Introduction

Worldwide, COPD is one of the leading causes of morbidity and mortality, as well as having a substantial and growing negative socioeconomic impact. This disease is characterized by progressive deterioration of respiratory function over time, with systemic effects that lead to permanent disability, as evidenced by fatigue, limited exercise capacity, and a resulting negative impact on quality of life. The major manifestation of airflow obstruction in COPD is the reduction in FEV1. However, the European Respiratory Society and the American Thoracic Society (ATS) state that "the measurement of FEV1, alone does not

Abstract
Objective: To determine whether the Body mass index, airway Obstruction, Dyspnea, and Exercise capacity (BODE) index correlates with health-related quality of life in patients with COPD. Methods: We evaluated 42 patients with COPD, quantifying the following: lung function parameters; anthropometric variables; exercise capacity, with the six-minute walk test; dyspnea, with the modified Medical Research Council (MRC) scale; the BODE index; and quality of life, with the modified Saint George’s Respiratory Questionnaire (mSGRQ). Patients were divided into two groups by disease severity: FEV1 ≥ 50% and FEV1 < 50%. Results: The mean BODE index was 2.58 ± 1.17 and 4.15 ± 1.81, respectively, for the FEV1 ≥ 50% and FEV1 < 50% groups. There was a significant difference between the groups in terms of FEV1 and the FEV1/FVC ratio. There were moderate to significant correlations between the BODE index scores and all of the mSGRQ domains in the group of patients with FEV1 < 50%. Conclusions: The BODE index score correlated with the scores of all of the mSGRQ domains in COPD patients with FEV1 < 50%. Therefore, COPD patients with FEV1 < 50% die sooner and have a poorer quality of life.

Keywords: Pulmonary disease, chronic obstructive; Quality of life; Severity of illness index; Prognosis.

Resumo
Objetivo: Determinar se há uma correlação entre o índice Body mass index, airway Obstruction, Dyspnea, and Exercise capacity (BODE; IMC, obstrução das vias aéreas, dispneia e capacidade de exercício) e a qualidade de vida relacionada à saúde em pacientes com DPOC. Métodos: Foram avaliados 42 pacientes com DPOC quanto a parâmetros de função pulmonar; variáveis antropométricas; capacidade de exercício através da distância máxima percorrida no teste de caminhada de seis minutos; dispneia através da escala modificada Medical Research Council (MRC); índice BODE; e a qualidade de vida através do questionário do Saint George’s Respiratory Questionnaire modificado (SGRQm). Os pacientes foram alocados em dois grupos de acordo com a estratificação de gravidade da doença: VEF1 ≥ 50% e VEF1 < 50%. Resultados: Os valores médios do índice BODE para os grupos VEF1 ≥ 50% e VEF1 < 50% foram, respectivamente, 2,58 ± 1,17 e 4,15 ± 1,81. Houve diferença significativa na comparação das variáveis VEF1 e VEF1/CVF entre os grupos. Houve correlações moderadas e significativas entre os escores do índice BODE e todos os domínios do SGRQm no grupo de pacientes com VEF1 < 50%. Conclusões: Houve correlação entre o escore do índice BODE e os escores de todos os domínios do SGRQm nos pacientes com DPOC com VEF1 < 50%. Portanto, os pacientes DPOC com VEF1 < 50% morrem mais rápido e têm pior qualidade de vida.

Descritores: Doença pulmonar obstrutiva crônica; Qualidade de vida; Índice de gravidade de doença; Prognóstico.

Worldwide, COPD is one of the leading causes of morbidity and mortality, as well as having a substantial and growing negative socioeconomic impact. This disease is characterized by progressive deterioration of respiratory function over time, with systemic effects that lead to permanent disability, as evidenced by fatigue, limited exercise capacity, and a resulting negative impact on quality of life. The major manifestation of airflow obstruction in COPD is the reduction in FEV1. However, the European Respiratory Society and the American Thoracic Society (ATS) state that "the measurement of FEV1, alone does not

Does the BODE index correlate with quality of life in patients with COPD?*

O índice BODE correlaciona-se com a qualidade de vida em pacientes com DPOC?

