RESEARCH ARTICLE

A breath of fresh air: Validity and reliability of a Portuguese version of the Multidimensional Dyspnea Profile for patients with COPD

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Abstract

Aim

To provide a Portuguese version of the Multidimensional Dyspnea Profile (MDP), investigating its validity and reliability in Brazilian patients with COPD.

Methods

This was a cross-sectional study for translation and linguist validation of the Portuguese MDP version for patients with COPD. The process occurred according to the protocol of Mapi Research Trust, Lyon, France. Three scores of MDP were used for the analysis: the immediate unpleasantness of dyspnea (A1); the "immediate perception domain" (S) (sum of A1 plus the sensory descriptors) and the "emotional response domain" (A2) (sum of the emotional descriptors). The questionnaires COPD assessment Test (CAT), Hospital Anxiety and Depression scale (HADS) and Medical Research Council scale (MRC) were used as anchors to investigate MDP's validity. Internal consistency was assessed with Cronbach's alpha. Test–retest reliability was assessed with intraclass correlation coefficient (ICC) and concurrent validity was assessed with Spearman correlation coefficients.

Results

Thirty patients with moderate-severe COPD were studied for MDP's validation analysis (43% male, 63±8years, body mass index [BMI] 27±6Kg/m^2, forced expiratory volume in the first second [FEV$_1$] 48±15%predicted, six-minute walking test [6MWT] 464±84m and 84 ±16%predicted), whereas 10 patients were excluded from the test-retest reliability analysis due to missing data, resulting in a sample of 20 subjects for this purpose (50% male, 62 ±8years, BMI 27±6Kg/m^2, FEV$_1$ 48±15%predicted, 6MWT 452±93m and 82±19%predicted). Both samples were similar regarding general characteristics (*P*>0,05 for all variables). MDP presented strong correlations, i.e., ICC intra-rater: A1: 0.77 (0.48–0.90), S: 0.78 (0.52–0.91), and A2: 0.85 (0.66–0.94), with high internal consistency (Cronbach's α

0.86, 0.88 and 0.92 respectively); and ICC inter-rater: A1: 0.74 (0.46–0.89), S: 0.75 (0.48–0.89) and A2: 0.91 (0.78–0.96) with Cronbach's α 0.85, 0.86 and 0.95 respectively.

Conclusion

The Portuguese version of the MDP is the first valid and reliable instrument to assess dyspnea multidimensionally in Portuguese-speaking patients with COPD.

Introduction

Dyspnea is a major disabling symptom reported by patients with chronic obstructive pulmonary disease (COPD), described as a subjective experience, derived from interactions among multiple physiological, psychosocial, and environmental factors [1]. Noteworthy, the majority of available instruments in Portuguese assesses dyspnea only in a one-dimensional approach [2,3]. Therefore, an instrument in Portuguese language which is able to assess and distinguish multiple aspects of dyspnea is necessary.

The multidimensional dyspnea profile (MDP) is an instrument indicated for this purpose [4–7]. It assesses immediate respiratory discomfort, qualities of the breathlessness, and emotional responses [4,6]. It is already known that MDP is sensitive to detect changes in dyspnea sensation evoked by different physiologic stimulus [6]. Furthermore, the English and French versions of MDP were already shown to be valid and reproducible for clinical and laboratory assessments, also presenting excellent internal reliability (Cronbach's α ≥ 0.84) [4,5,7]. However, a Portuguese version of this instrument is not yet available, hindering its use in Portuguese-speaking countries. Therefore, the aim of this study was to provide a Portuguese version of MDP, investigating its validity and reliability in Brazilian patients with COPD.

Material and methods

This was a cross-sectional study involving the translation and linguist validation of the MDP. The Portuguese version has been developed by three of the present researchers (LFB, LAC and NAH) in collaboration with Robert Banzett and Mapi Research Trust, Lyon, France (for information about permission to use the MDP, please access *https://eprovide.mapi-trust.org*), according to standard process of forward and backward translations, followed by cognitive interviews with five patients with previous diagnosis of chronic respiratory diseases (COPD, bronchiectasis and asthma) (S1 and S2 Appendix). The process was undertaken similarly to the French version [7], and it was not necessary to adapt or withdraw any item of the instrument.

