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Association between body mass index and exacerbation frequency in patients with chronic obstructive pulmonary disease from Santa Marta, Colombia

Relación entre el índice de masa corporal y la frecuencia de exacerbaciones en pacientes con enfermedad pulmonar obstructiva crónica en Santa Marta, Colombia

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Resumen

Introducción: El índice de masa corporal (IMC) se asocia inversamente a la frecuencia de exacerbaciones en pacientes con enfermedad pulmonar obstructiva crónica (EPOC); sin embargo, esta puede variar según el contexto. **Objetivo:** Cuantificar la asociación entre el IMC y la frecuencia de exacerbaciones en pacientes en Santa Marta, Colombia. **Materiales y métodos:** Estudio transversal de adultos con EPOC. Se calculó el IMC y la frecuencia de exacerbaciones se estimó a partir de la clasificación GOLD de estado global. **Resultados:** Participaron 292 pacientes entre 49 y 95 años; 61,6% eran hombres. Los IMC se observaron entre 12,8 y 40,2 (media=24,2; DE=4,5) distribuidos en 21 pacientes (7,2%) con desnutrición; 153 (52,4%), saludables; y 118 (40,4%), sobrepeso-obesidad. Un total de 146 pacientes (53,4%) se clasificaron GOLD A o B (exacerbaciones no frecuentes); y 136 pacientes (46,6%), GOLD C o D (exacerbaciones frecuentes). El 85,7% de los pacientes con desnutrición presentaron exacerbaciones frecuentes comparado con 51,6% en pacientes con peso saludable y 33,1% en pacientes con sobrepeso-obesidad (OR=0,18; IC95% 0,05-0,66 para peso saludable y OR=0,08; IC95% 0,02-0,29 para sobrepeso-obesidad frente a desnutrición). **Conclusiones:** El IMC presenta una relación inversa con la frecuencia de exacerbaciones en pacientes con EPOC de Santa Marta, Colombia.

Palabras clave: Enfermedad pulmonar obstructiva crónica; índice de masa corporal; calidad de vida; estudios transversales. (Fuente: DeCS, Bireme).

Abstract

Introduction: Body mass index (BMI) is inversely related to the exacerbation frequency in patients with chronic obstructive pulmonary disease (COPD). However, this relationship may vary depending on the context. **Objective:** To quantify the association of BMI with exacerbation frequency in patients from Santa Marta-Colombia. **Materials and methods:** A cross- sectional study of adults with COPD. We calculated the BMIs, and the exacerbation frequencies were estimated using the Global initiative for Chronic Obstructive Lung Disease (GOLD) classification. **Results:** 292 patients aged between 49-95 years were included. From those, 180 (61.6%) were male, 153 (52.4%) were healthy, 21 (7.2%) showed malnutrition, and 118 (40.4%) were overweight/obese patients. The observed IMCs were between 12.8 and 40.2 (median=24.2; SD=4.5). Whereas 156 patients (53,4%) were classified as GOLD A or B (infrequent exacerbations), 136 of them (46.6%) were GOLD C of D (frequent exacerbations). 85,7% of the patients with malnutrition showed frequent exacerbations, compared to both patients with healthy weight (51,6%) and overweight/obese patients (33.1%) (OR=0.18; CI95% 0.05-0.66 for healthy weight and OR=0.08; CI95% 0.02-0.29 for overweight/obesity, both compared to patients with malnutrition). **Conclusions:** BMI is inversely correlated with exacerbation frequency in patients with COPD from Santa Marta-Colombia.

Key words: Chronic pulmonary obstructive disease; body mass index; quality of life; cross-sectional studies. (Source: DeCS, Bireme).

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Introduction

The prevalence of chronic obstructive pulmonary disease (COPD) is variable. For example, in Mexico City it is 7%, in Montevideo it is 19%, whereas the PREPOCOL (prevalence of COPD in Colombia) study determined that the prevalence of COPD in Colombia is approximately 8.9%[1]. According to the GOLD initiative (*Global Initiative for Chronic Obstructive Lung Disease*), COPD is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitations caused by alveolar and/or respiratory airway abnormalities. It has been demonstrated these conditions are triggered by a significant exposition to harmful particles or gases[2]. Despite the high prevalence of COPD, its diagnosis is frequently made in late stages[3].