Zênia Trindade de Souto Araujo, Gardenia Holanda

Introduction

Worldwide, COPD is one of the leading causes of morbidity and mortality, as well as having a substantial and growing negative socioeconomic impact. This disease is characterized by progressive deterioration of respiratory function over time, with systemic effects that lead to permanent disability, as evidenced by fatigue, limited exercise capacity, and a resulting negative impact on quality of life. The major manifestation of airflow obstruction in COPD is the reduction in FEV1. However, the European Respiratory Society and the American Thoracic Society (ATS) state that "the measurement of FEV1, alone does not

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The chronic symptoms of COPD (dyspnea, wheezing, cough, expectoration, exercise intolerance, anxiety, and depression) are the major factors responsible for altering the relationship between health and quality of life. Studies of health-related quality of life (HRQoL) in patients with COPD with varying degrees of severity have consistently shown that these patients have significant decrements in HRQoL. Therefore, HRQoL is an important clinical outcome in COPD.

In the Brazilian population, COPD is highly prevalent, being considered a major public health problem. It is crucial to identify the factors that cause the persistent deterioration of HRQoL. However, in Brazil, there have been no studies relating the BODE index to HRQoL in COPD patients. Therefore, the objective of this study was to verify the correlation between the BODE index and HRQoL in COPD patients in Brazil.

Methods

This was a descriptive, observational study of 42 patients at a pulmonology outpatient clinic who were diagnosed (clinical and functional diagnosis) with moderate to very severe COPD by a pulmonologist. The patients were clinically stable (no exacerbations within the last eight weeks), were nonsmokers or had stopped smoking at least three months prior, and were free of pulmonary infection at the time of the assessment. Patients with cardiovascular, osteoarticular, neuromuscular, or renal diseases were excluded, as were those who were unable to perform the functional tests safely or who did not perform all of the functional tests.

In accordance with Brazilian National Health Council Resolution 196/96, this study was approved by the Research Ethics Committee of the Federal University of Rio Grande do Norte (ruling no. 124/2007). All of the individuals who agreed to participate in the study gave written informed consent.

For each of the patients selected, the clinical history was analyzed and a complete physical examination was performed. Subsequently, the patients underwent functional tests.

Anthropometric data were recorded by a previously calibrated digital scale with a stadiometer (Soehnle, Murrhardt, Germany). The measurements were performed with patients wearing light clothing and no shoes, with both ankles together, and standing as erect as possible, with their ankles, calves, buttocks, and back against the anthropometer. Subsequently, body weight (kg) and height (m) were measured, and the BMI was calculated.

Pulmonary function was measured with a spirometer (Pulmowin version 2.30E; DTLI Datalink Instruments, Grabels, France). In accordance with the ATS recommendations, the following spirometric variables were analyzed: FVC; FEV1; and the FEV1/FVC ratio. The relative values were calculated by the reference equations proposed by Knudson et al.

Functional exercise capacity was measured with the six-minute walk test (6MWT), in accordance with the ATS recommendations, and the reference values were those described by Enright & Sherril. The test was performed in a level, covered corridor of approximately 30 m in length. At the beginning and end of the test, SpO2%, HR, and arterial pressure were determined, as were the perception of respiratory effort (Borg scale; dyspnea) and the perception of lower limb fatigue (Borg scale; lower limbs). The 6MWT was conducted by the same investigator, without monitoring, and standard phrases of encouragement were used at the end of each minute.

The degree of dyspnea was measured with the modified Medical Research Council (MRC)
dyspnea scale, which correlates well with the prognosis of COPD.\(^\text{[9]}\)

The BODE index was calculated for each patient based on the following variables: FEV\(_1\); six-minute walk distance (6MWD); MRC scale score; and BMI. The scores obtained for each variable were summed, and the BODE score was calculated. The BODE score ranges from zero (minimum) to ten points (maximum). A higher score translates to a greater likelihood of mortality in individuals with COPD.\(^\text{[5]}\)

The Saint George’s Respiratory Questionnaire (SGRQ), modified for the assessment of the last three months (mSGRQ), was used in order to assess HRQoL. This questionnaire, specific to COPD patients, has been validated for use in Brazil.\(^\text{[14]}\) It consists of 76 items divided into three domains: symptoms (problems caused by respiratory symptoms); activity (activity restrictions caused by dyspnea); and psychosocial impact (impact of the disease on daily life). The score ranges from 0 (no reduction in quality of life) to 100 (maximum reduction in quality of life). The questionnaire was administered as an interview, during which the questions in each domain of the questionnaire were read in a clear and understandable manner so that the patients could give their responses without any external influences. If the patients did not understand the question, the researcher repeated it until the patients were able to choose the alternative they considered correct.