Patients were recruited during the baseline evaluation before taking part in a pulmonary rehabilitation program, and only pre-rehabilitation data were used for the present study. COPD diagnosis was done by spirometry, according to international criteria as described in the Global Initiative for Obstructive Lung Disease (GOLD) [8]. In addition to the diagnosis of COPD, other inclusion criteria were: one-month clinical stability and absence of severe and/or unstable cardiac disease and musculoskeletal comorbidities that could interfere in the assessments. Exclusion criteria were the occurrence of osteoneuromuscular complications or acute exacerbation during the assessment period. Patients who did not perform the second or third MDP assessment were excluded from the reliability analysis. The study was approved by the Ethics Committee on Research Involving Human Beings of State University of Londrina (number: 1.887.424) and all patients provided informed consent.

The MDP was applied in three different time-points: day one and day two 24 hours apart, by different raters, and day three, by the first rater, one to two weeks after the first evaluation. The focus period was established as breathlessness during activities of daily living (ADL) on the past 2 weeks. The MDP consists of 11 items evaluating sensory and affective dimensions of dyspnea. One item assesses the immediate unpleasantness of dyspnea (A1) on a 0–10 visual numerical scale anchored by "neutral" (0) and "unbearable" (10). Five items assess dyspnea's sensory dimension and five items assess affective dimension of dyspnea, in terms of quality and intensity (on a scale of 0–10). Further, two scores are calculated: an "immediate perception domain" score (S), corresponding to the sum of A1 intensity plus intensities of the five sensory descriptors; and an "emotional response domain" score (A2), corresponding the sum of the five emotional descriptors [4,5].

Besides the assessment of dyspnea by the MDP, patients were assessed regarding pulmonary function (spirometry) and exercise capacity (6-minute walk test [6MWT]) following international guidelines and local reference values [9–12]. Furthermore, health status (COPD assessment Test—CAT)[3], anxiety and depression (Hospital Anxiety and Depression scale–HADS) [13] and dyspnea in daily life (Medical Research Council scale–MRC)[2] were also assessed and used as anchors.

Statistical analyses were performed with the SPSS Statistical Package 21.0 (IBM SPSS Statistics, Chicago, IL, USA). Normality in data distribution was evaluated using the Shapiro-Wilk test. Data were described as mean±standard deviation or median [interquartile range 25%-75%]. The concurrent validity was assessed by correlations of the MDP domains with CAT, HADS and MRC scores, using the Spearman correlation coefficient. Internal consistency was assessed by Cronbach's α. Inter- and intra-rater test-retest reliability was evaluated between all items and dimensions of the MDP using intraclass coefficient correlation (ICC). For Cronbach's α and ICC, values greater than 0.70 were considered satisfactory [14]. Significance level was set at $P<0.05$.

Sample size was calculated from the values proposed by Hulley et al.[15] based on the study by Silva et al.[3], expecting a minimum correlation of 0.60 between MDP and CAT, considering a two-sided alpha value of 0.05 and 80% of power. Hence, a minimum of 19 individuals were required.

Results

Thirty patients with COPD were included in the validation analysis (43% male, 63±8years, body mass index [BMI] 27±6Kg/m^2, forced expiratory volume in the first second [FEV$_1$] 48 ±15%predicted, 6MWT 464±84m and 84±16%predicted). Ten patients were excluded from the reliability analysis due to the unavailability of data from the second and/or third MDP application upon these patients' request to be dismissed from this assessment. This resulted in a sample of 20 subjects for this purpose (50% male, 62±8years, BMI 27±6Kg/m^2, FEV$_1$ 48 ±15%predicted, 6MWT 452±93m and 82±19%predicted). Both samples were similar regarding general characteristics ($P>0.05$ for all). No patient reported exacerbation of symptoms and/or hospitalization during the focal period (data evaluated by a general questionnaire of anthropometric and exacerbation data).

According to the concurrent validity, the Portuguese version of the MDP was moderately to strongly correlate with the questionnaires CAT, HADS and MRC, as shown in Table 1, Fig 1 and Fig 2.

