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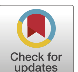

Translation, cultural adaption, and measurement properties of the Brazilian Portuguese version of the dialysis patient-perceived exercise benefits and barriers scale (DPEBBS–BP)

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ABSTRACT

Objective: To translate, culturally adapt, and evaluate the measurement properties of the Dialysis Patient-Perceived Exercise Benefits and Barriers Scale (DPEBBS) in people on hemodialysis in Brazil.
Design: This methodological study adhered to COSMIN recommendations.
Methods: A multi-method approach: (1) the translation and cultural adaptation, and (2) a cross-sectional survey in people on hemodialysis to assess measurement properties. Factor structure was assessed through confirmatory factor analysis. Convergent validity was tested using Pearson or Spearman correlations. Internal consistency was estimated with Cronbach's alpha (α) and test-retest reliability with Intraclass Correlation Coefficient (ICC). Measurement error was evaluated through the Standard Error of Measurement (SEM) and the minimal detectable change (MDC).
Results: After translating, seven experts determined that the Brazilian Portuguese version of the Dialysis Patient-Perceived Exercise Benefits and Barriers Scale (DPEBBS-BP) was applicable. Additionally, the inclusion of six items was suggested. In the evaluation of measurement properties, 299 participants were included (57.2 ± 15.3 years, 64% male). Confirmatory factor analysis produced a seven-factor solution, which represented 59% of the explained variance of the construct. For convergent validity, the barriers score showed moderate correlations with the Duke Activity Status Index (DASI) and with the functional capacity domain of the SF-36. The internal consistency for benefits was $\alpha = 0.87$, and barriers $\alpha = 0.80$. The ICC for benefits and barriers was 0.90 and 0.81, respectively. The SEM and MDC for the benefits were 1.83 and 5.07, while 2.70 and 7.50 for the barriers.
Conclusion: The DPEBBS was translated and adapted to Brazilian Portuguese and presented adequate measurement properties.

Introduction

Physical exercise is a safe and beneficial intervention for individuals on hemodialysis, improving cardiovascular health, physical function, and quality of life.[1–3] However, despite these benefits, exercise participation remains low and is poorly integrated into kidney care routines.[4,5] In this context, investigating perceived benefits and barriers to exercise has emerged as a crucial factor for improving adherence among these individuals.[6] Delgado and Johansen demonstrated that, despite the numerous documented benefits, 92% of individuals with End-Stage Kidney Disease (ESKD) reported encountering at least one barrier to exercise participation.[7] Commonly reported barriers include tiredness, muscle fatigue in the lower limbs, and body pain.[8–10]

Questionnaires are recognized as cost-effective tools that provide an objective means of gathering information from large samples.[11] In a systematic review conducted by our research group, we observed that the assessment of perceived benefits and barriers to exercise has largely relied on a single instrument: the "Dialysis Patient-Perceived Exercise Benefits and Barriers Scale" (DPEBBS), which is considered reliable, valid, and structurally adequate.[12] The DPEBBS has been used in five

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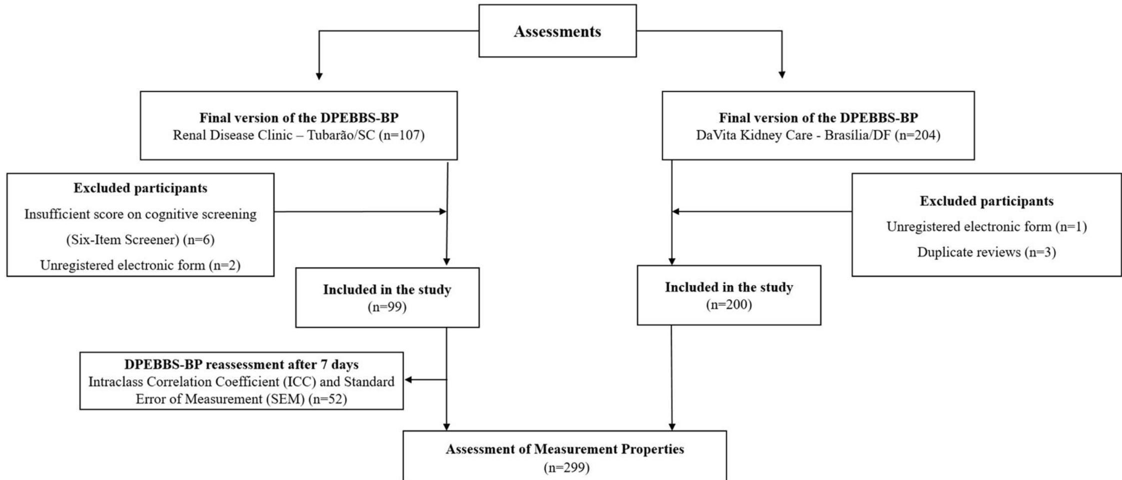

Fig. 1. Flowchart of recruitment of study participants. Source: Author (2024).

studies, showing positive results in 6 out of 9 psychometric properties. However, it has been validated for use only for English, Chinese,[13] and Turkish speaking patients,[14] which may contribute to its limited application in research studies.[12] Moreover, the DPEBBS has yet to be translated, culturally adapted, and validated for other languages, including Brazilian Portuguese.

