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Validity and reliability of Turkish transcultural adaptation of the Prosthetic Limb Users Survey of Mobility

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Abstract

Background: Amputee-specific, self-assessment mobility scales are essential to evaluate mobility in lower-limb amputees.

Objectives: To evaluate the validity and reliability of a Turkish translation and adaptation of the Prosthetic Limb Users Survey of Mobility.

Study design: This is a validation study.

Methods: Turkish translation of the Prosthetic Limb Users Survey of Mobility (PLUS-M-T) from its original was performed following the rules of intercultural adaptation and translation methods. The PLUS-M-T and its 12-item short form were applied to '100 individuals with limb loss twice in 3-day intervals. The structural validity analysis was determined by calculating the correlation with the Amputee Mobility Scale, which is a valid, reliable scale for assessing the functional level in amputees. The Cronbach alpha coefficient was calculated to analyze the internal consistency. The interclass correlation coefficient (ICC) and Spearman correlation coefficient (r) were calculated, and the test–retest reliability was determined.

Results: A positive, high correlation was found between the first application and its repetition of both PLUS-M-T (ICC = 0.85, r = 0.94, $P < 0.001$) and 12-item short form (ICC = 0.92, r = 0.93, $P < 0.001$). The internal consistency was high for both PLUS-M-T (Cronbach alpha = 0.94) and 12-item short form (Cronbach alpha = 0.91). A positive, high correlation was found between the scores obtained from the Amputee Mobility Scale and PLUS-M-T (r = 0.84, $P < 0.001$) and 12 question short form (r = 0.77, $P < 0.001$).

Conclusion: Turkish translation of the PLUS-M questionnaire is a valid and reliable scale for assessing the mobility of individuals who have undergone lower-extremity amputation using a prosthesis.

Keywords

amputation, outcome assessment, quality of life

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Background

Functional mobility is a key element of quality of life and is therefore a primary goal of prosthetic rehabilitation after lower-limb loss.[1-3]

Self-report surveys and questionnaires are the essential tools with which to assess mobility and functional level in people with limb loss. These tools allow us to determine and evaluate the functional status and mobility of the prosthesis user regarding how the patient feels. It is one of the most preferred methods for functional evaluation in the clinic because it is cheap, practical, quick, and easy to apply.[4-6]

Functional mobility may vary due to an individual's physical conditions or prosthetic problems. Therefore, specific questionnaires and scales have been developed to determine the functional and mobility levels of prosthesis users. The Prosthetic Limb Users Survey of Mobility (PLUS-M) is one of these surveys. The PLUS-M is a mobility scale consisting of clear, precise, clinically relevant questions. The PLUS-M includes 44 mobility items that have been calibrated to an item response theory model using mobility data from more than 1000 people with limb loss. There are two short forms (i.e. 12 and 7 items), and simple scoring tables are available for use in clinical care and research involving people with lower-limb loss. The PLUS-M has good validity and reliability among those with limb loss. It has been demonstrated that the PLUS-M has a moderate positive relationship with Amputee Mobility Predictor (AMP) scores and a moderate negative relationship with Timed Up and Go test scores. The PLUS-M also showed a strong positive relationship with Patient-Reported Outcomes Measurement Information System-Physical Function, Prosthesis Evaluation Questionnaire-Mobility Subscale, and Activities-specific Balance Confidence Scale.[7] It is an ideal scale for the evaluation of the mobility of individuals who have undergone lower-extremity amputation due to its short application time and self-assessment. The PLUS-M is recommended for clinical and scientific research, which may be useful for the rehabilitation team who work

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with persons with limb loss, to assess functional mobility with the prosthesis, measure the effectiveness of the prosthesis used, and determine the mobility level of the individual.[7]

This study aimed to provide a Turkish translation and adaptation of the PLUS-M with proven validity and reliability. For this purpose, subjects' functional mobility was also assessed using the AMP scale. The AMP scale is designed as a clinical tool for assessing mobility and potential functional ambulation in people with lower-limb loss. The AMP scale is a scale that assesses the functional mobility of the individual before and after the prosthesis is applied. It consists of 20 questions in total. Questions concern sitting balance, transfers, standing balance, walking, climbing up and down stairs, and using assistive devices. The score range is between 0 and 47. High scores indicate an increase in the activity level of the patient. The validity and reliability of AMP (test–retest and interuser) were investigated in people with limb loss and found to be very high.[8]

In the first stage of the study, permission was obtained from the developer of the PLUS-M scale. Then, the procedure was started to translate the scale from the original language into Turkish. For this procedure, the Eremenco method for the translation and cross-cultural validation of the health status questionnaire was followed.[9] Second, to determine to what extent the PLUS-M reflects the functionality and mobility status, the correlation with the AMP scale was calculated. The aim of this study was to evaluate the validity and reliability of the PLUS-M Turkish version.