All dimensions of the MDP demonstrated to be reliable independently of different raters and had good internal consistency. Intra-rater ICCS were: A1: 0.77 (0.48–0.90), S: 0.78 (0.52–0.91), and A2: 0.85 (0.66–0.94), and Cronbach's α of 0.86, 0.88 and 0.92, respectively. Inter-

Table 1. Concurrent validity of the Multidimensional Dyspnea Profile (MDP) with clinical instruments.

MDP Variables	CAT Total	HADS Anxiety	HADS Depression	MRC
A1- Immediate umpleseanteness	0.62*	0.68*	0.71*	0.55*
Breathing effort	0.59*	0.33	0.43*	0.44*
Air hunger	0.61*	0.45*	0.53*	0.53*
Chest tightness	0.55*	0.48*	0.59*	0.48*
Mental effort	0.63*	0.64*	0.64*	0.63*
Breathing a lot	0.37*	0.04	0.25	0.13
S- Immediate Perception Domain	0.75*	0.55*	0.71*	0.61*
Depression	0.44*	0.54*	0.52*	0.53*
Anxiety	0.75*	0.58*	0.66*	0.62*
Frustration	0.54*	0.52*	0.42*	0.52*
Anger	0.42*	0.44*	0.40*	0.34
Fear	0.26	0.32	0.52*	0.35
A2- Emotional Domain	0.74*	0.65*	0.66*	0.66*

Spearman correlation coefficient

*$P < 0.05$

CAT: COPD assessment Test; HADS: Hospital Anxiety and Depression scale; MRC: Medical Research Council scale

rater ICCs were: A1: 0.74 (0.46–0.89), S: 0.75 (0.48–0.89) and A2: 0.91 (0.78–0.96), with Cronbach's α of 0.85, 0.86 and 0.95, respectively.

Discussion

Similarly to the French version [7], the moderate-to-strong correlations between the MDP Portuguese version and *a priori* established anchors (i.e., CAT, HADS and MRC) (Table 1) demonstrate that this version was valid to assess dyspnea in patients with COPD, strongly endorsing its use. Notably, concurrent validity was carried out against these three instruments
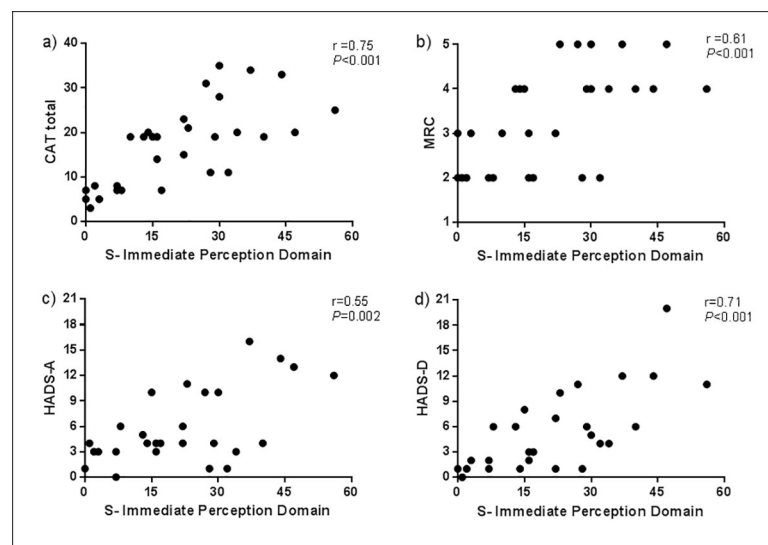

Fig 1. Correlations between the immediate perception domain (S) and the established anchors. (a) CAT: COPD Assessment Test; (b) MRC: Medical Research Council; (c) HADS-A: Hospital Anxiety and depression scale–Anxiety subscale; (d)HADS-D: Hospital Anxiety and depression scale–Depression subscale.