Given the burden of ESKD,[5] this study is essential to address an existing gap by providing a validated tool that accurately assesses exercise perceptions among Brazilian Portuguese-speaking hemodialysis patients. Therefore, the aim of this study was to translate, culturally adapt, and assess the measurement properties of the DPEBBS in people with hemodialysis in Brazil.

Methods

Design and procedures

This study followed a multi-method approach with two phases: (1) translation and cultural adaptation of the DPEBBS to Brazilian Portuguese (DPEBBS-BP) following best practices,[15] and (2) a cross-sectional survey to evaluate its measurement properties in individuals with ESKD. Ethical approval was granted by the Human Research Ethics Committee of the Federal University of Santa Catarina, Brazil (CAAE: 65,560, 222.8.0000.0121), and all participants provided written informed consent.

The validation process for the Brazilian Portuguese version of the DPEBBS-BP was conducted in this study. The questionnaire was originally developed in English and Chinese, it assesses various aspects such as knowledge, daily life, symptoms, physical function, care needs, adverse outcomes associated with exercise, and general information. Consists of 24 items, with 12 focusing on benefits and 12 on barriers. Each item is rated on a 4-point Likert scale, where 1 means "completely disagree", 2 "disagree", 3 "agree" and 4 "completely agree". The total possible scores range from 24 to 96, with higher scores reflecting greater awareness of the benefits and barriers of exercise. Additionally, includes two open-ended questions.[13]

Phase 1: translation and cultural adaptation

The original authors granted permission to translate, culturally adapt, and evaluate the DPEBBS (**Supplemental Appendix 1**). Two sworn bilingual translators, native in Portuguese and unfamiliar with the concepts or the medical field, independently translated the scale. The translations were then synthesized by two study managers during the reconciliation stage. A back-translation was then conducted to ensure the translated version accurately reflected the original content. Using the synthesized translations, a fluent translator with knowledge of the study's objectives back-translated the questionnaire into English. In the harmonization stage, all versions were compared with the original to ensure consistency. A final consensus was then reached to produce the finalized DPEBBS-BP.[16]

Subsequently, an expert committee of seven nephrology professionals (three physical therapists, two exercise physiologists, one nurse, and one nephrologist) independently assessed each item of the translated scale.[17] The committee members held master's to doctorate degrees, with nephrology experience ranging from 5 to 19 years (average 11 ± 5.53 years).

The instrument was distributed to the experts in two stages via electronic forms (Google Forms). Members assessed the theoretical relevance of each item using a Likert scale: 1 = not relevant, 2 = needs major revision to become relevant, 3 = relevant but needs minor changes, and 4 = absolutely relevant. For items rated between 2 and 3, suggestions for modifications were solicited. Based on a preliminary literature review, ten items were proposed to accurately reflect the perception of benefits and barriers to physical exercise among individuals on hemodialysis in Brazil.

Following the expert review, the questionnaire was adapted based on the feedback received. Thereafter, for the pilot test, twenty-one participants were randomly selected from the Nephrology Clinic in Araranguá-SC[13] to complete the questionnaire, with completion times recorded. Participants assessed the clarity of each item on a Likert scale from 1 (not clear) to 5 (very clear), with scores below 3 evaluated separately for further review. This pilot test aimed to assess the comprehensibility and cognitive equivalence of the translation. The results from this stage guided the refinement of the Brazilian Portuguese version of the DPEBBS, which determined the final version of the questionnaire (See **Supplemental Appendix 2 and 4).**

Phase 2: measurement properties

Participant recruitment for Phase 2 occurred between May to November 2023. After providing informed consent to participate in this phase of the study, individuals with ESKD were interviewed by trained assessors to ensure consistency and accuracy in data collection.

The measurement properties of the instrument were rigorously evaluated, including structural and convergent validity, internal consistency, test-retest reliability, and measurement error. These assessments were conducted following standards established by Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) to ensure reliable evaluation of the instrument's performance.[18]

Participants and setting

Participants in Phase 2 were required to have ESKD, undergo hemodialysis for at least three months, attend 2–6 sessions per week (2–4 h each), and be 18 or older.[13] Exclusion criteria included inability to read/write or comprehend the procedures, as indicated by a Six-Item Screener score of ≤ 3.[19] The DPEBBS-BP was administered to patients at the Kidney Disease Outpatient Clinic in the city of Tubarão (Brazil), and at five DaVita Kidney Care units in Brasília (Brazil).

