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Original Article

Psychometric validity of the Exercise Benefits/Barriers Scale, Brazilian version, in adults and older adults with cardiovascular diseases

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ABSTRACT

Objective: to describe the internal consistency and construct validity of the Exercise Benefits/Barriers Scale, Brazilian version, for adults and older adults with cardiovascular disease. **Methods:** this is a methodological study with 121 participants. The scale has 42 items divided into barriers (14 items) and benefits (28) subscales. The total score was between 42 and 168. Higher values indicate greater perception of benefits and lower perception of barriers to exercise. Internal consistency, construct validity (convergent and divergent) and the presence of ceiling and floor effects were described. **Results:** among the participants, 58.7% were male, with a mean age of 58.2 years (SD = 13.2) and low education (mean = 7.9 years; SD = 4.5). Cronbach's alpha values were 0.92 (total scale), 0.95 (benefits) and 0.65 (barriers). A negative and moderate linear correlation was verified between the total scores of the scale and the Cardiac Rehabilitation Barriers Scale ($r=-0.513$; $p<0.001$). Convergent and divergent validity were satisfactory according to multitrait-multimethod analysis. The presence of a ceiling effect was observed in 75% of benefits subscale items and a floor effect in item 12 of the barriers subscale. **Conclusion:** the instrument showed satisfactory internal consistency and construct validity in a sample of Brazilian adults and older adults with cardiovascular diseases. Future investigations are recommended with the performance of confirmatory factor analysis, assessing individuals with cardiovascular diseases, higher education, undergoing different therapeutic modalities and coming from different regions of the country.

Descriptors: Validation Study; Nursing Methodology Research; Exercise; Perception; Cardiovascular Diseases; Psychometrics.

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INTRODUCTION

Cardiovascular diseases are the leading cause of death in Brazil[1] and include conditions such as coronary artery disease, heart failure, hypertension, and stroke[2]. Physical exercise is the main pillar of a cardiac rehabilitation program[3]. Important benefits have been associated with regular exercises, such as reducing mortality, disability, risk of myocardial infarction and hospitalizations, reducing general health costs, improving quality of life and cardiovascular capacity of individuals[3–5].

Perceptions of the benefits and barriers of exercising can affect individuals' behavior[6]. While individuals with a better perception of benefits are more likely to exercise[7], the perception of barriers consists of real or imaginary obstacles, inconveniences, difficulties and expenses that can negatively influence the performance of physical exercises. These barriers need to be identified by the health team with a view to individualized planning of cardiac rehabilitation. Barriers to participation and compliance with cardiac rehabilitation programs can be assessed using several instruments, including the Cardiac Rehabilitation Barriers Scale (CRBS)[8-9] and the Exercise Benefits/Barriers Scale (EBBS)[10]. The EBBS was translated, culturally adapted and psychometrically validated for Brazilian Portuguese with older adults from the community inserted in primary health care[7,11]. This study aimed to describe the internal consistency and construct validity of EBBS, Brazilian version, in Brazilian adults and older adults with cardiovascular diseases.

METHOD

This is a methodological study approved by the Research Ethics Committee (CAAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration) 24836819.9.0000.5393). A non-probabilistic and consecutive sample consisted of 121 individuals with cardiovascular diseases, treated at a university hospital located in the city of Ribeirão Preto, in São Paulo (SP), and who met the following inclusion criteria: being 18 years old or older, of both sexes, regardless of race; being under clinical follow-up at the referred hospital during the period of data collection; and having a confirmed diagnosis of cardiovascular disease. The established exclusion criteria were: presence of signs and symptoms of clinical decompensation at the time of the interview; not being oriented as to time, space and person.

Data collection began in January 2020, being resumed from September to November 2021 due to the coronavirus pandemic. Clinical variables were obtained from the participant's electronic medical

record, while sociodemographic characteristics were self-reported during the interview. All individual interviews took place in a single moment, with a mean duration of 15 minutes (SD = 6; range from 7 to 41 minutes).