Fig 2. Correlations between the emotional response domain (A2) and the established anchors. (a) CAT: COPD Assessment Test; (b) MRC: Medical Research Council; (c) HADS-A: Hospital Anxiety and depression scale–Anxiety subscale; (d) HADS-D: Hospital Anxiety and depression scale–Depression subscale.
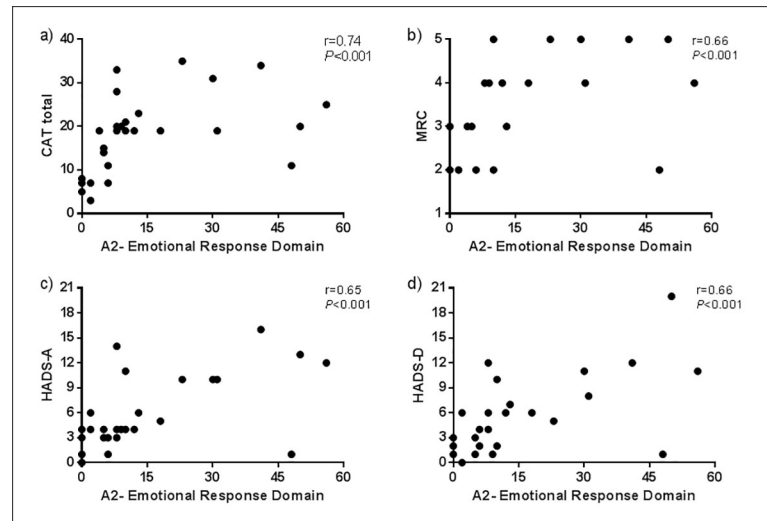
since they are widely used in COPD and measure dimensions similar to the MDP's composition.

Interestingly, the description "breathing a lot" was poorly correlated with all variables (Table 1). This may have happened because only 19% of patients reported this descriptor, hindering its correlation with other variables. Likewise, Banzett et al. [6] unveil this sensation as being reported during induced-hyperpnea in heathy subjects. Indeed, the focus period in the present study was based on ADL (i.e., lower ventilatory burden); this could have mitigated this description by our patients. Moreover, CO_2 desensitization can also be hypothesized as a possible explanation [1,4].

Test-retest reliability analysis showed that MDP is highly reliable, independently whether performed by the same or a different rater. This reinforces the fact that it is not necessary the same rater in different evaluations, but another trained rater who knows the instrument may also re-apply it, simplifying the MDP application.

These results have to be taken into account in light of study's strengths and limitations. Firstly, the samples were not the same for two analyses (validity and reliability), however both were larger than the minimum required sample size (i.e., 19 subjects), and these samples presented no differences between them concerning general characteristics. Second, the focus period of the present study, which was ADL in the last two weeks as well as the intervals between time-points 1–2 and 3 (one to two weeks), can be seen as time periods with risk of change in symptoms; however, this study followed the recommendations of specific guidelines for reliability studies [16]. Moreover, patients' breathlessness was not affected in the study course since none of the patients experienced COPD exacerbations or other acute conditions during the study's period.

Not less important, despite translation was done according to the Portuguese language spoken in Brazil; we believe there is no limitation for its use in any Portuguese-speaking countries. Whether necessary, minor changes are possible without changing sentences' meaning. Furthermore, the MDP was not developed for a specific disease. Thus, as for other languages [5–7], the Portuguese version can be used without adaptations for a wide spectrum of disease

conditions, although specific validation is required. In addition, a minimal important difference for the MDP has not been established, and this is an open field for future research.

Therefore, according to the present results it is possible to affirm that the Portuguese version of the MDP is the first valid and reliable instrument to assess dyspnea multidimensionally in Portuguese-speaking patients with COPD.