Sample size

The sample size calculation was based on Kline's (1993) recommendation, which suggests a minimum of 10 subjects per item of the instrument. Given that the DPEBBS-BP consists of 30 items, a sample size of 300 participants was considered adequate.[20] To evaluate the test-retest reliability of the DPEBBS-BP, the instrument was randomly reapplied to 52 individuals (49.8 ± 15.5 years, 67.3% men) at the Renal Disease Clinic in Tubarão. All participants were clinically stable between the two assessments. Furthermore, evaluators ensured that standardized procedures were consistently followed for both assessments. The interval between the test and retest was 7 days.[11,13] Fig. 1 presents the flowchart with the different stages of the participant recruitment process.

Measures

Sociodemographic and clinical characteristics were collected through investigator-generated items with choice response options. Participants also provided self-reported data on exercise.

In addition to the primary measurements, the *Associação Brasileira de Empresas de Pesquisa* (ABEP) questionnaire assessed participants' socioeconomic status, categorizing them into six strata (A, B1, B2, C1, C2, DE), which were grouped into high, average, and low socioeconomic classes.[21] The Duke Activity Status Index (DASI), validated for Brazilian Portuguese, assessed functional status with 12 items covering daily activities, weighted by metabolic costs (MET). Scores range from 0 to 58.2, with higher scores indicating better functional capacity.[22] Finally, quality of life was evaluated using the Short Form Health Survey (SF-36) questionnaire, a multidimensional instrument comprising 36 items across eight domains.[23]

Statistical analysis

Analyses were performed using SPSS v29.0.2.0. Data distribution was assessed with the Shapiro-Wilk test. Parametric data were expressed as mean ± SD and 95% confidence intervals, while non-parametric data as median (IQR). Student's t-test or Mann-Whitney U test was used for two-group comparisons, and ANOVA or Kruskal-Wallis for three or more groups, depending on data distribution. Effect sizes (ES) were calculated for these comparisons. A significance level of 5% was applied to all tests.

Content validity was evaluated using the Content Validity Index (CVI), with an acceptable threshold set at ≥ 0.80.[24] The factor structure was assessed through Confirmatory Factor Analysis (CFA). The component method for factor extraction was used, including only factors with eigenvalues > 1.0. A correlation matrix was generated after factor selection, and item-factor associations were examined through factor loadings greater than 0.30 on a single factor. The Varimax rotation method with Kaiser normalization was applied to interpret the matrix. The Kaiser-Meyer-Olkin (KMO) index and Bartlett's test of sphericity (χ^2) were conducted. According to Hair et al. (2009), a KMO value above 0.80 is considered satisfactory for sample adequacy.[25]

To assess convergent validity, correlation coefficients between the DPEBBS-BP benefits and barriers scores and ABEP, DASI and SF-36 questionnaire scores were calculated using Pearson or Spearman correlation tests, depending on data distribution. The socioeconomic level of participants was assessed using the ABEP questionnaire, functional capacity with the DASI questionnaire, and quality of life with the SF-36 instrument, evaluating each domain separately. Correlation magnitudes were classified as follows: minimal or absent (r < 0.25); weak (r between 0.25 and 0.50); moderate (r between 0.50 and 0.75); and strong (r > 0.75).[26]

Internal consistency was assessed using Cronbach's alpha coefficient. Values greater than 0.70 indicated acceptable internal consistency, those above 0.80 were considered good, and values exceeding 0.90 were deemed excellent.[27] Reliability was assessed using the Intraclass Correlation Coefficient (ICC) with 95% confidence intervals, based on test-retest responses for the total benefits and barriers scores. Coefficients of ≤ 0.40 were considered low, 0.40 to 0.75 were classified as moderate, ≥ 0.75 to 0.90 as adequate, and ≥ 0.90 as excellent.[28]

Measurement error was calculated using the Standard Error of Measurement (SEM) with the formula: $SEM = SD \times \sqrt{(1 - ICC)}$, and the Minimal Detectable Change (MDC) using the formula: $MDC = SEM \times 1.96 \times \sqrt{2}$. These results were derived from test-retest reliability analyses.[11,29]

Finally, a total mean DPEBBS-BP score was calculated to understand the perception of benefits and barriers of people on hemodialysis in Brazil.

Table 1
Characteristics of the participants (n = 299).

