Dietary intake of elderly outpatients with chronic obstructive pulmonary disease

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ABSTRACT

Purpose: Chronic obstructive pulmonary disease (COPD) is often associated with malnutrition, which is in turn associated with poor outcomes. Accordingly, in COPD patients adequate nutrition might improve several clinical and functional outcomes. Nevertheless, information about nutrient intake of older populations with COPD is still scanty.

Materials and methods: We analysed data of 523 elderly attending a geriatric ambulatory. Of these, 165 had a diagnosis of COPD, while 358 were control participants, matched for demographic characteristics and free from respiratory diseases. COPD was diagnosed according to the global initiative for chronic obstructive lung disease (GOLD) criteria. The intake of micro and macronutrients was recorded using the European prospective investigation into cancer and nutrition (EPIC) questionnaire. Nutrient intake of COPD patients was compared with that of the control group and with recommended dietary allowances RDA.

Results: COPD patients had a lower energy intake, as compared with control participants (29.4 vs 34.4 kcal/kg of ideal weight; $P < .0001$), due to reduced intake of carbohydrates and proteins. Accordingly, in the energy intake was lower than recommended in 52% of COPD patients, vs 30% of controls ($P < .0001$). The intake of calcium, potassium, folate, cholecalciferol, retinol, and thiamine was lower than RDA in over 75% of COPD patients.

Conclusions: The diet of elderly COPD outpatients does not provide the recommended energy intake, nor does it meet the RDA for many micronutrients. Such deficits are more severe than in age matched non-respiratory subjects.

1. Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by a variable, yet clinically significant impact on nutritional status and body composition. Indeed, decreased free fat mass has been repeatedly reported and variously ascribed to muscle autophagy, increased energy expenditure and inadequate nutrient intake (Guo et al., 2013; Sergi et al., 2006; Itoh, Tsuji, Nemoto, Nakamura, & Aoshiba, 2013). Malnutrition becomes more severe in COPD patients on long-term oxygen therapy, although to a lesser extent than in people requiring long-term oxygen therapy because of restrictive and neuromuscular diseases or bronchiectases (Cano et al., 2002). However, age per se seems to modulate the effects of COPD on nutritional status: in COPD patients aged 65 and over, loss of appetite and reduced intake of liquids are primarily associated with malnutrition (Battaglia et al., 2011). Coexisting obesity might also contribute to malnutrition by promoting systemic inflammation and loss of free fat mass (Tkacova, 2010). Finally, female patients are at greater risk of nutritional depletion; neither the Forced Expiratory Volume in the first second nor severity of dyspnoea and health status impairment correlate with loss of free fat mass, as if systemic factors play a primary role in the development of nutritional status impairment (Di Marco et al., 2006).

While inflammatory and procatabolic status have been variously related to fat mass depletion in COPD, poor attention

has been paid to the quality of dietary intake. Indeed, in a Spanish cohort of 275COPD patients aged 68 ± 8 years, 93% males, in seemingly overall good nutritional status (BMI = 28.8), nutrient intake was found to fit the Spanish recommended allowances except for low vitamin D intake and a lower than recommended energy intake from carbohydrates, but fair whole caloric intake (de Batlle et al., 2009). Analogously, the intake of vitamin D, but also of folic acid, calcium and proteins was found to be low in a small sample of COPD patients aged 70 years or more (Andersson, Grönberg, Slinde, Bosaeus, & Larsson, 2007). Inadequate intake of cholecalciferol, calcium and proteins clustered also in a subset of a large cohort ($n = 556$) of Dutch COPD patients in stable conditions; further confirming the Spanish data, the overall caloric intake was fair, but in obese people defective intake of micronutrients and proteins was more common (van de Bool et al., 2014).

Overall, the nutrient intake of COPD patients may be considered to fit the recommended standards with regard to global energy intake and macronutrients, though with a trend toward lesser protein intake, and to be distinctly defective in calcium and cholecalciferol. This latter finding is of special concern, given that these patients spend very little time outdoor and have a very high prevalence of osteoporosis (Watanabe et al., 2015). Finally, selected deficits in the intake of micronutrients have been reported, but these findings largely depend upon the quality of the assessment dietary questionnaire, its completeness, i.e. the array of assessed micronutrients, and its appropriateness to the enquired population. While selected non modifiable factors, such as age and sex, have been recognized to affect nutrient intake, it is unclear whether and to which extent the observed nutrient deficits may be fully ascribed to COPD in itself. Indeed, the nutrient intake of COPD patients has never been compared with that of non- respiratory patients, thus it cannot be excluded that age per se and/or comorbid diseases account for the observed deficits (Guyonnet and Rolland, 2015).