Supporting information

S1 Appendix. Multidimensional Dyspnea Profile: Portuguese and English versions.
(PDF)

S2 Appendix. Translation process and linguistic validation of Portuguese version of the Multidimensional Dyspnea Profile.
(PDF)

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References

1. Parshall MB, Schwartzstein RM, Adams L, Banzett RB, Manning HL, Bourbeau J, et al. An official American Thoracic Society statement: update on the mechanisms, assessment, and management of dyspnea. Am J Respir Crit Care Med 2012; 185:435–452. https://doi.org/10.1164/rccm.201111-2042ST PMID: 22336677

2. Kovelis D, Segretti NO, Probst VS, Lareau SC, Brunetto AF, Pitta F. Validação do Modified Pulmonary Functional Status and Dyspnea Questionnaire e da escala do Medical Research Council para o uso em pacientes com doença pulmonar obstrutiva crônica no Brasil. J Bras Pneumol. 2008; 34:1008–1018. PMID: 19180335

3. Silva GPF, Morano MTAP, Viana CMS, Magalhães CBA, Pereira EDB. Validação do Teste de Avaliação da DPOC em português para uso no Brasil. J. Bras Pneumol. 2013; 39:402–408. https://doi.org/10.1590/S1806-37132013000400002 PMID: 24068260

4. Banzett RB, O'Donnell CR, Guilfoyle TE, Parshall MB, Schwartzstein RM, Meek PM, et al. Multidimensional Dyspnea Profile: an instrument for clinical and laboratory research. Eur Respir J 2015; 45: 1681–1691. https://doi.org/10.1183/09031936.00038914 PMID: 25792641

5. Meek PM, Banzett R, Parshall MB, Gracely RH, Schwartzstein RM, Lansing RW. Reliability and validity of the multidimensional dyspnea profile. Chest 2012; 141:1546–1553. https://doi.org/10.1378/chest.11-1087 PMID: 22267681

6. Banzett RB, Pedersen SH, Schwartzstein RM, Lansing RW. The affective dimension of laboratory dyspnea: air hunger I more unpleasant than work/effort. Am J Respir Crit Care Med 2008; 177:1384–1390. https://doi.org/10.1164/rccm.200711-1675OC PMID: 18369200

7. Morélot-Panzini C, Gilet H, Aguilaniu B, Devillier P, Didier A, Perez T, Pignier C, Arnould B and Similowski T. Real-life assessment of the multidimensional nature of dyspnoea in COPD outpatients. Eur Respir J 2016; 47:1668–1679. https://doi.org/10.1183/13993003.01998-2015 PMID: 27076585

8. Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2017. Available from: http://goldcopd.org.

9. Miller MR, Hankinson J, Brusasco V, Burgos V, Casaburi R, Coates A, et al. Standardisation of spirometry. Eur Respir J. 2005; 26:319–338. https://doi.org/10.1183/09031936.05.00034805 PMID: 16055882

10. Pereira CAC, Rodrigues SC, Sato T. Novos valores de referência para espirometria forçada em brasileiros adultos de raça branca. J Bras Pneumol. 2007; 33:397–406. PMID: 17982531

11. Holland AE, Spruit MA, Troosters T, Puhan MA, Pepin V, Saey D, et al. An Official European Respiratory Society / American Thoracic Society Technical Standard: Field Walking Tests in Chronic Respiratory Disease. Eur Respir J. 2014; 44:1428–1446. https://doi.org/10.1183/09031936.00150314 PMID: 25359355

12. Britto RR, Probst VS, de Andrade AF, Samora GA, Hernandes NA, Marinho PE, et al. Reference equations for the six-minute walk distance based on a Brazilian multicenter study. Braz J Phys Ther. 2013; 17:556–563. https://doi.org/10.1590/S1413-35552012005000122 PMID: 24271092

13. Botega NJ, Bio MR, Zomignani MA, Garcia C Jr, Pereira WA. [Mood disorders among inpatients in ambulatory and validation of the anxiety and depression scale HAD]. Rev Saude Publica. 1995; 29:355–363. PMID: 8731275

14. Nunnally JC, Bernstein IH. Psychometric theory. Third Edition. McGraw-Hill I, New York, 1994.

15. Hulley SB, Cummings SR, Browner WS, Grady DG, Newman TB. Delineando a pesquisa clínica. Uma abordagem epidemiológica. 3ª edição. Porto Alegre: Artmed; 2008.

16. Mokkink LB, Terwee CB, Patrick DL, Alonso J, Stratford PW, Knol DL, et al. The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: An international Delphi study. Qual Life Res. 2010; 19:539–549. https://doi.org/10.1007/s11136-010-9606-8 PMID: 20169472