ORIGINAL ARTICLE

Validity and reliability of the brazilian version of Trinity Amputation and Prosthesis Experience Scales – Revised (TAPES-R)

Validade e confiabilidade da versão brasileira da Trinity Amputation and Prosthesis Experience Scales - Revised (TAPES-R)

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ABSTRACT

Objective: Evaluate the validity and reliability of the Brazilian version of TAPES-R in people with lower limb amputation. **Method:** 102 people with lower limb amputation who used a prosthesis participated in this cross-sectional study. The psychometric properties (concurrent validity, degree of agreement (Kappa Index) and intra and inter-observer reliability (ICC), in addition to the internal consistency of the items by Cronbach's alpha) of the Brazilian version of TAPES-R were evaluated. To assess concurrent validity, the Prosthesis Evaluation Questionnaire (PEQ) was used. **Results:** TAPES-R was correlated with PEQ, except for the subscales of social and general adjustment. The inter-observer ICC ranged from 0.38 to 0.88 in part 1 and from 0.27 to 0.88 in part 2, whereas the intra-observer ICC ranged from 0.63 to 0.83 in part 1 and 0.27 to 0.79 in part 2. The Kappa index varied from 0.18 to 0.66 in the inter-observer analysis and from 0.25 to 0.69 in the intra-observer analysis. Cronbach's alpha ranged from 0.75 to 0.89. **Conclusion:** The evaluation of psychometric properties allows us to verify that a TAPES-R is valid, reliable and has a good internal consistency to be applied to Brazilian adults with lower limb amputations.

Keywords: Amputation, Artificial Limbs, Prosthesis Fitting

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RESUMO

Objetivo: Avaliar a validade e confiabilidade da versão brasileira da TAPES-R em uma população com amputação de membro inferior. **Método:** Participaram deste estudo transversal 102 pessoas com amputação de membro inferior, usuárias de prótese. Foram avaliadas as propriedades psicométricas (validade concorrente, grau de concordância (Índice de Kappa) e confiabilidade (ICC) intra e interobservador, além da consistência interna dos itens pelo alfa de Cronbach) da versão brasileira da TAPES-R. Para avaliação da validade concorrente foi utilizado o Prosthesis Evaluation Questionnaire (PEQ). **Resultados:** A TAPES-R se correlacionou com o PEQ, com exceção das subescalas de ajuste social e geral. O ICC interobservador variou de 0,38 a 0,88 na parte 1 e de 0,27 a 0,88 na parte 2, já o ICC intraobservador variou de 0,63 a 0,83 na parte 1 e de 0,27 a 0,79 na parte 2. O índice de Kappa variou de 0,18 a 0,66 na análise interobservador e de 0,25 a 0,69 na análise intraobservador. O Alfa de Cronbach variou de 0,75 a 0,89. **Conclusão:** A avaliação das propriedades psicométricas permite concluir que a TAPES-R é válida, confiável e apresenta uma boa consistência interna para ser aplicada em adultos brasileiros amputados de membro inferior.

Palavras-chaves: Amputação, Membros Artificiais, Ajuste de Prótese

INTRODUCTION

Amputations can be considered a current public health problem and one of the biggest causes of permanent physical disability.[1] According to the World Health Organization, there are 30 million amputees in Asia, Africa, and South America.[2] Brazilian official data show that between 2015 and 2020, 129,851 lower limb amputation surgeries were conducted by the Brazilian National Health System (SUS).[3] Evidently, after amputation surgery, the use of the prosthesis and prosthetic adaptation emerges as a fundamental rehabilitation process.

In this context, the combination of mourning and life adjustments after losing the limb and using the prosthesis is complex, demanding physical, psychological, and social adaptations. Physically because the body needs to be adapted to the consequences of losing a limb or part of it; psychologically, the patient needs to accept the new body image; socially, the amputee needs to maintain their network of relationships and play their social roles.[4] These adjustments are essential during the rehabilitation of the amputee, as they are associated with greater autonomy and independence and promote the patient's return to activities of daily living and labor activities performed before the amputation event.[4,5]

The Trinity Amputation and Prosthesis Experience Scales (TAPES), created in 20004 and revised in 2010 by Gallagher et al.[6] (TAPES-R), is one of the most used scales for assessing biopsychosocial related aspects of amputation and use of the prosthesis. This scale also evaluates the aesthetic and functional satisfaction of prostheses for people with limb amputation. This scale is validated for the Turkish, Iranian, and French populations.[7-9] In Brazil, the process of cross-cultural adaptation of this scale was conducted by Pires et al.10 in 2020. However, its psychometric properties are not entirely known regarding amputees.

OBJECTIVE

This study aims to reveal the validity, reliability, and reproducibility of the Brazilian version of TAPES-R10 in adult lower limb amputees.