Characteristics	Mean ± SD
Age (years)	57.2 ± 15.3
Comorbidities	**n (%)**
Diabetes	26 (8.70)
Hypertension	106 (35.45)
Diabetes + Hypertension	86 (28.76)
Heart failure	78 (26.10)
Obesity	45 (15.05)
Neuropathies	5 (1.67)
CAD	34 (11.37)
Arrhythmias	31 (10.36)
Stent Placement	5 (1.67)
Pneumopathies	13 (4.34)
Others	15 (4.97)
CKD etiology	**n (%)**
Diabetes	63 (21.07)
Hypertension	60 (20.06)
Diabetes + Hypertension	30 (10.03)
Glomerulonephritis	29 (9.69)
Polycystic Kidneys	27 (9.03)
Medicines	20 (6.68)
Others	66 (22.07)
Unknown	19 (6.35)

Legends: CAD, Coronary Artery Disease; CKD, Chronic Kidney Disease; SD, Standard Deviation.

Results

Phase 1: translation and cultural adaptation

After translating and harmonizing the DPEBBS-BP, the seven specialist health professionals determined that all 24 items from the original version of the DPEBBS were applicable to individuals on hemodialysis in Brazil. Changes were suggested for the following items: 1, 4, 7, 12, 14, 17, 20 and 24 while minor revisions were made to items 2, 5, 11, 15, 19, 21, 22 and 23 based on expert feedback. Additionally, the expert committee suggested new topics, resulting in the inclusion of six items - three addressing benefits and three addressing barriers. The CVI of 0.93 confirmed that the DPEBBS-BP has acceptable content validity. **Supplemental Appendix 2** presents the English version of the DPEBBS, the version sent to the expert committee, and the adjustments made as suggested by the members of the expert committee. In the pilot test, the 21 participants (52.3 years ± 15.1, 76% male) took an average of seven minutes to complete the questionnaire. After this step, small changes

Table 2
Clinical and demographic characteristics of the participants, scores, benefits, and barriers (n = 299).

Characteristics	n (%)	Mean Total Benefits	*p* Value	Effect size	Mean Total Barriers	*p* Value	Effect size
Age (years)							
< 65	195 (65.2%)	50 (44 - 54)	0.029*	0.13	34 (30 - 39)	0.016**	0.14
≥ 65	104 (34.8%)	47 (43 - 52)			37 (33 - 40)		
Sex							
Female	106 (35.5%)	47 (43 - 53)	0.233	0.07	36 (32 - 41.25)	0.023**	0.13
Male	193 (64.5%)	48 (44 - 54)			35 (30 - 39)		
Years of formal education (years)							
< 8	81 (27.1%)	47 (44 - 55)	0.632[a]	0.0008	37.11 ± 6.70 95%CI 35.65, 38.57	0.227[a]	
Between 8 and 11	102 (34.1%)	47 (43 - 53)	0.436[b]		35.25 ± 6.88 95%CI 33.92, 36.58	0.361[b]	0.04
> 11	116 (38.8)	49.50 (43 - 54)	1.00[c]		33.78 ± 7.28 95%CI 32.46, 35.10	0.003[c,**]	
Socioeconomic level (ABEP questionnaire)							
High	137 (45.8%)	50 (43.50 - 54.50)	0.490[d]	0.0004	33.36 ± 6.98 95%CI 32.20, 34.53	0.001[d,**]	
Average	107 (35.8%)	47 (43 - 53)	0.740[e]		36.62 ± 7.17 95%CI 35.26, 37.98	1.00 [e]	0.06
Low	55 (18.4%)	47 (44 - 54)	1.00[f]		36.93 ± 6.21 95%CI 35.29, 38.57	0.004[f,**]	
Hemodialysis vintage (months)							
≤12	51 (17.1%)	47 (44 – 54)	0.440	0.05	36.22 ± 6.36 95%CI 34.47, 37.97	0.390	0.19
> 12	248 (82.9%)	48 (43.25 – 54)			34.94 ± 7.23 95%CI 34.04, 35.84		
Frequency of Hemodialysis							
2 and 3x/week	188 (62.9%)	48 (43.25 - 54)	0.924	0.005	35 (31 - 41)	0.372	0.05
4 to 6x/week	111 (37.1%)	48 (44 - 54)			36 (31 - 40)		
Duration of Hemodialysis (hours)							
2 to 3	160 (53.5%)	50 (44 - 54)	0.136	0.09	35 (30 - 39)	0.010**	0.15
3.5 to 4	139 (46.5%)	47 (43 - 53)			36 (32 - 41)		
Hemodialysis Access							
Arteriovenous fistula	260 (87%)	48 (44 - 54)	0.062	0.11	35.10 ± 7.16 95%CI 34.23, 35.97	0.583	0.10
Catheter	39 (13%)	47 (43 - 50)			35.77 ± 6.72 95%CI 33.67, 37.88		
Currently practice physical exercise							
Yes	200 (66.9%)	49 (45 - 54)	0.001*	0.19	33.88 ± 6.56 95%CI 32.97, 34.79	0.000007*	0.55
No	99 (33.1%)	45.50 (41 - 53)			37.77 ± 7.49 95%CI 36.29, 39.25		

