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Nutritional status and disease severity in patients with chronic obstructive pulmonary disease (COPD)

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ABSTRACT

The purpose of this study was to identify the relationship between nutritional status and the severity of the disease in patients with COPD in South Korea. This study used pretest data from a larger intervention study. Data were collected from March to October 2010, and 251 patients diagnosed with COPD from five hospitals in South Korea were included in the analysis. All participants were interviewed face-to-face. Actual dietary intake was measured by a 24-h dietary recall, and the body mass index (BMI), obstruction of the airway (FEV1% predicted), degree of dyspnea (modified Medical Research Council: MMRC), and exercise capacity (6 min walking distance: 6MWD) (BODE) index was calculated to estimate the severity of the condition. Lower BODE index scores indicate lower risk of mortality. The data were analyzed by descriptive statistics, a χ^2 test, *t*-tests, analysis of variance (ANOVA), Pearson correlation, and hierarchical multiple regression using SPSS 18.0. The mean age of the participants was 66.83 years and 92.4% of the participants were men. The mean total energy intake was 1431.65 kcal, and the mean BODE index score was 2.89. Total energy intake significantly explained additional variance in BODE, BMI, the severity of the perceived dyspnea, and the length of 6 min walk after controlling for age, duration after diagnosed with COPD, and physical activities. The findings of this study emphasized the importance of calorie intake in the disease severity among COPD patients. Further research on the effects of nutritional intervention on the health outcomes of patients with COPD is warranted.

1. Introduction

The nutritional status of patients with COPD has been considered an important factor that influences the experiencing symptoms and prognosis of the disease (Ferreira, Brooks, Lacasse, Goldstein, & White, 2005). Approximately 20–40% of COPD patients have been reported as being underweight or malnourished (Hallin et al., 2007; Raguso & Luthy, 2011; Sahebjami, Doers, Render, & Bond, 1993). According to the study of Benedik, Farkas, Kosnik, Kadivec, and Lainscak (2011), 68.5% of COPD patients were at risk of developing malnutrition, and patients with poor nutritional status reported severe dyspnea, tended to be in an advanced stage in terms of disease severity, and were more likely to be admitted to a hospital within 6 months. When oxygen needs increase as the disease progresses, patients with COPD require more energy. However, experienced symptoms such as anorexia, increased responses to inflammation, and steroid use could cause poor food intake and result in nutrition deprivation (Hallin et al., 2007; Lee, 2004; Raguso & Luthy, 2011; Sahebjami et al., 1993).

In previous studies (Hallin et al., 2007; Pouw et al., 2000; Sahebjami et al., 1993), a low BMI was closely related to decreased pulmonary function, increased chance of re-admission, and increased mortality rate. The 2-year mortality rate in patients whose BMI was <20 was three times higher than that in their counterparts (Hallin et al., 2007). Patients re-admitted to the hospital within 14 days after discharge lost a significant amount of weight compared to the patients who were not re-admitted three months after discharge (Pouw et al., 2000).

Even though it is obvious that nutritional status is critical for the prognosis of COPD patients, little is known about which nutrient relates more to the prognosis of the disease. Most of the previous studies (Hallin et al., 2007; Pouw et al., 2000; Sahebjami et al., 1993) examined the nutritional status of patients with BMI rather than examining real amount of intake. The 24-h nutritional recall provides reliable and valid nutrient information and has been used worldwide (Sun, Roth, Ritchie, Burgio, & Locher, 2010).

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Examining the relationship between specific nutritional indices and the severity of the disease would provide some direction regarding which nutrients should be encouraged more compared to other nutrients. In addition, little information is available for the nutritional status of Korean COPD patients. A significant relationship of nutritional status to the severity of disease was reported among Korean COPD patients in a study conducted on a small number of patients (Park, Yoon, Sohn, & Choue, 2008; Yoon et al., 2008). As the Korean diet includes more carbohydrates and less protein, calcium, and fat (Moon & Kong, 2010), examining the relationship between each nutrient with the disease severity among Korean COPD patients would provide valuable direction for future clinical intervention. Among various characteristics of participants, age itself has increased the prevalence of malnutrition (Battaglia et al., 2011). Age, the duration after diagnosed with COPD, and physical activities have been reported as significant predictors of the severity of COPD (Gudmundsson et al., 2006; Gunen et al., 2005; Waschki et al., 2011), thus, we included these characteristics in the model as covariates. In this study, we aimed to examine the nutritional status of Korean COPD patients and the relationship of nutritional status to disease severity after controlling for the characteristics of the participants. The specific aims of this study were to examine the following: (1) the nutritional status of the participants, (2) the relationship between characteristics of the participants (age, duration after diagnosed with COPD, and physical activities), nutritional status, and disease severity, and (3) the unique contribution of total calorie intake to disease severity after controlling for age, duration after diagnosed with COPD, and physical activities.