EBBS, Brazilian version, translated and adapted into Portuguese (11) consists of 42 items, 14 of which are from the barriers subscale, and 28 from the benefits subscale, one item less than in the original version[10]. Responses to the EBBS items are provided on a Likert-type scale with four options: 4 (completely agree), 3 (agree), 2 (disagree) and 1 (completely disagree). The total EBBS score can vary from 42 to 168, and the higher the score, the more positively individuals perceive the benefits of physical exercise in relation to barriers.

The total scores of the two subscales can also be used individually. The EBBS-benefits subscale score varies from 28 to 112, being obtained with the sum of the values answered by the participants to the 28 items. Higher values indicate greater perception of benefits from physical exercise. However, to calculate the EBBS-barriers subscale score, the values answered for the 14 items must be reversed before summing, i.e., the value 1 becomes 4, the 2 is changed to 3, the value 3 to 2 and 4 to 1. Values can vary from 14 to 56, and higher values indicate greater perception of barriers to exercise[7,11].

The version validated for Brazil[9] of CRBS contains 21 items, divided into five subscales, and answered on a 5-point Likert scale, ranging from strongly disagree (value 1) to strongly agree (5). The total score ranges from 21 to 105, the higher the score, the greater the number of perceived barriers to cardiac rehabilitation[9].

Data were entered into a Microsoft Excel for Windows electronic spreadsheet, using the technique of double typing the responses obtained and subsequent verification. After validity, to minimize transcription errors, data were transported and descriptively analyzed in the IBM-SPSS program, version 26.0 for Windows (SPSS, Inc., Chicago, IL, USA). The internal consistency of the total EBBS and subscales was verified by Cronbach's alpha coefficient, with values above 0.7 considered acceptable[12]. Convergent construct validity was analyzed using the non-parametric Spearman's Linear Correlation test between EBBS (total and subscales) and CRBS measurements. A moderate correlation was considered when the coefficient was greater than or equal to 0.3[13]. Multitrait-multimethod analysis, to test convergent and divergent validity, was conducted in the Multitrait Analysis Program[14] to explore linear correlations between EBBS items and dimensions. Acceptable values of Pearson's linear correlation, between an item and the dimension to which it belongs, for

convergent validity, were those greater than 0.30[13]. As for divergent validity, the percentage of times in which the linear correlation between a given item and a dimension to which it belongs was greater, or statistically greater than its correlation with a dimension to which it does not belong, was verified. The fit index should be close to 100% to indicate discrimination between instrument dimensions. The presence of ceiling and floor effects was considered when the percentage of responses in the extreme values of EBBS was equal to or greater than 15%[12]. The significance level adopted was 0.05 for Spearman's test.

RESULTS

The study included 121 individuals. Most were male (58.7%), with a mean age of 58.2 (SD = 13.2), married (53.7%), with low education (mean of seven years of formal study), non-residents of the city where the study was located (61.2%). The mean family income was 3,151 reais (SD = 3,094) and 95 (78.5%) did not perform occupational activities at the time of the interview. Regarding clinical characterization, medical records were consulted in order to obtain data regarding the previous clinical history. The main cardiovascular diseases identified were heart failure (43.7%) and coronary artery disease (29.4%). Participants had, on average, two comorbidities, and used several medications (mean = 7; SD = 3). Regarding regular physical exercises, 57% reported exercising regularly, with walking being the most cited activity by participants (46.4%). However, the majority (62.3%) reported having started regular exercises less than a year ago.

Among the participants, the total EBBS score ranged from 99 to 154, with a median of 122 and mean of 125.2 (SD = 10.8). The mean benefit subscale score was 87.1 (SD = 9.2), with a median of 84 (range obtained from 63 to 111). In the barriers subscale, the mean was 38 (SD = 3.5), with the same value observed for the median (variation between 27 and 47). Cronbach's alpha coefficient values were 0.92 (EBBS – total), 0.95 (benefits) and 0.65 (barriers).

As for distribution of participants' response percentages, we found extreme values greater than 15% in the benefits subscale, characterizing the presence of a ceiling effect in 21 (75%) of the 28 items. The presence of a floor effect was not observed in the subscale of benefits. The results related to the 14 items of the barriers subscale showed no ceiling effect and the floor effect was observed only in item 12 ("*Você sente vergonha em praticar atividade física*."), which corresponds to 7% of the 14 items.

The results showed negative correlations of moderate intensity for most

correlations between the EBBS and CRBS measurements (Table 1).