Methods

Translation method

The methodological steps for the translation and cross-cultural validation process are explained as follows:

1. Translation phase: The original text was translated simultaneously by two independent translators. The first translator was designated as a professional translator. The second translator was a health professional. At this stage, a question bank containing explanations of each question was used by the developer of the questionnaire, focusing on capturing the meaning of each item rather than a literal translation, taking into account patients of different educational levels. The question "Can you sweep the floors?" was changed to "Can you sweep the floors with the help of a broom or brush?" based on the description in the question bank with a broom or brush. In the survey instructions section, the word "scooter" is not common in daily life in Turkey and this was changed to "motorized wheelchair."
2. Reconciliation phase: In the reconciliation phase, the two translations were evaluated by an independent health professional to resolve the inconsistencies between the two translations and, if necessary, to do an alternative translation. In the original scale, the phrase "theater or church" was adopted as "theater or cinema" because approximately 95% of the Turkish people are Muslim and do not go to church. The reason why the cinema was chosen instead of the church was because the seating in both involves a bench (or chair). In addition, the "2 miles" was changed to "3 km" because, in Turkey, kilometers are used as the unit of length measurement rather than miles. The third translator was an experienced researcher who had previously performed the Turkish version and intercultural adaptation of two scales in the field of health sciences.[10,11]
3. Back translation: The translated Turkish version of the questionnaire was translated into English by a native English speaker who spoke fluent Turkish, was not included in the previous stages, and was not aware of the original questionnaire. He was a medical biologist at the Johns Hopkins University School of Medicine in the United States. In the re-English translation of the scale, the meaning and structure of the sentence were not changed, but there were word differences. In the original survey, the phrase "tall buildings" was re-translated as "skyscrapers" in the English translation.
4. Review phase: During this phase, three bilingual health professionals analyzed the translations performed at all stages. The aim at this stage was to decide on the best Turkish translation for each item in the questionnaire. At this stage, "a block" was changed to 120 m because "a block" is not a word used in daily life in Turkey.
5. Finalization: After the review phase was completed, it was evaluated by the translation team and the final translation for each item was decided.
6. Pilot test phase: The final version of the questionnaire, which was translated into Turkish, was applied to five patients who had undergone lower-limb amputation and who used prosthesis at different levels. After answering the questions, the patient was asked whether there was a word they did not understand or a part that they had difficulty in understanding while answering. The patients stated that they could understand each item of the questions. Two patients had difficulty answering the question, "Are you able to continue walking when someone bumps into you while you are walking on the road?" because they could not decide on the speed of impact. However, the question was not changed because they could reach a decision and answer the question, and there were no problems in understanding that problem in other patients.

Data collection

Subjects

The study included 100 patients who had undergone lower-extremity amputation and were still using a prosthesis in daily life.

Inclusion criteria were as follows:

- to know how to read and write in Turkish,
- being older than 18 years,
- not having a cognitive problem,
- unilateral or bilateral lower-extremity amputation,
- using the existing prosthesis in daily life activities, and
- lower-limb amputation due to traumatic, vascular, or other reasons.

Exclusion criterion was

- upper-extremity amputation

All data were collected through a face-to-face interview. The PLUS-M Turkish translation was administered twice at 72-hour intervals to determine the consistency between the results when administered at different times. Because the participants were treated in an inpatient rehabilitation center, they were contacted regularly in 72 hours. The AMP was also held with the first administration of PLUS-M–Turkish, and its correlation with this scale was analyzed.

Table 1. Demographic information.

n = 100	Mean	SD	Min	Max
Age (y)	34	10	18	70
Height (cm)	172	7	155	193
Weight (kg)	72	10	53	110

Data analysis

Internal consistency

To analyze the internal consistency of the Turkish version of the PLUS-M scale (44-item), the Cronbach alpha internal consistency coefficient was calculated. The Cronbach alpha is a widely used statistical coefficient to determine internal consistency in almost all scale studies.[12] A 12-item short form of the PLUS-M Turkish version was also separated from the data set, and then, all the steps described above were repeated for the short form as well.

Reliability

To analyze the test–retest reliability of the Turkish version of the PLUS-M scale (44-item), the interclass correlation coefficient (ICC) and Spearman correlation coefficient were calculated. Before performing the Spearman correlation analysis, whether the data were distributed normally was examined using the Kolmogorov–Smirnov test. Short-form items in the PLUS-M version were also separated from the data set, and all the steps described above were repeated.