After the assessment procedure, the patients were stratified into two groups by disease severity: FEV\(_1\) \(\geq 50\%\) and FEV\(_1\) \(< 50\%\).

For descriptive statistical analysis and inferences, we employed the Statistical Package for the Social Sciences, version 16.0 for Windows (SPSS Inc. Chicago, IL, USA), and the level of significance was set at 5\% \(p < 0.05\). The Kolmogorov-Smirnov test was used in order to evaluate the normality of the data. Data are expressed as mean \(\pm SD\). Unpaired t-tests were used in order to compare the FEV\(_1\) \(\geq 50\%\) and FEV\(_1\) \(< 50\%\) groups. Pearson’s coefficient was used in order to study the correlation between the BODE index and HRQoL.

### Results

Of the 42 patients who were referred to the department of physical therapy, 10 were excluded from the study: 2 because they presented with exacerbations; and 8 because they did not complete all of the tests proposed.

The study population comprised 32 patients, of whom 12 (38\%) were allocated to the FEV\(_1\) \(\geq 50\%\) group and 20 (62\%) were allocated to the FEV\(_1\) \(< 50\%\) group. The characteristics of the study sample are shown in Table 1.

The study revealed no significant differences between the FEV\(_1\) \(\geq 50\%\) and FEV\(_1\) \(< 50\%\) groups in terms of the following variables: age; gender; BMI; FVC; 6MWD; dyspnea as measured by the MRC scale; or the BODE index. However, there was a significant difference between the two groups in terms of FEV\(_1\) and the FEV\(_1\)/FVC ratio (Table 1).

Measurement of the 6MWD revealed no differences between the FEV\(_1\) \(\geq 50\%\) group and FEV\(_1\) \(< 50\%\) groups (464.6 \(\pm\) 133.5 vs. 401.6 \(\pm\) 111.0 m, respectively; \(p = 0.60\)). The comparison of predicted 6MWD values with the 6MWD values obtained revealed a difference of 48.8 m in the FEV\(_1\) \(\geq 50\%\) group and a difference of 74.4 m in the FEV\(_1\) \(< 50\%\) group. The mean 6MWD values are also shown in Table 1.

Figure 1 shows the reduction in quality of life as assessed by the mSGRQ symptoms, activity, and impact domains, as well as by the mSGRQ total score, in the study groups. However, there were no significant differences between the two groups in terms of any of the mSGRQ domains.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>FEV(_1) (\geq 50%)</th>
<th>FEV(_1) (&lt; 50%)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>60.3 (\pm) 9.32</td>
<td>64.9 (\pm) 11.6</td>
<td>0.45</td>
</tr>
<tr>
<td>Gender, M/F</td>
<td>08/04</td>
<td>12/08</td>
<td>0.45</td>
</tr>
<tr>
<td>BMI, kg/m(^2)</td>
<td>27.6 (\pm) 8.73</td>
<td>27.6 (\pm) 8.80</td>
<td>0.90</td>
</tr>
<tr>
<td>Pulmonary function</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV(_1), % of predicted</td>
<td>54.4 (\pm) 5.04</td>
<td>35.2 (\pm) 7.40</td>
<td>0.03*</td>
</tr>
<tr>
<td>FVC, % of predicted</td>
<td>84.3 (\pm) 7.67</td>
<td>50.8 (\pm) 11.1</td>
<td>0.12</td>
</tr>
<tr>
<td>FEV(_1)/FVC, % of predicted</td>
<td>62.0 (\pm) 3.44</td>
<td>62.7 (\pm) 7.40</td>
<td>&lt; 0.01*</td>
</tr>
<tr>
<td>Exercise capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6MWD, % of predicted</td>
<td>90.2 (\pm) 22.5</td>
<td>85.8 (\pm) 26.3</td>
<td>0.56</td>
</tr>
<tr>
<td>6MWD, m</td>
<td>464.6 (\pm) 133.5</td>
<td>401.6 (\pm) 111.0</td>
<td>0.60</td>
</tr>
<tr>
<td>MRC</td>
<td>2.08 (\pm) 1.00</td>
<td>2.00 (\pm) 1.21</td>
<td>0.34</td>
</tr>
<tr>
<td>BODE index</td>
<td>2.58 (\pm) 1.17</td>
<td>4.15 (\pm) 1.81</td>
<td>0.19</td>
</tr>
</tbody>
</table>