Table 1 - Spearman correlation coefficients between the Exercise Benefits/Barriers Scale (total EBBS and subscales) and the Cardiac Rehabilitation Barriers Scale (total CRBS and subscales) measurements. Ribeirão Preto, SP, Brazil, 2021

Variables	EBBS* - total *Spearman's rho(p)*	EBBS - Benefits *Spearman's rho(p)*	EBBS - Barriers *Spearman's rho(p)*
Total CRBS†	-0,513(p<0,001)	-0,449(p<0,001)	-0,325 (p<0,001)
Subscales Comorbidities/ functional status	-0,569(p<0,001)	-0,534(p<0,001)	-0,370 (p<0,001)
Perceived needs	-0,352(p<0,001)	-0,294(p=0,001)	-0,226 (p=0,013)
Personal/Family problems	-0,280(p=0,02)	-0,290(p=0,001)	-0,134 (p=0,143
Work/travel conflicts	-0,324 (p<0,001)	-0,245 (p=0,007)	-0,301 (p=0,001)
Access	-0,444(p<0,001)	-0,398(p<0,001)	-0,287 (p=0,001)

EBBS*: Exercise Benefits/Barriers Scale; CRBS†: Cardiac Rehabilitation Barriers Scale.

EBBS was analyzed according to convergent and divergent construct validity through multitrait-multimethod analysis. Regarding convergent validity, most correlations between items and the dimensions they belong to were equal to or greater than 0.30 for the EBBS benefits and barriers subscales; therefore, convergent validity was considered satisfactory. As for divergent validity, for all dimensions, the percentages of times in which the correlation between an item and its dimension was greater or statistically greater than its correlation with a dimension to which it does not belong were close to 100% in most cases, showing satisfactory divergent validity (Table 2).

Table 2 - Adjustment values according to the multitrait-multimethod analysis for the Exercise Benefits/Barriers Scale (EBBS) scores. Ribeirão Preto, SP, Brazil, 2021

Variables	-2 (n items/%)	-1 (n items/%)	1 (n items/%)	2 (n items/%)	Adjustment (1 + 2) (n items/%)
Benefits subscale	0 (0)	0 (0)	1 (3.6)	27 (96.4)	**28 (100)**
Barriers subscale	1 (7.1)	2 (14.3)	6 (42.9)	5 (35.7)	**11 (78.6)**
Total	1 (2.4)	2 (4.8)	7 (16.7)	32 (76.2)	**39 (92.9)**

Considering:

-2: correlation between the item and the dimension to which it belongs is significantly lower than its correlation with the dimension to which it does not belong;

-1: correlation between the item and the dimension to which it belongs is less than its correlation with the dimension to which it does not belong;

1: correlation between the item and the dimension to which it belongs is greater than its correlation with the dimension to which it does not belong;

2: correlation between the item and the dimension it belongs to is significantly greater than its correlation with the dimension it does not belong to.

DISCUSSION

In this study, it was found that, for use in Brazil, only the EBBS[10] was available as a valid and reliable instrument to assess the benefits and perceived barriers to physical exercise among healthy adults and older adults. However, as the EBBS was designed for healthy populations, and validated in Brazil in older adults in the northeast of the country[7,11], it could not fully reflect the perceptions of individuals with cardiovascular diseases, which motivated us to develop this methodological study. It was investigated whether the EBBS psychometric properties would be maintained when used to identify the perceptions of adult Brazilian patients and older adults with different cardiovascular diseases about the barriers and specific benefits to regular physical exercises.

The most common barrier to physical exercises after cardiac surgery would be comorbidities[15]. Hypertension, diabetes mellitus and dyslipidemia were the most common comorbidities in our sample. The presence of hypertension or hyperlipidemia would be associated with a decrease in physical exercises[16]. Similar results were found in the validity study of EBBS in Mexico with 203 older adult women, predominantly hypertension (56%) and diabetes *mellitus* (37%)[17]. Patients with cardiovascular disease often have comorbidities such as hypertension, diabetes *mellitus*, kidney disease, or hyperlipidemia; these multiple coexisting health problems would limit these patients' mobility as well as aggravate the physical discomfort during physical exercises[18].