METHOD

This is a methodological study with quantitative and cross-sectional validation methodology, in which the psychometric properties are analyzed for reliability (internal consistency), reproducibility (inter and intra-observer agreement), and validity (criterion, concurrent) of the Brazilian version of TAPES-R.[10] The Prosthesis Evaluation Questionnaire[11] (PEQ), validated for the Brazilian population, was used to assess the concurrent validity of TAPES-R.[12]

At first, a survey was carried out among the public and private health institutions for amputees in the states of Rio Grande do Sul, Santa Catarina, and Paraná. Subsequently, the directing board of these institutions was contacted, the study was disclosed, and they were requested for authorization to include patients from such institutions. Then, all amputees from those institutions were contacted. Those who agreed to participate in the study were selected based on the following inclusion criteria: lower limb amputation, at least 18 years of age regardless of sex, and prosthesis use for at least one month.

One hundred two participants, aged between 20 and 82 years (mean 48.66; standard deviation, SD, 15.52), were selected, 82 men (80.40%) and 20 women (19.60%). As for education, one (1.00%) participant was illiterate, 25 (24.50%) had incomplete primary education, 19 (18.60%) completed the primary education, 18 (27.40) had secondary education, 16 (15.70%) had higher education, and 13 (12.80%) did not report their educational background.

The study sample had 51 (50.00%) participants with amputation below the knee, 9 (8.80%) at the knee level, and 42 (41.20%) above the knee. They had a mean amputation time of 11.14 (SD= 10.11) years and 10.64 (SD= 5.53) hours of daily use of the prosthesis. Regarding the cause of the amputation, 25 (24.50%) had vascular etiology, 62 (60.80%) traumatic etiology, and 15 (14.70%) were due to other causes.

Demographic Data Sheet

The authors designed a demographic questionnaire to collect information on age, sex, schooling, amputation level, and daily prosthesis use.

Trinity Amputation and Prosthesis Experience Scales - Revised (TAPES-R)

The TAPES-R is a questionnaire that assesses adjustments to amputation and use of the prosthesis and satisfaction with the prosthesis itself, and it is divided into two parts. The first contains three sections: psychosocial adjustment, activity restriction, and satisfaction with the prosthesis. These sections are divided into three subscales: general adjustment, social adjustment, and adjustment to limitation. Each subscale contains five possible responses, scored with a 4-point Likert scale (strongly disagree; disagree; neither agree nor disagree; agree; strongly agree). The scores can range from 4 to 20 points, with higher scores indicating greater levels of psychosocial adjustment. The second section consists of the activity restriction, with ten items on a 3-point Likert scale (not limited; slightly limited; a lot limited).

The third section involves aesthetic and functional satisfaction with the use of the prosthesis. Scores range from 10 to 30 points, and the higher the score, the greater the restriction of activities. This section consists of eight items with a 3-point Likert scale (not satisfied; satisfied; very satisfied), with higher scores indicating greater satisfaction with the esthetics and functionality of the prosthesis.

The second part of TAPES-R refers to health issues, physical abilities, residual limb pain, phantom limb pain, health problems, and other types of pain. For this part, the questions are open and closed with a five-point Likert scale,[4,6] and the answer options are very good, bad, fair, good, or very good (questions 3 and 4e); excruciating, horrible, distressing, discomforting, and mild (questions 5d and 6d); a lot, quite a bit, moderately, a little bit, and not at all (questions 4e, 5e, and 6e).

Prosthesis Evaluation Questionnaire (PEQ)

The PEQ consists of 82 questions divided into nine subscales covering four sections: 1- Function of the prosthesis: Utility (8 items), residual limb health (6 items), appearance (5 items), and sounds (2 items); 2- Mobility: Ambulation (8 items) and

transfers (5 items); 3- Psychosocial aspects: frustration (2 items), perceived response (5 items), and social burden (3 items); 4- Well-being (2 items).

The PEQ also contains individual questions that are included in the scale scores, such as satisfaction with particular situations (3 items), specific bodily sensations (stump pain, phantom limb pain, non-painful sensations (16 items), prosthetic care (3 items), self-efficacy (3 items) and questions about the importance of different aspects of the experience with the prosthesis (10 items). Most of the PEQ questions (76 out of 82) use the visual analog scale (VAS), ranging from 0 to 100, where 100 represents the best possible score.

The study for the Brazilian version of the instrument was conducted after authorization from the TAPES-R original authors. Each participant signed the Informed Consent Form (ICF), which stated that the objectives and procedures of the study were provided and explained, which allowed their free decision to participate in the study.

The demographic datasheet and the TAPES-R and PEQ questionnaires were used during data collection, to which they were applied in person, with interviews conducted by the researchers. To assess the inter-observer agreement, the TAPES-R was reapplied by two different observers with a 10-minute interval between each other. In contrast, the intra-observer agreement was tested with another interview conducted by the first observer three to seven days after the first assessment.