2. Methods

2.1. Design

This research used a cross-sectional descriptive study to identify the nutritional status of patients with COPD and the relationship of nutritional intake to the severity of the disease. Data in this study were derived from a baseline survey of an intervention study, which examined the effects of nurse-led problem solving telephone counseling on patients' outcomes (Kim, Lee, Lim, & Park, 2011). The 20-min telephone counseling had provided at 2-week intervals for 6 months and consisted of assessing and managing symptom exacerbation, changing life style, and problem solving.

2.2. Participants

The study population was recruited from COPD patients who visited the outpatient respiratory clinics of five general hospitals in South Korea. Patients who were aged between 40 and 80 years, clinically stable, and cognitively intact to answer the questions were invited to the study. Data were collected between March and October 2010; 254 patients participated in the pretest; three participants were excluded due to refusal of the pulmonary function test. In total, 251 participants were included in the final data analysis of this study.

2.3. Measurements

2.3.1. Nutritional intake assessment

Nutritional intake was assessed by the 24-h dietary recall on the day of survey. Food models were used to assist the respondents in identifying the quantity of food, and the specific ingredients and food recipes were investigated. The survey data were entered using CAN-pro 2.0 (Computer-Aided Nutrient analysis program), provided by the Korean Nutrition and Society (2010), and total intake of calorie, carbohydrate, protein, fat, calcium, sodium, and iron were calculated. The level of nutritional intake was determined by Dietary Reference Intakes (DRI) such as Estimated Energy Requirement (EER) and Recommended Nutrient Intake (RNI) for Koreans. EER was used for total energy intake and RNI for protein, calcium, and iron. Considering the age and sex of each patient, we calculated the percentiles of EER (%EER) and RNI (%RNI). According to the EER percentile, patients were classified into three groups: low intake (<75% of the EER), normal (75% to ≤125% of the EER), and high intake (≥125% of the EER). However, the number of participants belonging to the high intake group ($n = 6$) was too small and combined with the normal intake group ($n = 79$) for the analysis.

2.3.2. Disease severity

Disease severity was measured by the BODE index developed by Celli et al. (2004). This multidimensional index comprises four factors: the BMI, the degree of airflow obstruction with the FEV1% predicted, functional dyspnea assessed by the MMRC scale, and exercise capacity assessed by the 6MWD. The total BODE index scores ranged 0–10 and were divided into 4 stages: 0–2 for Stage 1, 3–4 for Stage 2, 5–6 for Stage 3, and 7–10 for Stage 4. A higher score is associated with a greater risk of death. The BMI was calculated as kg/m^2. The weight and height were measured on the day of questionnaire survey. The FEV1% predicted was measured with a spirometer (Vmax 22; SensorMedics, USA; Ultima PFX; Medical Graphics, Canada). The MMRC dyspnea scale was used to evaluate the degree of the patient's dyspnea perception. This is a 5-point scale ranging 0–4; a higher score corresponds to higher levels of dyspnea. The 6MWD was assessed before the pulmonary function test to avoid the effects of the bronchodilator.

2.3.3. Characteristics of participants

A self-reported questionnaire was used to collect information about age, gender, marital status, educational level, total monthly family income, duration since diagnosed with COPD, physical activity, and experience of visiting the emergency room during the past 6 months due to COPD exacerbation. Physical activity was measured by the International Physical Activity Questionnaire (IPAQ) short version calculating a metabolic equivalent score (MET – min/week) based on the types of activities and activity times (Ainsworth et al., 2000).

2.4. Data collection and analysis

This study was approved by the Institutional Review Boards (IRBs) of three hospitals and permitted by the hospital managerial committees of two hospitals that did not have IRBs. Patients ($N = 794$) who fulfill the inclusion criteria were contacted and explained about the purpose of the study, confidentiality of the personal information, voluntary participation of the study, and freedom to withdraw from the participation anytime without any disadvantage. Two hundred fifty-four patients agreed to participate in the study and all participants provided written informed consent. Three participants were excluded because of the missing information in pulmonary function tests and 251 participants were included in the final analysis. Trained research assistants collected data using questionnaires. The data were analyzed with SPSS WIN 18.0 (SPSS, Chicago, IL). Descriptive statistics described the patients' characteristics, nutritional intake, and disease severity. ANOVA and a χ^2 test determined the differences of characteristics and disease severity among patient groups based on their nutritional intake. Pearson correlation and hierarchical multiple regression examined the relationship between energy intake and disease severity.