Data are presented as mean ± standard deviation and 95% confidence interval (CI) or median (interquartile range: 25–75%).
* *p* Value < 0.05 for benefits.
** *p* Value < 0.05 for barriers.
[a] Comparison difference between the groups less than 8 years and between 8 and 11 years of education.
[b] Comparison difference between the groups between 8 and 11 years and more than 11 years of education.
[c] Comparison difference between the groups less than 8 years and more than 11 years of education.
[d] Comparison difference between high and average socioeconomic level.
[e] Comparison difference between average with low socioeconomic level.
[f] Comparison difference between low with high socioeconomic level.

were made to improve the agreement of the sentences, and item 3 was modified. In this process, "Exercise can delay the loss of body function (e.g., walking, running, balance)" was changed to "Exercise can postpone the decline of body function". See **Supplemental Appendix 2 and 4**.

Phase 2: measurement properties

Participant characteristics, benefit and barrier scores, and correlates

The final sample consisted of 299 participants with a mean age of 57.2 years ± 15.3 and 64% were male. The primary causes of chronic kidney disease were diabetes mellitus (21%) and hypertension (20%). The detailed characteristics of the participants included in the study are presented in Table 1.

As presented in Table 2, the average score for perceived benefits was 48.33 ± 6.29, while the average score for barriers was 35.18 ± 7.09. Younger individuals (p = 0.029; ES = 0.13) and those who reported engaging in exercise (p = 0.001; ES = 0.19) perceived greater benefits. Conversely, older individuals (p = 0.016; ES = 0.14) and women (p = 0.023; ES = 0.13) reported encountering more barriers.

Individuals with < 8 years of education had higher barrier scores compared to those with more than 11 years of education (p = 0.003; ES = 0.48). Those of high social status showed significantly lower barrier scores compared to those in middle (p = 0.001; ES = 0.46) and low social classes (p = 0.004; ES = 0.54). Individuals who spent more time undergoing the hemodialysis treatment per session (3.5 to 4 h) had higher barrier scores (p = 0.010; ES = 0.15). Additionally, individuals who engaged in exercise perceived fewer barriers (p = 0.000007; ES = 0.55).

Evaluation of measurement properties

The KMO measure of sampling adequacy was 0.85, and Bartlett's test of sphericity was significant (χ^2[435] = 3300.162, p < 0.001), indicating the suitability of the data for factor analysis. The CFA revealed a seven-factor solution, accounting for 59% of the explained construct variance. All items loaded adequately on their respective factors. The factors were named according to the underlying constructs associated with the items: benefits related to daily life and physical function; barriers related to exercise-associated outcomes; barriers related to

Table 3
Confirmatory factor analysis of the DPEBBS-BP, reliability of factors and mean scores by item, n = 299.

Item	Factor 1: Benefits related to daily life and physical function	Factor 2: Barriers related to exercise-associated untoward outcomes	Factor 3: Barriers related to symptoms	Factor 4: Barriers related to care needs	Factor 5: Benefits related to willingness to exercise and self-care perception	Factor 6: Barriers related to information	Factor 7: Benefits related to psychological health
1. O exercício ajuda a diminuir meus gastos financeiros totais com assistência médica e tratamentos de saúde.	0.72						
2. O exercício ajuda a diminuir as dores no meu corpo.	0.72						
3. O exercício pode adiar o declínio da função do corpo.	0.70						
4. O exercício previne o enfraquecimento dos músculos.	0.73						
7. O exercício melhora a minha saúde óssea.	0.70						
10. O exercício melhora o meu apetite.	0.40						
16. O exercício melhora a minha qualidade de vida.	0.58						
20. O exercício pode auxiliar na manutenção do meu peso corporal.	0.40						
Q2. O exercício melhora a força dos músculos dos braços e das pernas.	0.51						
Q3. O incentivo da equipe de diálise me motiva a participar do exercício.	0.34						
8. O exercício é prejudicial para a saúde dos pacientes em diálise.		0.70					
14. O exercício não é adequado para mim, pois tenho outros problemas de saúde.		0.70					
18. Eu me preocupo que o exercício possa me deixar com sede.		0.53					
19. O exercício não é adequado para mim, pois tenho doença renal.		0.80					
21. Eu me preocupo que o exercício possa afetar a minha fístula arteriovenosa/ cateter.		0.70					
5. O cansaço impede que eu pratique exercícios.			0.79				
11. O cansaço muscular nas pernas impede que eu pratique exercícios.			0.79				
15. Dores no corpo impedem que eu pratique exercícios.			0.73				
9. Tenho medo de cair durante o exercício.				0.64			
24. Exercícios ao ar livre atrapalham a vida da minha família porque eu precisoda companhia deles quando eu saio.				0.66			
Q5. Tenho medo de que minha pressão se altere durante o exercício.				0.58			
Q6. A falta de profissionais do exercício (fisioterapeutas e profissionais de educação física) dificulta que eu pratique exercícios.				0.67			
22. O exercício pode ajudar a aumentar o meu autocuidado.					0.66		