The majority (71.9%) of participants reported never having participated in a structured cardiac rehabilitation program. The main barriers identified in this work, by both EBBS and CRBS, were related to distance, transportation and costs, reiterating that the majority (61.2%) did not reside in the city of Ribeirão Preto. The literature points out that living a long distance from the cardiac rehabilitation center, the costs involved, and the fixed schedule of the program would limit patient access, being significant barriers to rehabilitation[19]. Moreover, perceived lack of time and having other priorities (such as work or family) would be perceived as important barriers to exercising[20].

In the present study, 57% of patients with cardiovascular diseases reported exercising regularly, with walking being the most cited activity (46.4%), similar to that reported in the study of EBBS, Brazilian version, with 58% of older adults practicing some physical activity during leisure[7] and walking being the activity most reported by older adult participants in the Mexican version[17]. However, the majority (62.3%) of the

sample reported having started the exercises less than a year ago.

Difficulties were found in understanding and understanding some EBBS items by some participants in this study (especially with the term "no"), even when applied in the form of an interview, and after changes to the instrument in the pre-test stage. It is possible that the difficulties are related to the low level of education of some participants, as well as advanced age, presence of comorbidities, polypharmacy, and the fact that the scale has a high number of items. Additionally, participants whose marital status was reported as single or widowed were unable to respond to item 21 of EBBS "*Seu/sua esposo/a ou companheiro/companheira não te incentiva a fazer atividade física*".

In this work, it was verified that EBBS, Brazilian version, presented excellent internal consistency for patients with cardiovascular diseases, according to international classification[13], with Cronbach's alpha values for the total EBBS of 0.92 and 0.95 for the benefits subscale. The values are close to the original version[10], whose alpha was 0.95 for the total EBBS and 0.95 for the benefits subscale. In the original version of the instrument, Cronbach's alpha of the EBBS barriers subscale was 0.86[10], while in our study we found a value of 0.65. Similarly, values below 0.80 were found in the Mexican (α = 0.71) (21) and Persian (α = 0.68) (22-23) versions of EBBS.

In general, moderate and statistically significant negative correlations were observed between the total EBBS and the benefits and barriers subscales, with the total CRBS and its five subscales. These results of convergent construct validity assessment of EBBS, Brazilian version, through Spearman's correlations between the scores of the EBBS and CRBS measurement instruments, pointed to a convergence between the assessed constructs. In the validity studies of EBBS for other cultures, the authors performed convergent construct validity with other measurement instruments: Yale Physical Activity Scale[23]; Seven-Day Physical Activity Recall[24]; Physical Activity Scale of the Elderly; and Exercise Self-Efficacy Scale[17].

The choice of extreme values can be explained by participants' low education level. Individuals with low levels of education would have difficulty in discriminating more than two response option[25]. Moreover, the ceiling effect would indicate possible problems in the scale, such as the presence of potentially irrelevant items, in addition to the difficulty in the response scale's discriminatory capacity for the assessed population[26].

The values for convergent and divergent validity of EBBS by the multitrait-multimethod analysis were satisfactory. However, it is still necessary to test the version used in future studies by confirmatory factor analysis and with larger sample sizes.

EBBS, Brazilian version, could support the work process of the entire cardiac rehabilitation team. Thus, strategies centered on real needs can be developed and implemented with the support of EBBS, aiming to increase the levels of regular physical exercise by patients with cardiovascular diseases at different stages of treatment.

CONCLUSION

Thus, according to the proposed objectives and the results obtained by this methodological study, it can be concluded that the tested version of EBBS in a group of adult and older adult patients with cardiovascular diseases showed evidence of: reliability, with satisfactory internal consistency values for intra-item correlation coefficients; convergent construct validity through the value of Spearman's linear correlation coefficient between the measures of CRBS and those of EBBS; and convergent and divergent construct validity through multitrait-multimethod analysis.

The results showed that EBBS can be a valid and reliable instrument to assess the benefits and barriers perceived in relation to physical exercises by adult patients and older adults with cardiovascular diseases. Future investigations are recommended with the performance of confirmatory factor analysis, assessing individuals with cardiovascular diseases, with different levels of education, submitted to different therapeutic modalities and coming from different regions of the country.

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