH, Sonel B, Tennant A. Adaptation of the functional independence measure for use in Turkey. *Clin Rehabil*. 2001;15(3):311–319. doi:10.1191/026921501672063235.
26. Vittinghoff E, Glidden DV, Shiboski SC, McCulloch CE. *Regression Methods in Biostatistics*. New York, USA: Springer; 2005.
27. Lesser M, Borst J, Dekerlegand J. Use of the postural assessment scale for stroke patients in determining acute care discharge recommendations. *J Acute Care Phys Ther*. 2017;8(3):79–85. doi:10.1097/JAT.0000000000000057.
28. Mao HF, Hsueh IP, Tang PF, Sheu CF, Hsieh CL. Analysis and comparison of the psychometric properties of three balance measures for stroke patients. *Stroke*. 2002;33:1022–1027.
29. An SH, Lee JH. Reliability and validity of the postural assessment scale for stroke in chronic stroke patients. *J Kor Soc Phys Ther*. 2009;21:9–18.
30. Liaw LJ, Hsieh CL, Lo SK, Chen HM, Lee S, Lin JH. The relative and absolute reliability of two balance performance measures in chronic stroke patients. *Disabil Rehabil*. 2008;30(9):656–661. doi:10.1080/09638280701400698.
31. Şahin DB, Gülleroğlu HD. Examination of the psychometric properties of scales developed through item analysis techniques that are used to select items for likert-type. *Asian J Instruction*. 2013;1:18–28.
32. Karakoç FY, Dönmez L. Basic principles of scale development. *Tip Egitimi Dünyasi*. 2014;40:39–49. doi:10.25282/ted.228738.
33. Yaşar M. Attitudes toward statistics scale: validity and reliability study. *Pamukkale Univ J Educ*. 2014;36(2):59–75. doi:10.9779/PUJE640.
34. Çakmur H. Measurement-reliability-validity in research. *TAF Prev Med Bull*. 2012;11(3):339–344. doi:10.5455/pmb.1-1322486024.
35. AktürkZ, Acemoğlu H. Reliability and validity in medical research. *Dicle Med J*. 2012;39(2):316–319. doi:10.5798/diclemedj.0921.2012.02.0150.
36. Ercan İ, Kan İ. Reliability and validity in the scales. *Uludag Üniversitesi Tip Fakültesi Dergisi*. 2004;30:211–216.

Appendix 1. Turkish Version of the Postural Assessment Scale for Stroke Patients

(PASS-Turk)

Postür Sürdürme

Hastaya, her madde için aşağıda yazan talimatı verin. Maddeyi puanlarken, her madde için en düşük cevap kategorisini kaydedin.

1. Desteksiz Oturma

Değerlendirici: Hastayı 50 cm yükseklikte bir masanın (Bobath yatağı vb) kenarına, sırt desteği olmadan ve ayakları yerde olacak şekilde oturtun.

- (3) Desteksiz 5 dakika oturabiliyor.
- (2) Desteksiz 10 saniyeden fazla oturabiliyor.
- (1) Hafif destekle (örneğin 1 el yardımıyla) oturabiliyor.
- (0) Oturamıyor.

2. Destekli Ayakta Durma

Değerlendirici: Gerekli desteği sağlayarak hastayı ayakta tutun. Sadece destekli veya desteksiz ayakta durma yeteneğini değerlendirin. Ayakta durma kalitesini dikkate almayın.

- (3) Sadece tek el desteğiyle ayakta durabiliyor.
- (2) Bir kişinin orta derecede desteğiyle ayakta durabiliyor.
- (1) İki kişinin güçlü desteğiyle ayakta durabiliyor.
- (0) Destekle bile ayakta duramıyor.

3. Desteksiz Ayakta Durma

Değerlendirici: Hastayı desteksiz ayakta tutun. Sadece destekli veya desteksiz ayakta durma yeteneğini değerlendirin. Ayakta durma kalitesini dikkate almayın.

- (3) Desteksiz 1 dakikadan fazla ayakta durabiliyor ve aynı anda yaklaşık omuz seviyesinde kol hareketleri yapabiliyor.
- (2) Desteksiz 1 dakika ayakta durabiliyor veya hafif asimetrik şekilde ayakta durabiliyor.
- (1) Desteksiz 10 saniye ayakta durabiliyor veya tek bacak üzerine fazla ağırlık vererek durabiliyor.
- (0) Desteksiz ayakta duramıyor.

4. Sağlam Bacak Üzerinde Ayakta Durma

Değerlendirici: Hastayı sağlam bacak üzerinde ayakta tutun. Sadece sağlam bacak üzerinde tüm ağırlığı taşıma yeteneğini değerlendirin. Ayakta durma kalitesini dikkate almayın.

- (3) Sağlam bacak üzerinde 10 saniyeden fazla durabiliyor.
- (2) Sağlam bacak üzerinde 5 saniyeden fazla durabiliyor.
- (1) Sağlam bacak üzerinde birkaç saniye durabiliyor.
- (0) Sağlam bacak üzerinde duramıyor.