6MWD: six-minute walk distance; MRC: Medical Research Council Dyspnea Scale; and BODE: Body mass index, airway Obstruction, Dyspnea, and Exercise capacity. Values expressed as mean \(\pm\) SD, except for gender (n). *\(p < 0.05\) (unpaired t-test).
In the FEV₁ ≥ 50% group, the BODE index did not correlate significantly with any of the mSGRQ domains (symptoms: r = 0.27; p = 0.39; activity: r = 0.30; p = 0.22; or impact: r = 0.35; p = 0.27) or with the mSGRQ total score (r = 0.25; p = 0.43).

However, as shown in Table 2, in the FEV₁ < 50% group, the BODE index showed moderate to significant correlations with all of the mSGRQ domains (symptoms: r = 0.51; p = 0.02; activity: r = 0.58; p = 0.01; and impact: r = 0.53; p = 0.02) and with the mSGRQ total score (r = 0.56; p = 0.01).

### Discussion

In our study, a correlation analysis was used in order to determine the relationship between the BODE index and quality of life in patients with moderate to very severe COPD. In addition, the BODE index, which is a predictor of mortality in COPD, was found to be associated with quality of life in patients with greater disease severity (FEV₁ < 50%), which is therefore prognostic of decreased survival and poorer quality of life.

The BODE index was chosen for its use of multiple factors to determine prognosis in COPD patients. The BODE index associates four variables (BMI, airway obstruction, dyspnea, and exercise capacity) that, together, characterize the major alterations found in such patients.

Among the variables analyzed in the present study, significant differences between the two groups were found only for FEV₁ and the FEV₁/FVC ratio. It is likely that the differences presented here are attributable to the fact that COPD patients show deterioration of pulmonary function caused by hyperinflation, with a consequent increase in functional residual capacity and decrease in FVC, factors that are responsible for the development of dyspnea, which has a major (negative) impact on exercise capacity. Dyspnea is also a major predictor of mortality in COPD.

When the study groups were compared in terms of the BODE index, which is a predictor of mortality, we found that the mortality rate was higher among the individuals with FEV₁.
FEV\textsubscript{1} is not identified as a predictor of HRQoL in COPD.\textsuperscript{(21,22)} However, in the opinion of other authors, BMI might not reliably identify loss of muscle mass in COPD patients.\textsuperscript{(23,24)}

An interesting finding in our study was that related to exercise capacity: the mean 6MWD in our COPD patients (\textgreater 400 m) was greater than that observed in COPD patients evaluated in a study conducted in Europe, in which the mean 6MWD was \textless 400 m.\textsuperscript{(19)} This can be explained, at least in part, by the higher level of physical activity in the patients in Brazil in relation those other countries.\textsuperscript{(20)}

In our study, we found that a high BODE index score was associated with the scores of all of the mSGRQ domains in COPD patients with FEV\textsubscript{1} < 50%. Therefore, COPD patients with FEV\textsubscript{1} < 50% have lower survival a greater impairment of HRQoL.\textsuperscript{(27)}

One limitation of the present study is that the levels of anxiety and depression, which are known to be significantly associated with quality of life in COPD patients, were not determined in the present study. It would be desirable to conduct a cross-sectional study to determine the relationship between the BODE index and selected measures of health status at the beginning and end of the follow-up period. Another limitation of our study was the small sample size, which would have precluded other subanalyses.

Despite these limitations, the present study showed that the BODE index score was associated with the scores of all of the mSGRQ domains in COPD patients with FEV\textsubscript{1} < 50%. Therefore, COPD patients with FEV\textsubscript{1} < 50% have lower survival a greater impairment of HRQoL.

### References


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