(*continued on next page*)

Table 3 (*continued*)

Item	Factor 1: Benefits related to daily life and physical function	Factor 2: Barriers related to exercise-associated untoward outcomes	Factor 3: Barriers related to symptoms	Factor 4: Barriers related to care needs	Factor 5: Benefits related to willingness to exercise and self-care perception	Factor 6: Barriers related to information	Factor 7: Benefits related to psychological health
23. O exercício pode impedir de ter outras doenças (por exemplo, resfriado).					0.81		
Q1. O exercício me faz sentir mais disposto.					0.42		
12. Eu não tenho muito conhecimento sobre os benefícios do exercício.						0.71	
17. Eu não tenho muito conhecimento sobre como realizar o exercício.						0.73	
6. O exercício melhora o meu humor.							0.33
13. O exercício me ajuda a levar uma vida ativa e otimista.							0.37
Q4. Não me sinto motivado(a) a praticar exercício.							0.40
Variance explained	**16.0%**	**9.7%**	**8.4%**	**7.5%**	**6.5%**	**6.1%**	**5.3%**
Eigenvalues	**7.0**	**3.1**	**2.4**	**1.6**	**1.4**	**1.3**	**1.1**
Reliability	**0.8**	**0.7**	**0.8**	**0.7**	**0.7**	**0.7**	**0.7**

Legends: Q1-Q6 items included in the questionnaire.

symptoms and care needs; benefits related to willingness to exercise and self-care perception; barriers related to information; and benefits related to psychological health (Table 3 and Fig. 2).

For convergent validity, the DPEBBS-BP barrier scores showed moderate correlations with the DASI ($r = -0.503$; $p = 0.001$) and the functional capacity domain of SF-36 ($r = -0.521$; $p = 0.001$). Detailed results can be found in **Supplemental Appendix 3**.

Regarding the internal consistency of the DPEBBS-BP, Cronbach's alpha coefficients were 0.87 for the benefits scores and 0.80 for the barriers scores. The ICC for the benefits scores was 0.90 (95% CI, 0.85, 0.93) and 0.81 (95% CI, 0.73, 0.88) for the barriers scores. The SEM and MDC were 1.83 and 5.07 for benefits scores, and 2.70 and 7.50 for barriers scores.

DPEBBS-BP score

The final version of the DPEBBS-BP is available in **Supplemental Appendix 4** with the mean and standard deviation of the DPEBBS-BP questions presented in **Supplemental Appendix 5.** The items with the highest scores for benefits were: "Q3. Encouragement from the dialysis team motivates me to participate in the exercise" 3.44 ± 0.54 (95% CI 3.38–3.50), "4. Exercise prevents muscle weakening" 3.36 ± 0.58 (95% CI 3.29, 3.43), and "Q2. Exercise improves the strength of the muscles in your arms and legs. " 3.33 ± 0.67 (95% CI 3.25, 3.41). The most scored items for barriers were: "5. Fatigue prevents me from exercising" 3.47 ± 0.53 (95% CI 3.41, 3.53), "8. Exercise is harmful to the health of dialysis patients" 3.41 ± 0.53 (95% CI 3.35, 3.47) and "21. I worry that exercise may affect my arteriovenous fistula/catheter" 3.39 ± 0.70 (95% CI 3.31, 3.47).

Discussion

The development of the DPEBBS-BP addresses a critical gap in understanding the benefits and barriers to physical exercise among individuals on hemodialysis in Brazil. Prior to this adaptation, there was a lack of culturally relevant tools specifically designed for this population, which limited the ability to accurately assess and address their exercise-related needs and challenges. Evaluating the measurement properties and clinical viability of instruments is essential to avoid the use of measures with low quality and little applicability.[30] In this context, the main results of this study demonstrate that the DPEBBS-BP is a valid and reliable instrument for evaluating these factors in the Brazilian setting.

The confirmatory factor analysis supported a robust seven-factor structure, accounting for a significant portion of the variance, indicating that the translated instrument effectively captures the intended constructs. The DPEBBS-BP demonstrated strong internal consistency and test-retest reliability, confirming its stability over time. Additionally, the moderate correlations between the DPEBBS-BP barrier scores and established measures of functional capacity highlight its relevance in assessing key aspects of participants' experiences with exercise. During the adaptation process, all 24 original items of the scale were retained, while 6 new items were added to better reflect cultural and contextual factors. Furthermore, 9 items were revised to enhance clarity and comprehension based on feedback from both experts and the target population. As a result, the final version of the DPEBBS-BP consists of 30 items - 15 addressing perceived benefits and 15 addressing perceived barriers to exercise. The authors recommend evaluating these domains separately to facilitate a more nuanced interpretation of the results. The successful adaptation of the DPEBBS-BP offers a valuable tool for clinical practice and research, enabling healthcare professionals to better understand exercise perceptions among Brazilian individuals undergoing hemodialysis. This, in turn, can inform more targeted interventions and support strategies to improve patient adherence and outcomes.