We designed this study to assess the intake of macronutrients and micronutrients through a high quality nutritional questionnaire developed and validated in the Italian population, and to compare it with that of a non-COPD population, matched for age and sex. Our final objective was to provide a full spectrum picture of nutrient intake and to verify whether or not it may be considered COPD-specific.

2. Materials and methods

2.1. Participants

The study involved 523 outpatients admitted to the geriatric ambulatory of the Campus Bio-Medico University, Rome, and to the Respiratory Day Hospital of Fondazione Santa Lucia I.R.C.C.S., Rome, between December 1st, 2011 and December 31th, 2014. Of those, 165 were elderly subjects with diagnosis of COPD. The diagnosis was stated according to the global initiative for chronic obstructive lung disease (GOLD) criteria. The control group was represented by 358 outpatients without COPD, matched for age, sex and free from respiratory diseases comorbidities, who were admitted to the geriatric ambulatory of the Campus Bio-Medico University, Rome.

Exclusion criteria were the following: malignancy or life expectancy <6 months; cognitive impairment; unstable clinical of functional conditions in the last three months; social or financial problems, heavy enough to affect the purchase of food; sensory impairment preventing the completion of the questionnaire.

The Institutional Review Board of the Campus Bio-Medico University (14/13 PAR) and the Fondazione Santa Lucia I.R.C.C.S. approved the protocol of the present study, and all patients provided written informed consent.

2.2. Dietary assessment

Dietary intake was estimated using the questionnaire developed by the European prospective investigation into cancer and nutrition (EPIC) (Pisani et al., 1997). The EPIC questionnaire is divided into two parts: the former investigates the general dietary pattern and the frequency of meals consumed away from home, the latter the intake frequency of 236 specific foods, along with the average size of the serving, selected from a range as shown in photographs. The information derived from the questionnaire was automatically converted into data on energy, micro- and macronutrient intake, by software specifically designed for the EPIC study.

2.3. Covariates

Comorbidity was quantified using the Charlson comorbidity index score by adding scores assigned to specific diagnoses (Charlson, Pompei, Ales, & MacKenzie, 1987). Body mass index was calculated as weight (kg) divided by height squared (m^2). Weight was measured to the nearest 0.1 kg using a high-precision mechanical scale and standing height to the nearest 0.1 cm based on wall measure with participants wearing light indoor clothes and no shoes. Basal metabolic rate was calculated according to the Harris–Benedict formula (Harris and Benedict, 1918); ideal body weight was estimated using the Lorenz formula (Lorentz, 1929). Education was expressed as years of school attendance. Diagnoses were coded according to the International Classification of Diseases, ninth edition, Clinical Modification codes (WHO Collaborating Centre for Drug Statistics Methodology).

2.4. Statistical analyses

Data were recorded using dedicated software. Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS for Mac version 20.0, 2011, SPSS Inc., Chicago, IL); differences were considered significant at the $P < .050$ level. Data of continuous variables are presented as mean values $\pm$ standard deviation (SD). Medians and inter-quartile ranges were provided for non-normally distributed variables. Analyses of variance for normally distributed variables according to diagnosis of COPD were performed by ANOVA comparisons; otherwise, the nonparametric Mann–Whitney U-test was adopted.

For micronutrients (minerals, and vitamins), the absolute intake and, where available, the intake expressed as recommended daily allowance (RDA) percentage was reported; in addition, we calculated the proportion of patients whose intake was below the RDA. For macronutrients, the intake was calculated both in absolute values and according to the actual and ideal body weight. In addition, the basal metabolic rate and the total energy intake ratio was estimated. Eventually, analyses of variance for normally distributed variables according to the severity of COPD (GOLD II and GOLD III stage) were performed by ANOVA comparisons; otherwise, the nonparametric Mann–Whitney U-test was adopted.

3. Results

The study included 165/523 (32%) subjects with COPD and 358/523 (68%) without respiratory diseases. These participants were comparable for comorbidity, demographic, and anthropometric characteristics, except for weight, that was higher in the COPD group as compared with controls. We excluded 9 patients with COPD, and 22 patients without COPD because they did not meet inclusion criteria.

All COPD patients were on I–III GOLD stage. Specifically, 8 participants were on I GOLD stage, 98 subjects on II GOLD stage,