Background: Chronic Obstructive Pulmonary Disease (COPD) is characteristic with chronic airway inflammation and airflow obstruction, which presents as dyspnea and, chronic cough with sputum. Severe COPD with acute exacerbation needs hospitalization. Progressive and irreversible airway obstruction of COPD may result in dyspnea aggravation, malnutrition, sarcopenia, and decreased exercise capacity. Patients with COPD have not only impaired social activities but quality of life as well. The impact on family and carers for taking caregivers of COPD is substantial. Studies have shown that medical treatment, pulmonary rehabilitation, muscle training, and self-management can improve COPD symptoms and exercise capacity. However, studies investigating causes and predictor factors of cardiopulmonary endurance for COPD patients are scant.

Purpose: To explore whether and how cardiopulmonary endurance is related to age, body composition, dyspnea, respiratory muscle strength, lower limb muscle strength and endurance. In addition, we evaluated predictor factors, explanatory power and models in a sample of the elderly hospitalized with COPD.

Methods: This is a cross-sectional study design by using a random sampling in the elderly hospitalized with COPD. A total of 83 participants admitted to a chest specialist hospital with a diagnosis of COPD were enrolled in this study. We evaluated 6-minute walk distance (6MWD) for cardiopulmonary endurance, while age, sex, COPD severity, body composition, dyspnea, respiratory muscle strength, lower limb muscle strength and endurance parameters were collected as well. We measured COPD severity by Global Initiative for Chronic Obstructive Lung Disease guideline (GOLD), body composition by body mass index (BMI), dyspnea by modified Medical Research Council dyspnea scale (mMRC), respiratory muscle strength by measuring the maximal inspiratory pressure (PImax) and the maximal expiratory pressure (PEmax), lower limb muscle strength by measuring quadriceps, and lower limb muscle endurance by measuring the 30-s chair stand test. T test, one-way ANOVA, correlation, and multivariate regression analyses were used to evaluate association between variables and predictor factors. The study received approval from the Ethics Committee and informed consent was obtained from all study participants.

Results: A total of 83 participants participated in the study. The study patients were aged 74.01±6.93 years, were male (90.63%), body composition abnormalities > 60.25%, with stage 3 mMRC (57.83%). The Cardiopulmonary endurance was significantly associated with age (r = -0.27, p = .013), respiratory muscle strength including PImax (r = 0.54, p < .001) and PEmax(r = 0.49, p < .001), lower limb muscle strength (r = 0.34, p = .002), lower limb muscle endurance (r = 0.64, p < .001), COPD severity (F = 10.28, p < .001), and dypnesa (F = 11.16, p< .001). Mutivariate analyses showed that cardiopulmonary endurance was associated with the severity of disease (extremely
severe reference group mild) ($\beta = -42.12, p = .011$), dypnesa (level 2 reference group level 4) ($\beta = 58.16, p = .001$) and with lower limb muscle endurance ($\beta = 17.35, p < .001$). These variables can explain 53% ($\text{Adj } R^2=0.53, \ p < .001$) of variance in the cardiopulmonary endurance of older adults with COPD. COPD severity, dypnesa and lower limb muscle endurance were main predictive factors that explained 41% of variance ($R^2= 0.41, p < .001$).

**Conclusion:** This study indicated that cardiopulmonary endurance was associated with age, respiratory muscle strength, lower limb muscle strength, lower limb muscle endurance, COPD severity and dypnesa. Our results may provide caregiver information to improve cardiopulmonary endurance in the elderly with COPD.

**Key words:** Chronic Obstructive Pulmonary Disease, the elderly, Cardiopulmonary Endurance

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**Title:**

Factors Related to Cardiopulmonary Endurance of Hospitalized Older Adults With Chronic Obstructive Pulmonary Disease

**Keywords:**

Cardiopulmonary Endurance, Chronic Obstructive Pulmonary Disease and the elderly

**References:**

**References**


**Abstract Summary:**

Our study can investigate cardiopulmonary endurance associated effect factors and predictors, specifically age, gender, disease severity, BMI, dyspnea, respiratory muscle strength, lower extremity muscle strength, and lower limb muscle endurance. Our results find risk factors and could be a predictor of cardiopulmonary endurance in COPD’s elderly inpatients.

**Content Outline:**

1. Chronic obstructive pulmonary disease (COPD) can be caused cough, dyspnea, sputum productions and hard to cough up (Vestbo et al., 2013), which as COPD symptoms progresses become more sever have to seek hospital admissions treatment (Rodriguez-Roisin, 2006). Admitted treatment during tend to skeletal muscle dysfunction and is also decreased exercise intolerance (Spruit et al., 2003).

2. According to the 「Global Initiative for Chronic Obstructive Lung Disease (GOLD)」, since 2003, CAT (COPD Assessment Test) and mMRC (modified Medical Research Council dyspnea scale) has become as a tool for evaluation patient symptoms and respiratory rehabilitation have recommended as part of medical treatment for period of hospital admissions(Vestbo et al., 2013). Overall, the GOLD indicates that complete symptoms assessment can be promote in the exercise capacity (Vestbo et al., 2013).

2. However, take medicine treatment is first choice investigated for improve the COPD condition strength, in addition, laboratory examine (improvement of Chest x-ray, and inflammatory index, etc.) have become as a recovery indicator. In contrast, the exercise capacity almost unincorporated to recovery indicator for COPD inpatients. Based on discharge planning purpose
for the avoid readmissions with COPD outpatient, the exercise capacity should be involved in assessment and care process for during hospital admissions.

3. In previous research has indicated that the greater age, worse nutritional status, higher severity of disease, more difficulty of breathing (Dogra et al., 2014), weaker inspiratory muscles and exhaled muscles (Ramon et al., 2016), worse muscle strength and muscle endurance of the lower limbs, than the worse cardiorespiratory endurance (Rausch-Osthoff et al., 2014).

4. Studies of cardiopulmonary endurance in COPD tend to nutritional therapy, pulmonary rehabilitation and muscle strength training (Beauchamp et al., 2013; Can et al., 2002; Liao et al., 2015), followed by mortality prediction (Volaklis et al., 2015) and tracheal tube is removed success rate (Patsaki et al., 2013). However, little is known to investigate the effects of cardiopulmonary endurance, association with body mass index, dyspnea, respiratory muscle strength, lower limb muscle strength and muscular endurance in hospitalized patients with COPD.

5. In previous outpatients of COPD studies had reported that age, BMI, FEV1/FVC ratio (percent predicted), SpO2, and dyspnea are negative correlation with cardiorespiratory endurance (Dogra et al., 2014). However, in the abovementioned studies that the cardiorespiratory endurance risk factors and predictors were not investigated for inpatients.

6. Although, the past empirical studies have shown that the respiratory rehabilitation can be improved of 6-minute walking distance (6MWD) in elderly inpatients with COPD. However, the benefits of this respiratory rehabilitation strategy on cardiopulmonary endurance are need to spend time and only also can be recovery local function.

7. Thus, the aim of this study was to investigate cardiopulmonary endurance associated effect factors and predictors, specifically age, gender, disease severity, BMI, dyspnea, respiratory muscle strength, lower extremity muscle strength, and lower limb muscle endurance in COPD’s elderly inpatients. We hypothesized that age, gender, disease severity; BMI, dyspnea, respiratory muscle strength, lower extremity muscle strength, and lower limb muscle endurance were risk factors and could be a predictor of cardiopulmonary endurance in COPD’s elderly inpatients.

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