Validity

The structural validity analysis of the Turkish version of the PLUS-M scale was determined by calculating the correlation with the AMP scale, which is a valid, reliable scale for determining the functional level in person with limb loss. Participants completed the PLUS-M Turkish version first, and then, their functional levels were determined by the AMP scale, and the resulting measurements were recorded. The correlation between the total scores of the two scales was calculated using the Spearman correlation coefficient. Before the correlation calculation, the normal distribution of the data was examined by the Kolmogorov–Smirnov test, and the frequency distributions were examined by plots and determined that the data were not distributed normally. Therefore, the Spearman correlation coefficient calculation method was used in the analysis of construct validity.

Table 2. Amputation levels.

Amputation level	n	(%)
Transtibial amputation	49	49
Transfemoral amputation	27	27
Knee disarticulation	8	8
Hip disarticulation	1	1
Partial foot amputation	2	2
Bilateral amputation	13	13
Sex		
Female	6	6
Male	94	94
Total	100	100

Table 3. Test–retest reliability of Turkish translation of PLUS-M.

	ICC	Spearman (r)	*P*
PLUS-M Turkish (n = 100)	0.85	0.94	<0.001
PLUS-M Turkish 12-item (n = 100)	0.92	0.93	<0.001

Abbreviations: ICC, intraclass correlation coefficient; PLUS-M, Prosthetic Limb Users Survey of Mobility.

Results

The study included 100 individuals who had undergone lower-limb amputation and were using a prosthesis (94 men and 6 women). Demographics and discrimination of amputation levels are given in Tables 1 and 2, respectively.

Turkish translation and adaptation of the PLUS-M had a positive, high correlation between the first test and the retest (Table 3). The internal consistency of translation and adaptation of the PLUS-M was found to be high in both the first and second measurements (Table 4).

Because the scores obtained from the Turkish version of the lower-extremity Prosthesis Mobility Questionnaire and the AMP scale scores obtained from prosthetic users do not show normal distribution, the Spearman correlation coefficient was calculated for validity measurement. Accordingly, a positive, high correlation was found between the scores obtained from both the first measurement and the last measurement of the Turkish version of the PLUS-M scale and the AMP scale (Table 5).

Because the scores obtained from the Turkish version of the 12-item short form of the PLUS-M and the AMP scale scores were not normally distributed, the Spearman correlation coefficient was calculated for the validity measurement. Accordingly, a positive, high correlation was found between the scores obtained from the first and last measurements of the Turkish version of the PLUS-M scale and the AMP scale scores (Table 5).

The internal consistency of the Turkish version of the 12-item short form of PLUS-M was found to be high in the first and second measurements (Table 4). The effect of each item on internal consistency was found to be compatible in both first and second applications.

There was a positive, high correlation between the first and repeat application of the Turkish version of the 12-item short form of the PLUS-M (Table 3).

Discussion

In this study, the validity and reliability of the Turkish version of the PLUS-M scale were investigated. The original form of the scale was translated from English to Turkish by following the intercultural adaptation guidelines, and the validity and reliability of the revealed Turkish scale were analyzed using statistical tests.

The findings of our study show that the test–retest reliability of the Turkish version of the PLUS-M scale is high. The ICC and

Table 4. PLUS-M Turkish version internal consistency.

	First test Cronbach alpha	Second test Cronbach alpha
PLUS-M Turkish (44-item) (n = 100)	0.93	0.94
PLUS-M Turkish (12-item) (n = 100)	0.91	0.91

Abbreviation: PLUS-M, Prosthetic Limb Users Survey of Mobility.

Spearman correlation values obtained from the two applications are the reliability coefficient of the scale and provide information about the scale's measurement stability. Although it generally seems sufficient to calculate the Spearman coefficient for reliability analysis, it is emphasized that this coefficient is insufficient to reflect the harmony between the two measurements accurately and to determine the similarity between the absolute values of the measurements. Therefore, it is emphasized that the calculation of the interclass correlation coefficient is a more reliable statistical method.[12] The correlation coefficient is above 0.7, which indicates the acceptable level for reliability.[12,13] In our study, the test–retest reliability correlation coefficient for the Turkish version of PLUS-M, both the 44-item long and the 12-item short form, was at the recommended level in the literature. When the reliability values of the original English version[6] of the PLUS-M scale are examined, it is seen that the reliability coefficient of the short form is 0.96. In this respect, the test–retest reliability value of the Turkish version of PLUS-M is very close to the original form's reliability. These results show that both the long and the short form of the PLUS-M scale give similar results in the repeated use with people with limb loss whose functional levels have not changed. Therefore, it can be used safely in determining the functional level in people with limb loss.