The nutritional status and/or the body mass index (BMI) are affected by the course, prognosis, quality of life and mortality of patients suffering with COPD[4-6]. Similar to other conditions, the BMI of patients with COPD is inversely related to quality of life[4,7,8].

The GOLD grading scale takes into account factors like (i) a comprehensive assessment of patients with COPD, (ii) airflow limitations, (iii) impact on patient's health (respiratory symptoms), and (iv) risk of future events such as exacerbations. Accordingly, patients are placed into one of four categories, A to D, in ascending order of severity[2].

Previous studies have shown a consistent association between obesity and I to IV GOLD categories (VEF1 isolated value), using parametric statistical comparisons[9-14]. Nonetheless, this association shows either conflicting evidence or results that are difficult to interpret when analyzed with nonparametric approximations[15-18].

Given the fact that GOLD came out with a new classification system (combined assessment), it is surprising to see that there is only one study that shows empiric data on the association of exacerbation frequencies (based on this recent classification) with BMI. Lambert, *et al.,* compared body weight (normal, overweight and three types of obesity) and observed associations that did not follow an ordinal pattern. Normal or overweight patients were commonly positioned in A to C categories of GOLD as compared to patients with any level of obesity. However, obese patients were more commonly placed in B category than normally-weighted or overweight patients[15].

Clearly, recognizing the correlation between BMI and the recent GOLD classification is important to use nutritional status not only as an indicator for general prognosis of COPD but also as an important rehabilitation factor. This is relevant to improve functionality and quality of life of COPD patients[19-21].

This study was aimed at quantifying the association between BMI and the frequency of exacerbations in COPD outpatients from Santa Marta, Colombia.

Materials and methods

Experimental design, population and sample

We designed a quantitative, analytic, cross-sectional study, with the participation of COPD patients who attended different health care institutions of Santa Marta (Colombia). A non-probability convenience sampling was used to choose a minimum of 267 patients admitted from January to December 2016. This number is necessary to match an expected prevalence of 25% for frequent exacerbations (GOLD C and D), an error margin of 5% and a confidence level of 95%[22]. Also, this number of participants would allow us to adjust up to six grouped variables, under the principle that at least 67 cases of frequent exacerbations were recorded, with a ratio of 10 cases per each variable of confusion[23]. We included older adult patients who attended institutions with outpatient pneumology services, excluding patients that did not complete a comprehensive assessment.

Measurements

In addition to demographic data, we registered weight, height, and exacerbation frequencies according to GOLD classification. The body mass index (BMI) was calculated using the Quetelet formula that considers weight and height, as explained below:

Formula 1: BMI = weight (kg) / height (m^2)[24]

Based on the calculated BMIs, patients were categorized into four groups: malnutrition (BMI $\leq$ 18.4 Kg/m^2), healthy (BMI between 18.5 and 24.9 Kg/m^2), overweight (BMI between 25.0 and 29.9 Kg/m^2), and obesity (BMI $\geq$ 30 Kg/m^2).

In order to narrow down the diagnosis, we considered patients with a pulmonary dysfunction

consistent with COPD and presenting key symptoms like dyspnea, cough, and sputum production. Likewise, we reviewed previous exposure to smoking or wood smoke as suggested by GOLD guidelines[2]. Spirometry was recorded using a *Master Screen PFT System* (CareFusion® – USA) and followed the guidelines issued by the *American Thoracic Society/European Respiratory Society* (ATS/ERS) to standardize the scores[25].

The GOLD classification includes findings in spirometry and *COPD Assessment Test* (CAT) scores, which addresses severity of symptoms, performance in daily and social activities, and exacerbations[2]. To properly analyze these variables, we defined two groups: (i) low frequency with categories A and B; (ii) high frequency exacerbations with categories C and D.

Patients diagnosed with COPD who attended different medical centers of Santa Marta were identified and invited to participate in this study. The assessment of all them was carried out in one institution and by one researcher (JCPP) only, which included all components of the GOLD initiative.