5. Paretik Bacak Üzerinde Ayakta Durma

Değerlendirici: Hastayı paretik bacak üzerinde ayakta tutun. Sadece paretik bacak üzerinde tüm ağırlığı taşıma yeteneğini değerlendirin. Ayakta durma kalitesini dikkate almayın.

- (3) Paretik bacak üzerinde 10 saniyeden fazla durabiliyor.
- (2) Paretik bacak üzerinde 5 saniyeden fazla durabiliyor.
- (1) Paretik bacak üzerinde birkaç saniye durabiliyor.
- (0) Paretik- bacak üzerinde duramıyor.

Postür Sürdürme Puanı: ……

Postür Değiştirme

6. Sırtüstü Yatarken Paretik Tarafa Doğru Dönme

Değerlendirici: Hasta tedavi minderi üzerinde sırtüstü yatarken başlayın. Hastaya, paretik tarafa doğru yuvarlanmasını söyleyin (lateral dönme). Gerekiyorsa yardım edin. Hastanın performansı için gerekli yardım miktarını değerlendirin. Performansın kalitesini değerlendirmeyin.

- (3) Yardımsız yapabiliyor
- (2) Az yardımla yapabiliyor
- (1) Çok yardımla yapabiliyor
- (0) Yapamıyor.

7. Sırtüstü Yatarken Sağlam Tarafa Doğru Dönme

Değerlendirici: Hasta tedavi minderi üzerinde sırtüstü yatarken başlayın. Hastaya sağlam tarafa doğru yuvarlanmasını söyleyin (lateral dönme). Gerekiyorsa yardım edin. Hastanın performansı için gerekli yardım miktarını değerlendirin. Performansın kalitesini değerlendirmeyin.

- (3) Yardımsız yapabiliyor
- (2) Az yardımla yapabiliyor
- (1) Çok yardımla yapabiliyor
- (0) Yapamıyor.

8. Sırtüstü Yatarken Minderin/Masanın Kenarında Oturmaya Geçme

Değerlendirici: Hasta tedavi minderi/masası üzerinde sırtüstü yatarken başlayın. Hastaya, minderin/masanın kenarında oturmasını söyleyin.

Gerekiyorsa yardım edin. Hastanın performansı için gerekli yardım miktarını değerlendirin. Performansın kalitesini değerlendirmeyin.

- (3) Yardımsız yapabiliyor
- (2) Az yardımla yapabiliyor
- (1) Çok yardımla yapabiliyor
- (0) Yapamıyor.

9. Minderin/Masanın Kenarında Otururken Sırtüstü Yatmaya Geçme

Değerlendirici: Hasta tedavi minderi/masası üzerinde otururken başlayın. Hastaya sırtüstü yatış konumuna dönmesini söyleyin. Gerekiyorsa yardım edin. Hastanın performansı için gerekli yardım miktarını değerlendirin. Performansın kalitesini değerlendirmeyin.

- (3) Yardımsız yapabiliyor
- (2) Az yardımla yapabiliyor
- (1) Çok yardımla yapabiliyor
- (0) Yapamıyor.

10. Oturma Pozisyonundan Ayağa Kalkma

Değerlendirici: Hasta tedavi minderi/masası üzerinde otururken başlayın. Hastaya desteksiz ayağa kalkmasını söyleyin. Gerekiyorsa yardım edin. Hastanın performansı için gerekli yardım miktarını değerlendirin. Performansın kalitesini değerlendirmeyin.

- (3) Yardımsız yapabiliyor
- (2) Az yardımla yapabiliyor
- (1) Çok yardımla yapabiliyor
- (0) Yapamıyor.

11. Ayakta Duruştan Oturma Pozisyonuna Geçme

Değerlendirici: Hasta tedavi minderinin/masasının kenarında ayakta dururken başlayın. Hastaya, minderin/masanın kenarına desteksiz oturmasını söyleyin. Gerekiyorsa yardım edin. Hastanın performansı için gerekli yardım miktarını değerlendirin. Performansın kalitesini değerlendirmeyin.

- (3) Yardımsız yapabiliyor
- (2) Az yardımla yapabiliyor
- (1) Çok yardımla yapabiliyor
- (0) Yapamıyor.

11. Ayakta Durma, Yerden Bir Kalem Alma

Değerlendirici: Hasta ayakta dururken başlayın. Hastaya, yerde duran kalemi desteksiz almasını söyleyin. Gerekiyorsa yardım edin. Hastanın performansı için gerekli yardım miktarını değerlendirin. Performansın kalitesini değerlendirmeyin.

- (3) Yardımsız yapabiliyor
- (2) Az yardımla yapabiliyor
- (1) Çok yardımla yapabiliyor
- (0) Yapamıyor.

Postür Değiştirme Puanı: ……

PASS-Turk Toplam Puanı: ……