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Effect of Tamarind (*Tamarindus indica* L.) to Increase Force Expiratory Volume in One Second (FEV1) among Active Smokers

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ABSTRACT

Low forced expired volume in one second (FEV1) indicates decreased lung function that might be caused by airway obstruction and could be associated with smoking. Tamarind (*Tamarindus indica L*) has been widely used as a traditional medicine and has anti-inflammation and antioxidant effects. This study aimed to assess the effect of tamarind to in reducing airway obstruction and improving FEV1 among active smokers. A quasi-experimental study of pre- and post-test was conducted among workers at wood furniture factories in Aceh, Indonesia. Before treatment, FEV1 was measured and compared between smokers and non-smokers. Active smokers were provided with tamarind for seven consecutive days and their FEV1 were re-measured on the 8th day. In total, 40 male adult smokers and 40 male non-smokers as the control were enrolled. Half of smoker participants (50%) aged between 35-44 years. Before treatment, the FEV1 in smoking group was significantly lower compared to the non-smoking group (56.45% ± 7.97% vs. 78.33% ± 6.29%, p<0.001). The FEV1 in smoking group was significantly higher after consumed tamarind compared pre-treatment, FEV1 73.60% ± 12.44% and 56.45% ± 7.97%, respectively with p<0.001. In conclusion, *T. indica* L supplement for 7 days significantly increased FEV1 in active smokers, suggesting its potential to reduce airway obstruction due to smoking.

Keywords: Tamarind, FEV1 value, smoker, obstruction, air way

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INTRODUCTION

Smoking remains a global health problem as it causes various diseases including cardiovascular diseases, respiratory diseases, cancer, and cerebrovascular diseases [1]. Approximately 1.2 billion people smoke worldwide and caused 700.000 deaths every year in European Union alone [2]. Smoking mostly affect the respiratory system by causing airway obstruction and inflammation resulting chronic obstructive lung diseases [1]. A study showed both active and passive smokers associated with significant lung impairment [3] and there is no variation by ethnicity when it comes to the effect of smoking on respiratory system [4]. Smoking causes structural changes, decreases respiratory function and damages lung tissue [5]. Cigarettes contain about 1,500 dangerous chemicals, among them are tar, nicotine, and carbon monoxide. These chemical components activate macrophages neutrophils and these cells release enzymes that destroy connective tissue in the lungs and stimulate mucus hyper secretion, lead to respiratory tract obstruction [5].

Chronic respiratory diseases resulted from reversible and irreversible abnormalities in the bronchus induce chronic airflow restriction and decrease lung function. Low pulmonary function is indicated by reduced the vital capacity (VC), the forced expired volume in one second (FEV1) and the peak expiratory flow rate (PEFR) [5]. FEV1 alongside the force vital capacity (FVC) are suggested as predictors of lung function [6]. The normal FEV1 in healthy population is >75% and FEV1 <75% indicates decreased lung function that might be caused by airway obstruction [7]. A previous study reported that smoking was related to a decrease in FEV1 and FCV [8].

Tamarind (*Tamarindus indica L*), belongs to the family Leguminosae (Fabaceae), is a plant that usually grow in tropical areas that has been widely used as a traditional medicine in wound healing, abdominal pain, diarrhea, dysentery, parasitic infection, fever, malaria, and respiratory problems [9, 10]. Tamarind is not only rich in essential amino acids, phytochemicals and vitamins, but also has antioxidant and anti-inflammation activities [11]. The leaves, seeds, and other parts of *T. indica* have been demonstrated to have anti-inflammation effects by stabilizing the red blood cell membrane and preventing cell damage, resulted in decreased inflammatory response [12]. *T. indica* fruit is also rich in polyphenol, that has hypo-lipidemic, anti-atherosclerotic, antioxidant, anti-inflammatory and immune modulatory effect [13]. Tamarind also exhibited antihistaminic and mast cell stabilizing effects; and therefore was effective for asthma and cough treatment [10]. Several studies have been conducted to elucidate the potential of *T. indica* as a traditional remedy [9-13]. However, little is known about the effect of tamarind in treating airway obstruction among smokers. This study aimed to assess the effect of tamarind consumption in reducing airway obstruction by assessing the improvement of FEV1 among active smokers.

METHODS

Study design and participants

This was a quasi-experimental study of pre-and post-test cohort. A total of 40 male adult smokers and worked at the wood furniture-processing factory were recruited. As a control group, 40 non-smoking adults with the same age as the treatment group were also recruited. The study was conducted in wood furniture processing factory in Aceh, Indonesia. A smoker defined as those who smoke more than 5 cigarettes a day. Those who had asthma and were taking medicine for respiratory diseases were excluded from the study. Signed informed consents were obtained from participants prior to the study.

Study procedure

During the study, smoker group members were given with tamarind to drink for seven days and were not allowed to use other drugs during the study. Flesh tamarind was used in this study, where it was given to the patients in decreasing dose for seven days: 21 gr on the 1st day, 18 gr on the 2nd day, 15 gr on the 3rd day, 12 gr on the 4th day, 9 gr on the 5th day, 6 gr on the 6th day, and 3 gr on the 7th day. The tamarind was diluted with 0.5 L of water and were drink at the end of the day, for seven days continuously. The control group received the placebos.