Privacy and confidentiality of data were granted. The Ethics Committee approved the study for Research with Humans of the University of the State of Santa Catarina (approvals 1.719.047, 1.757.437, and 1.852.457).

Data were initially analyzed for descriptive statistics (absolute and relative frequency, minimum and maximum values, median and interquartile range). For the inter and intra-observer reliability analysis, the Kappa coefficient of agreement and the Intraclass Correlation Coefficient (ICC) was used.

The Kappa coefficient of agreement (K) was classified according to Fayers & Machin[13] as poor agreement (K<0.20); mild agreement (0.21 < K < 0.40); moderate agreement (0.41 < K < 0.60); good agreement (0.61 < K < 0.80); and very good agreement (0.81 < K < 1).

Regarding ICC, it was classified according to Wahlund et al.14 as unacceptable agreement (ICC < 0.70); acceptable agreement (0.71 < ICC < 0.79); very good agreement (0.80 < ICC < 0.89); and excellent agreement (ICC > 0.90). Spearman's Correlation and Pearson's Correlation were used to verify the concurrent validity between the TAPES-R and the PEQ.

The internal consistency was assessed with Cronbach's alpha,[13,15] as values above 0.7 are generally described as acceptable for psychometric scales.

However values above 0.8 (good) or 0.9 (excellent) are recommended.[15-17] The Statistical Package for Social Sciences (SPSS), version 21.0 (SPSS Inc., Chicago, IL), was used for statistical analysis, and the significance level p < 0.05 was adopted.

RESULTS

The first part of TAPES-R assesses psychosocial adjustments to amputation and use of the prosthesis, restriction to physical activities and daily life activities, and satisfaction with the prosthesis. The results for these domains can be seen in Table 1.

Table 1. Psychosocial adjustments, restriction to activities of daily life, restriction to physical activities and daily life activities, and satisfaction with the prosthesis (n= 102)

Domains	Minimum	Maximum	Median	IQR
Psychosocial adjustments				
General Adjustments	1	4	3.2	1
Social Adjustments	1	4	3.2	1
Adjustments to limitation	1	4	2.2	0.8
Activity Restriction	0	2	1.1	0.7
Satisfaction with prosthesis use				
Aesthetic	3	9	6	1
Functional	5	15	9	4
Degree of satisfaction with the prosthesis	0	10	8	4.2

IQR, Interquartile Range

The second part of TAPES-R is dedicated to health-related issues and physical abilities, residual pain, phantom pain, health problems, and other types of pain. Regarding these matters, 3 (2.9%) individuals rated their health as “very bad,” 4 (3.9%) as “poor,” 27 (26.5%) as “fair,” 49 (48 %) as “good,” and 19 (18.7%) as “very good.”

As for physical capacity, 1 (0.9%) characterized it as “very bad, 14 (13.7%) as “poor”, 35 (34.3%) as “fair”, 42 (41.3 %) as “good” and 10 (9.8%) as “very good”. As for the presence of stump pain, 36 (35.3%) had pain and 66 (64.7%) did not. In addition, 40 (39.2%) reported phantom limb pain and 62 (60.8%) did not. As for the presence of health problems, 46 (45.1%) reported a problem and 56 (54.9%) did not.

Reliability

The inter-observer reliability analysis for the questions in part 1 reached ICC values ranging from 0.39 to 0.88, and in part 2 (1, 4b, 4c, 5b, 5c, 6b and 6c), values were 0.18 to 0 .70. The intra-observer reliability values ranged from 0.63 to 0.86 in part 1 and from 0.25 to 0.69 in part 2.

The Kappa agreement coefficient of inter-observer analysis resulted in values between 0.36 and 0.88, whereas the intra-observer analysis obtained values between 0.17 and 0.79.

Concerning the internal consistency analysis, Cronbach's alpha presented values between 0.75 and 0.89 in all subscales of TAPES-R part 1. Cronbach's alpha was not calculated for the degree of satisfaction with the prosthesis or the questions in part 2, once these domains are composed of a single item each (Table 2).

Concurrent Validity

The correlation between the TAPES-R and the PEQ for the scales of psychosocial adjustment (general adjustment and

social adjustment), activity restriction, aesthetic and functional satisfaction with the prosthesis, and the respective degree of satisfaction reached values between 0.100 and 0.740. (Table 3).