Another important finding of our study is that the Turkish version of PLUS-M is highly valid. The validity coefficient is calculated for the validity of the scales. This coefficient can vary from −1.00 to +1.00. The closer the value is to 1.00, the higher the validity. Analysis of the construct validity of the Turkish version of the PLUS-M scale was determined by calculating the correlation with the AMP scale, a valid and reliable scale for determining the functional level in people with limb loss. In our study, the validity correlation coefficient of the Turkish version of PLUS-M was found to be 0.84 for the first measurement and 0.77 for the last measurement, which reveals that the Turkish version of PLUS-M is a valid scale. In the literature, it is reported that $r > 0.5$ coefficient value indicates that the scale is valid and $r > 0.7$ value is evidence of a strong correlation for validity analysis.[14] In the validity analysis of the 12-item short form of the PLUS-M questionnaire, the correlation coefficient calculated as $r = 0.77$ indicates that the validity of the Turkish version of the short form was higher than the validity of the long form. This finding shows that the Turkish version of the short form can also be used effectively to determine the functional level in persons with limb loss. When the original scale development study is examined, it is seen that the validity of the original scale is calculated by comparing it with the AMP scale in our study.[7] Accordingly, the validity correlation coefficient of the original scale was reported as 0.56. Although this value represents an acceptable validity, it is slightly lower than the validity coefficient we found in our study. The possible reason for this difference is that the functional level average of the individuals constituting the sample of our study was higher than that of the original scale (8 participants K2, 41 participants K3, and 51 participants K4). Although the AMP scale, which is used in the comparison for validity analysis, is a high validity scale, it does not achieve high sensitivity and detailed classification in patients with high functional levels.[11]

The internal consistency findings of our study revealed that the internal consistency of the items constituting the PLUS-M Turkish version was high. Internal consistency analysis tests the compatibility, similarity, and homogeneity of the items that make up a rough scale.[15] In addition, the extent to which the items that make up the scale affect the result value is determined. The most commonly used analysis to determine the internal consistency of the measurement tools is to calculate the Cronbach alpha value. It is reported that this value should be greater than 0.70 for a scale to have high internal consistency.[16] Internal consistency analysis shows that the Cronbach alpha = 0.93 for the Turkish version of the long form of the PLUS-M scale and 0.91 for the short form. This result indicates that the items of the scale have high compatibility with each other. How much the Cronbach alpha value would change if each item was excluded from the scale was analyzed, and it was concluded that the consistency of the items in each other was high.

The PLUS-M is a survey that has been translated into many foreign languages besides Turkish. Japanese translations of the PLUS-M 7 and 12-item short forms were created for use in clinical practice and research.[17] A translation process similar to our study was also followed. Another transcultural adaptation of the PLUS-M was performed into French. The French translation of the PLUS-M 12-item short form has good to excellent psychometric properties comparable with those of the original English version. Internal consistency and reliability were found to be high (Cronbach alpha = 0.90, ICC = 0.89).[18] These results were consistent with the outcomes we found in our Turkish translation study.

The limitation of the study was that the participants were generally male and young individuals who lost their limbs for

Table 5. Construct validity of Turkish translation of PLUS-M (44-item) and short form (12-item).

	First test (r)	Second test (r)	*P*
AMP (n = 100)	PLUS-M Turkish 0.84	PLUS-M Turkish 0.77	<0.001
AMP (n = 100)	PLUS-M Turkish 12-item 0.77	PLUS-M Turkish 12-item 0.79	<0.001

Abbreviations: AMP, Amputee Mobility Predictor; PLUS-M, Prosthetic Limb Users Survey of Mobility; r, Spearman correlation coefficient.

traumatic reasons. It was not possible to increase the diversity because the study was performed in the veteran rehabilitation center. Another limitation of this study was that in the AMP scale Objective testing of the functional mobility is made by a third person but the PLUS-M is a self-reported scale. However, both scales give the clinician a numeric score as an outcome measure. Therefore, the high correlation between these scores can be used as evidence that the PLUS-M scale measures functionality and mobility validly.

Conclusion

Turkish translations of the PLUS-M scale and 12-item short form were accepted as valid and reliable instruments that can be used in individuals with lower-extremity amputation. The Turkish translation of the PLUS-M scale provides the functional status and functional competencies of the prosthesis user; it is a practical and easy-to-use measurement tool that allows the identification and evaluation of the way the patient feels.

Author contributions

The authors disclosed the following roles as contributors to this article: S.Y.—conceptualization, data curation, investigation, methodology, project administration, and writing–original draft. G.Y.—methodology, project administration, review, and editing. K.A. and Y.D.—investigation, review, and editing. H.B.Y.—methodology, writing–original draft, review, and editing.

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Supplemental material

No supplemental digital content is available in this article.

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