Spirometer examination (using Vitalograph COPD-6) was conducted in both study groups to measure their FEV1 value, which was presented in percentage (%) before the treatment started (i.e., day 0) to obtain the baseline FEV1. At the end of the treatment, the FEV1 values were re-measured in active smoker group.

Statistical analysis

To compare the FEV1 baseline between both groups, independent t-test was employed. Independent t-test was also used to assess the improvement of the FEV1 in smoking group. Statistical analysis was conducted using SPSS version 20.0.

RESULTS

A study was conducted to evaluate the use of tamarind as a traditional medicine to reduce airway obstruction by assessing FEV1 parameter in active smokers working in wood furniture processing factories in Indonesia. A total of 40 participants, male and active smokers, were included. The characteristics of study participants are shown in Table 1. Half of study participants (50%) aged between 35-44 years, and most of them (70%) worked more than 10 hours a week (Table 1).

Table 1. Characteristics of study participants within active smoker group (n=40)

Characteristics	n	Percentage (%)
Age		
25–34 year	6	15%
35–44 year	20	50%
45–54 year	10	25%
55–64 year	4	10%
Length of work per week		
4–10 hours	12	30%
11–12 hours	10	25%
10–24 hours	10	25%
25–31 hours	8	20%

As comparator group, 40 non-smoking male adults who age-matched were recruited. Comparison of FEV1 among non-smoker and smoker group before the treatment is presented in Table 2. The FEV1 in smoking group was significantly lower compared to the non-smoking group (56.45%±7.97% vs. 78.33%±6.29%, p<0.001) (Table 2).

Table 2. Comparison of FEV1 between non-smokers and smoker group pre-treatment

Parameter	Group		p-value
	Smokers group (n=40)	Non-smoker (n=40)	
FEV_1 (%) mean ± SD	56.45 ± 7.97	78.33 ± 6.29	<0.001

Comparison of FEV1 pre- and post-tamarind consumption in smoking group is presented in Table 3. The FEV1 in smoking group was significantly higher in post-tamarind treatment (73.60% ± 12.44%) compared to pre-treatment (56.45 % ± 7.97%, p<0.001)

Table 3. Comparison of FEV1 in smoker group before and after drinking tamarind.

Parameter	Group		p-value
	Pre-treatment (n=40)	Post-treatment (n=40)	
FEV_1 (%) mean ± SD	56.45±7.97	73.60±12.44	<0.001

DISCUSSION

This study sought to assess the effect of tamarind in reducing airway obstruction among active smokers in Indonesia. Due to local wisdom and value that makes smoking is unacceptable for women resulting in a very low number of female smokers in Aceh; and therefore, this study was conducted in male only. A total of 40 active smokers were recruited, and most of them (85%) aged above 35 years old. This might be due to the study setting, as people who work in the industry sectors are usually around this age. The possibility of recruiting younger active smokers could be high if the study setting is different, for example at the university or coffee shops.

This study found the mean FEV1 in smoker group was significantly lower than the mean of FEV1 in non-smokers. The mean of FEV1 in smokers in this study was lower than the normal value (>75%) indicating decreased lung function [7]. This finding is supported by a previous study that showed smoking significantly reduced FEV1 [8]. Cigarettes contain chemicals and irritants that cause inflammation on the respiratory system and cause airway obstruction resulting in reduced FEV1 and increased FVC

[14]. A previous study showed a dose-dependent relation between smoking and FEV1/FVC, suggesting the more cigarette intake, the lower FEV1, and the higher FVC [14]. The mean FEV1 in smoker group after 7 days of tamarind consumption was significantly higher compare to the baseline mean FEV1. This suggested that *T. indica* could improve lung function by reducing airway obstruction, shown through increased FEV1. This finding is consistent with previous studies that showed *T. indica* had anti-inflammation and antioxidant properties [11-13]. The leaves, seeds, and other parts of *T. indica* could stabilize the red blood cell membrane and prevent cell damage, resulting in decreased inflammatory response [12]. In addition, it is also rich in polyphenol and essential amino acids that has antioxidant effect [13]. Together, the anti-inflammation and antioxidant effect of *T. indica* helped in reducing airway obstruction in smokers and improved lung function, resulting in increased FEV1 among smokers after 7 days of tamarind consumption. A previous study also showed that *T. indica* had antihistaminic, adaptogenic, and mast stabilizing effects, suggesting its potential as asthma and cough treatment [10].

This study has some limitations. First, the sample size was relatively small, thus the results of this study might could not be generalized. A study with bigger sample size is therefore warrant. Second, the samples of this study were workers at the wood furniture factories, giving them another risk of getting pulmonary problems due to long exposure of wooden materials and debris. A study on male smokers working in less risky environment will be adamant to control other confounding. Nevertheless, this study has elucidated an important finding that tamarind could increase FEV1 suggesting its potential in reducing airway obstruction on active smokers.

CONCLUSIONS

Tamarind is a potential traditional medicine for airway obstruction problems in active smokers as it can reduce airway obstruction. Further studies on the effective and save dosage of tamarind for chronic respiratory diseases treatment are warrant.

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