Table 2. Inter-observer and intra-observer reliability and internal consistency of TAPES-R

	Reliability		Internal Consistency
	Inter-observer (n= 55)	Intra-observer (n= 54)	(n= 102)
Part 1			
Domains			
Psychosocial Adjustment			
General Adjustments	0,68*	0,78*	0,87&
Social Adjustments	0,39*	0,79*	0,89&
Adjustments to limitation	0,65*	0,70*	0,75&
Activity Restriction	0,63*	0,78*	0,85&
Satisfaction with prosthesis use			
Aesthetic	0,53*	0,63*	0,83&
Functional	0,70*	0,80*	0,87&
Degree of satisfaction with the prosthesis	0,88*	0,86*	N/A
Part 2			
Questions			
1	0,82#	0,71#	N/A
2	0,56*	0,30*	N/A
3	0,46*	0,52*	N/A
4a	0,66*	0,69*	N/A
4b	0,83#	0,79#	N/A
4c	0,36#	0,17#	N/A
4d	0,51*	0,54*	N/A
4e	0,41*	0,56*	N/A
5a	0,63*	0,65*	N/A
5b	0,83#	0,59#	N/A
5c	0,88#	0,24#	N/A
5d	0,40*	0,48*	N/A
5e	0,35*	0,43*	N/A
6a	0,70*	0,55*	N/A
6b	0,42#	0,61#	N/A
6c	0,27#	0,27#	N/A
6d	0,18*	0,25*	N/A
6e	0,40*	0,29*	N/A
6f	0,23*	0,53*	N/A

** Intra-Class Coefficient; # Kappa Agreement Coefficient; & Cronbach alfa; N/A – Not applicable*

Table 3. TAPES-R and PEQ subscales correlation

	Correlation	p
Psychosocial Adjustment		
General Adjustments	0.264	0.076
Social Adjustments	0.1	0.51
Activity Restriction	-0.654	0.001*
Satisfaction with prosthesis use		
Aesthetic	0.578	0.001*
Functional	0.74	0.001*
Degree of satisfaction with the prosthesis	0.704	0.001*

**Significance level p<0,05*

DISCUSSION

O The intra-observer reliability coefficients for the first part of the TAPES-R were considered satisfactory since only the aesthetic satisfaction subscale presented a coefficient below 0.7, even though it was close to acceptable (ICC= 0.63).

This finding agrees with the study by Mazaheri et al.[8] as they reported that only one variable had a value close to acceptable.

Most coefficients can be classified as nearly acceptable regarding inter-observer reliability, except for the social adjustment subscale. However, inter-observer reliability was not reported in the original validated versions of the TAPES-R.[4,7,8] Therefore, our results on the inter-observer assessments indicate that this evaluation tool is stable when applied by more than one observer.

In the second part of TAPES-R, regarding the numerical variables of the inter and intra-observer evaluation, the ICC was considered good, except for questions 4c, 5b, 5c, 6b, and 6c.

These questions refer to stump pain, phantom limb pain, and health problems of the previous week (the time in between the two evaluation moments). Hence, we assumed that the differences in the values of these items between both evaluation moments were not considered reasonable due to the occurrence of variation in stump pain, phantom limb pain, or health problem inherent to the pathology itself, nor to internal consistency.

Regarding the agreement analysis, the Kappa coefficient for categorical variables in the inter and intra-observer evaluations showed moderate to a strong agreement, except for items 2, 6d, 6e, and 6f, which were considered reasonable agreement.

To the best of our knowledge, no studies have been found that verified the psychometric properties of part 2 of TAPES-R. Therefore ours is the first to address this issue specifically.

Therefore, our results were not compared to other studies. According to the literature, all internal consistency, tested with Cronbach's Alpha, of the TAPES-R first part subscales, was acceptable. This result was similar to that found in the original version of TAPES, as well as in other publications that tested the psychometric properties of TAPES-R.[4,8]

Regarding the concurrent validity between the TAPES-R and the PEQ, correlations from moderate to strong were observed in the subscales of activity restriction and aesthetic, functional, and use of the prosthesis satisfaction. The general and social adjustments did not correlate with the PEQ domains once different questions address such domains. In TAPES-R, one of the items regarding social adjustment is “I don't care if someone looks at my prosthesis,” whereas the PEQ addresses this issue with “Assess how much your prosthesis has been a problem for your (a) partner."

In the study by Gallagher & MacLachlan,[4] significant correlations were found between TAPES and quality of life assessment scale (The World Health Organization Quality of Life – WHOQOL-bref). However, the same study suggests the concurrent validity of PEQ with WHOQOL-bref is yet to be established. Therefore, it is convenient to use the WHOQOL-bref and the PEQ to confirm their concurrent validity in general and social adjustment in future studies.

CONCLUSION

The assessment of psychometric properties allows us to conclude that the final version of the TAPES-R is valid, reliable, and has good internal consistency to be applied to Brazilian adults with lower-limb amputations. We also consider it is relevant that further studies on the validity and reliability of the TAPES-R should be conducted in Brazil.

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