Statistical analysis

Average and standard deviation (SD) were used for the descriptive analysis of frequencies and percentages of nominal and quantitative data. Odds ratios (OR) with a 95% confidence interval (CI) for data ordered by multinomial logistic regression were calculated. BMI and exacerbation frequency were stablished as independent and dependent variables, respectively, and the associations were established using a *IBM-SPSS version 22* software.

Ethical considerations

This study was reviewed and approved by the Ethics Committee of the Health Sciences Faculty of Magdalena University. Participants signed an informed consent form once they were aware of the study objectives and that their participation did not pose a greater risk to their emotional and physical integrity more than the routine clinical assessment, which was carried out following the Administrative Act 8430/2013 issued by the Colombian Health Ministry[21] for this purpose.

Results

We included 292 participants, aged between 49 to 95 years old (average=73.5; SD=8.7), 180 of which were men (61.6%) and 112 were women (38.4%). The BMI values were between 12.8 and 40.2 Kg/m^2, with an average of 24.2 and a SD of 4.5. Following an ordinal sequence, 21 patients (7.2%) were placed in the malnutrition group, followed by overweight/obesity and healthy groups with 118 (40.4%) and 153 (52.4%) patients, respectively. Overweight and obese patients were included within the same group since we did not observe statistically significant differences between these two groups in relation to the GOLD category (OR=1.4; CI 95% 0.6-3.8).

A larger number of exacerbations (GOLD C and D) were recorded in 136 patients (46.6%), while there was a lower frequency of exacerbations (Gold A and B) in 156 participants (53.4%). 85.7% of the patients with malnutrition showed a higher frequency of exacerbations, compared to 51.6% patients with a healthy weight and 33.1% overweight/obese participants, and this difference is statistically significant (Chi-square=23.2; df=2; p=0.001 and multinomial regression, OR=0.18; CI 95% 0.05-0.66 for healthy weight and OR=0.08; CI 95% 0.02-0.29 for overweight/obesity compared to malnutrition).

Discussion

Based on the evidence presented in this study, we observed that BMI and nutritional status are inversely correlated to the frequency of exacerbations in outpatients from Santa Marta, Colombia. This outcome coincides with the findings of Eriksson, *et al*., who showed that malnutrition patients were categorized as GOLD 3-4 under the previous grading system, as compared to patients with normal weight[16]. On the contrary, Lambert, *et al.*, revealed that patients with high BMI (obesity) are more frequently classified as GOLD D than either normal weight or overweight patients[15]. MacCormack, *et al*., using a sample of 84 patients, even described that BMI (normal weight and obesity) was not associated with any GOLD category[17], which is similar to what has been reported by Kiniski, *et al.*[18].

These inconsistencies in the analysis of the association between BMI and GOLD classification using non-parametric statistics can be explained to a large extent by the demographic and clinical characteristics of the population[26]. Similarly, the line of causality must be considered and taken into account since association does not necessarily imply causation[27]. It is possible that weight loss in COPD

patients classified as GOLD C and D is itself an indicator of functional deterioration and not the cause of it, i.e., pulmonary functional decline, systemic functioning and mortality of COPD patients are not caused by weight loss due to depletion of either muscular mass or body fat[6,19,28]. Similarly, the arbitrary nature of the GOLD classification is problematic because of its inconsistencies such as not following a lineal sequence from low to high frequency of exacerbations (i.e. A<B<C<D). Equally challenging is the fact that the classification varies according to the scale used to quantify symptoms[29,30].

The main contribution of this work is that we have specified how BMI and exacerbation frequencies are associated in COPD patients. Nevertheless, the limitation imposed by a reduced sample size made it difficult for us to adjust this association for variables of confusion such as age. This aspect should be taken into consideration by future studies.

Conclusions

BMI and nutritional status have an inverse correlation with exacerbation frequencies in COPD patients from Santa Marta, Colombia. We recommend to carry out more studies with larger sample sizes to corroborate this finding.

Conflict of interest

None of the authors has conflict of interest related to this publication.

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