In addition to our study, the DPEBBS has been validated by only two other research teams: one for the English and Chinese versions and the other for the Turkish version. [13,14] Our confirmatory factor analysis revealed a seven-factor solution that accounts for 59% of the variance, closely aligning with Zheng's six-factor solution (57% variance) and Tas and Akyol's five-factor solution (58% variance). While our analysis introduced two new factors - “Benefits related to willingness to exercise and self-care perception” and “Benefits related to psychological health” - the findings remain consistent with those reported by Zheng et al. and Tas and Akyol in terms of reliability. For a better view of comparisons between studies, see **Supplemental Appendix 6**. These studies demonstrate that, despite variations in factor structures and measurement properties, culturally specific adaptations like the DPEBBS-BP are crucial for addressing the unique needs of Brazilian individuals on hemodialysis.

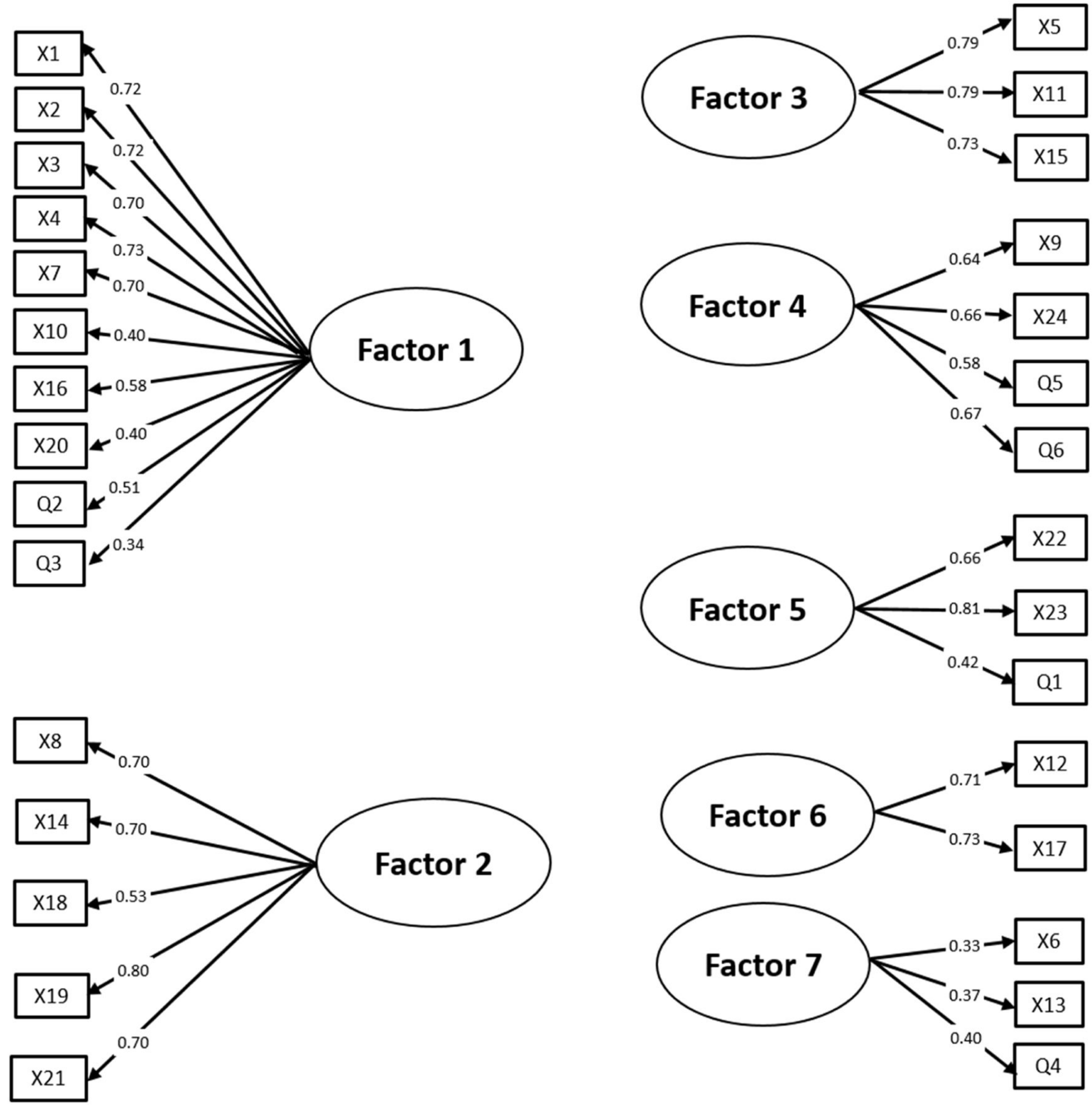

Fig. 2. Confirmatory Factor Analysis, seven factors.

