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The Correlation between Pulmonary Function Tests and The Salivary MMP-9 Activity among Chronic Obstructive Pulmonary Disease (COPD) Patients

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Abstract

The spirometry test is routinely performed to assess FEV_1, FVC, and FEV_1/FVC ratio among chronic obstructive pulmonary disease (COPD) patients with the increased activity of MMP-9. Saliva is less invasive to assess the MMP-9 activity. This study aimed to compare Pulmonary Function Tests to estimate the MMP-9 activity. The respondents were 30 COPD outpatients from Pulmonary Policlinic. Results showed mean ratio of FEV_1, FVC, FEV_1/FVC (SD) and that of the salivary MMP-9 activity were 1.67 (0.12) L, 2.97 (0.43) L, 56.15 (8.43) % and 1.85 (1.54) μM respectively. The correlation between FEV_1, FVC, and FEV_1/FVC ratio and the salivary MMP-9 activity was insignificant (p>0.05). The pulmonary function tests were not able to estimate the salivary MMP-9 activity. The findings suggest further activities of MMP-9 from other samples for comparison of protease activity.

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Keywords: Spirometry; Salivary; MMP-9; Comparison

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Nomenclature

BAL	Broncho-alveolar lavage
COPD	Chronic obstructive pulmonary disease
ECM	Extracellular matrix
FEV_1	Forced expiratory volume in 1 second
FVC	Forced vital capacity
GOLD	Global initiative for chronic obstructive lung disease
MMP-9	Matrix metalloproteinase-9
TIMP-1	Tissue inhibitor of metalloproteinase-1

1. Introduction

The prevalence of chronic obstructive pulmonary disease (COPD) in Indonesia has reached 4.8 millions of which 90% is smokers or former smokers. COPD is mainly triggered by smoke exposures and other dangerous agents like gases and chemical substances from the environment. The genetic inheritance, previous history of respiratory infection, intrauterine growth retardation (IUGR), poor nutrition, and low income also contribute to the increase of COPD. The passive smokers, approximately 20%, are also risky for getting COPD[1,2].

Spirometry is routinely performed by those complaining dyspnoe promptly, so that they may have the appropriate treatment subsequently. The calibrated spirometry is initially prepared before patients start the test. Then, the measurements of forced vital capacity (FVC) and forced expiratory volume in one second (FEV_1) are performed with acceptable maneuvers. The results are very beneficial to determine either obstruction, restriction, or mixed. Regarding the diagnosis of COPD, the baseline of GOLD 2013 is properly applied[1,2,3].

The increase of matrix metalloproteinase (MMP)-9 activity from plasma is correlated with α_1-anti tripsin-related emphysema[4,5]. Moreover, the higher MMP-9 level is linear with the lower FEV_1, transport of CO, and oxygen saturation. The increase of MMP-9 level might estimate the decline of pulmonary function and the risk of exacerbation. The cigarette consumption is also correlated with MMP-9 level[4]. Prior authors and colleagues have started numerous studies to determine the correlation between different biological biomarkers and the pulmonary function. For COPD, many biomarkers from broncho-alveolar lavage (BAL) fluid and sputum have been developed in order to generate precise relationships between types of biomarkers and pulmonary function. Types of biomarkers engaged in those studies were agents of oxidative stress, cytokines and various proteases describing the pathogenesis of COPD. However, how to get the respiratory samples should be considered as well as those body fluids which have not been easily obtained[5,6,7,8].

Since smoking would affect the pathological processes of oral cavity and lungs which induced inflammatory mediators releasing MMP-9, our study tried to utilize the saliva to assess the MMP-9 activity from the fluid in order to link the association between spirometry results and the activity of protease. Furthermore, hopefully, the spirometry tests might be correlated adequately to the salivary MMP-9 activity among COPD patients.

2. Methods

This study employed thirty (30) smoker outpatients with COPD who visited pulmonary policlinic of Dr. Zainoel Abidin General Hospital in Banda Aceh - Indonesia. The study applied cross sectional design to determine inclusion and exclusion criteria for those enrolled as respondents. In advance, they were confirmed as COPD patients based on spirometry results i.e. FEV_1/FVC ratio <70% with mild, moderate, severe and very severe GOLD spirometric level[3]. Other criteria were: smokers, male, >50 years old, 20 pack years of cigarette consumption. The exclusion criteria were tuberculosis and malignancy. The study was officially approved by the Ethics Committee of Faculty of Medicine, Syiah Kuala University - Banda Aceh. All respondents had to sign the informed consents before undergoing the physical examination and saliva collection.

The saliva was collected by spitting out the fluid into the sterile pot. Respondents who had shown the worst oral hygiene and bloody spittle discharge were excluded from the study. All collected saliva was stored in -80 ^{0}C freezer for subsequent analysis with *Sensolyte®520 Generic MMP assay kit Fluorimetric*.