To our knowledge, this study is the first to examine the correlations between benefit and barrier scores and variables such as socioeconomic status, functional capacity, and quality of life. While a previous study utilized the DPEBBS to assess the perception of benefits and barriers in relation to quality of life, using the KDQOL questionnaire, it focused solely on quality of life and found a significant correlation with DPEBBS scores ($r = 0.55$, $p < 0.001$).[8] In contrast, our study is pioneering in its exploration of how benefit and barrier scores relate to functional capacity. We found that participants with greater functional capacity, as measured by the DASI questionnaire and the functional capacity domain of the SF-36, reported fewer barriers to exercise. This suggests that individuals with higher functional capacity are better able to overcome perceived barriers.

This study also represents the first effort to calculate the SEM and the MDC for the DPEBBS-BP scale. The values presented provide a reference point for future research studies that will help to identify the lowest score needed to detect change between two assessments. In our analysis, we found that the average benefit and barrier scores related to age and self-reported physical activity exceeded the SEM value for benefits, and age and socioeconomic status differences between the upper and middle classes surpassed the SEM for barriers. These findings reflect statistical significance and also highlight clinically relevant differences, underscoring the practical utility of the DPEBBS-BP in assessing meaningful changes in the perceptions of individuals with ESKD over time.

Participants in this study reported higher scores for benefits compared to barriers, reflecting a greater awareness of the advantages of exercise. Items related to daily life and physical function received the highest scores. In contrast, items related to disease symptoms and potential adverse effects of exercise received the highest scores for barriers. These challenges should be addressed through educational interventions that encourage exercise, promoting a more active and healthy lifestyle for people with chronic kidney disease.[4,31,32]

Limitations

This study has some limitations. The lack of laboratory data limits a comprehensive health assessment of participants. Socioeconomic status was assessed using a Brazilian-specific tool, which may not reflect conditions in other countries, making extrapolation challenging. The sample, though adequate, was drawn from specific centers and may not represent the full diversity of Brazilian hemodialysis patients. The use of self-reported measures for physical activity could introduce recall and

social desirability biases. Additionally, cultural differences in exercise perceptions may still influence responses despite the adaptation of the DPEBBS-BP.

Implications

The findings of this study have some important implications for both clinical practice and future research. The validation of the DPEBBS-BP for Brazilian individuals on hemodialysis provides a robust tool to assess perceptions of benefits and barriers to exercise. Despite being an individual response, it was observed that older individuals, women, those with fewer years of formal education, and those with lower socioeconomic status perceived more barriers. This may be a guide for some actions regarding individuals on hemodialysis treatment. By identifying specific benefits and barriers related to daily living, physical function, and psychological health, health professionals can develop targeted educational and motivational strategies to address the unique challenges faced by this population. Furthermore, the correlation of barrier scores with functional capacity highlights the need for comprehensive support systems that address physiological factors that affect individual participation. Future research should explore changes in perceptions, test interventions and expand the application of the DPEBBS-BP.

Conclusion

This study successfully validated the DPEBBS-BP, providing a reliable and culturally relevant instrument to assess perceptions of exercise among Brazilian people with hemodialysis. The results demonstrated a strong alignment with previous studies while also highlighting unique factors specific to this population, such as benefits related to willingness to exercise and psychological health. Additionally, the correlations identified between barrier scores, functional capacity offer valuable insights for healthcare professionals to develop more comprehensive, patient-centered care plans.

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Ethical approval

This study was carried out in accordance with the principles of the Declaration of Helsinki. The approval was granted by the Ethics and Research Committee on Human Beings (CEPSH) of the Federal University of Santa Catarina (UFSC), under approval number 65,560,222.8.0000.0121.

Consent to participate and publish

Informed consent was obtained from all individual participants included in the study.

CRediT authorship contribution statement

Marcieli A. Martins: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Gabriela L.M. Ghisi:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Marvery P. Duarte:** Investigation, Resources. **Jacqueline F.S. Monteiro:** Investigation, Resources. **Heitor S. Ribeiro:** Investigation, Resources, Writing – review & editing. **Danielle S.R. Vieira:** Data curation, Formal analysis, Writing – review & editing. **Daiana C. Bundchen:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors have no relevant financial or non-financial interests to disclose.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.bjpt.2026.101601.

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