

Oral Tamarillo Juice Preventable to Decline Lung Function among Parking Workers

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Abstract: Recently, the research on the effects of antioxidants on tamarillo has not done a lot. Tamarillo contains several types of antioxidants such as Vitamin C, Vitamin E, beta carotene, anthocyanins, flavonols, and phenolic acids. The objective of this study was to investigate the provision of oral tamarillo juice twice daily to prevent a decline in lung function among parking workers. This study used the expansion randomized pretest and posttest control group design. Subjects of this study was parking workers in Denpasar. Subject selected by purposive sampling and divided into two groups based on random allocation. Examination of lung function has been done by a spirometer Autospiro AS-500 Minato by measuring %FEV1 and %FVC pre and post in Treatment and Control Groups. The results were analyzed by independent sample and paired samples t-test. In this study, it was found that provision of oral tamarillo juice twice a day for two weeks may prevent decline of the force vital capacity (%FVC) but had no effect on expiratory force 1st second (%FEV1). From this study it can be concluded that the provision of oral tamarillo juice preventable to decline lung function mainly the force vital capacity (%FVC).

Keywords: Lung function, FVC, FEV1, Tamarillo juice, antioxidants

1. Introduction

Increasing of traffic density means increased vehicle emissions. This fact has a serious impact on acute lung function among parking workers. Vehicle exhaust emissions are one source of free radicals in the parking workers. During the combustion process, many chemical reactions involved and generate both reactive oxygen species (ROS) and reactive nitrogen species (RNS). Free radicals that produced during combustion such as hydroxyl radical, hidroperoksil, methyl, singlet oxygen, and hydrogen. ROS and RNS may induce oxidative stress and consequently may alter lung function acutely in parking workers. Free radical exposure can be neutralized by tamarillo juice that rich in antioxidants.

Tamarillo (*Cyphomandra betacea* (Cav.) Sendtn) is a fruit that found in some areas in Bali such as in Bangli and Tabanan regencies. The fruit is rich of antioxidants with a relatively cheap price. Research on the effects of antioxidants on tamarillo on health has not done a lot. Tamarillo contains several types of antioxidants such as Vitamin C, Vitamin E, beta carotene, anthocyanins, flavonols, and phenolic acids.

Based on above explanation, it seems there is a relationship between vehicle emissions exposure to the acute decline in lung function that can be prevented by tamarillo juice.

2. Materials and Methods

This study used experimental design with randomized pretest and posttest control group design. Subjects in this study involved 22 parking workers in Denpasar selected by

purposive sampling. Subjects selected by some criteria including 18-60 years old, working experience not less than 1 year. Subjects divided into two groups by simple random sampling. Subjects work every day as usual for 14 days. Treatment Group gave oral tamarillo juice twice daily at 7.30 am and 11.30 am for 14 d. Control Group didn't give tamarillo juice.

Data were collected pretest and posttest in Treatment Group and Control Group. Examination of lung function has been done by a spirometer Autospiro AS-500 Minato by measuring FEV1% and FVC% based on American Thoracic Society Standard. The results were analyzed by independent sample t-test, Wilcoxon, and Mann-Whitney test.

3. Results and Discussion

In this study, it was found that 86.4% subject with normal lung function and 13.6% subject with restrictive. The average of age in this study was 37.7±10.5 years old. Body mass index was 25.0±3.1 kg/m². Working experience was 6.3±4.4 years.

Comparison test on this study was conducted on %FEV1 and %FVC pretest between the Treatment and Control Groups, %FEV1 and %FVC between pretest and posttest in Treatment Group, %FEV1 and %FVC between pretest and posttest in Control Group, mean difference of %FEV1 and mean difference of %FVC Pre-posttest between Treatment and Control Groups. All of data analyzed by Shapiro-Wilk Test and showed normal distribution, so that comparison test analyzed by parametric test.

Comparison test on %FEV1 and %FVC pretest between the Treatment and Control Groups used independent samples t test. The average %FEV1 pre test in Treatment Group was 92.8±6.9%, %FEV1 pre test in Control was 93.8±6.1%. There was no significant difference of %FEV1 pretest between Treatment and Control Group with p value 0.732 respectively. The average %FVC pre test in Treatment Group was 83.7±4.5%, %FVC pre test in Control was 83.2±5.1%. There was no significant difference of %FVC1 pretest between Treatment and Control Group with p value 0.782 respectively as showed in Table 1.

Table 1: Mean Comparison of %FEV1 and %FVC Pretest between Treatment and Control Group

	Mean %FEV1	t	p	Mean %FVC	t	p
Treatment Group	92.8±6.9	-0.347	0.732	83.7±4.5	0.281	0.782
Control Group	93.8±6.1			83.2±5.1		

Comparison test of %FEV1 between pretest and posttest in Treatment Group and %FVC between pretest and posttest in Control Group used paired samples t-test. The average of %FEV1 pretest in Treatment Group was 92.8±6.9%, %FEV1 posttest in Control Group was 92.2±5.9%. There was no significant difference of decline %FEV1 between Treatment and Control Group with p value 0.427 respectively as showed in Table 2. The average of %FEV1 pretest in Control Group was 93.8±6.1%, %FEV1 posttest in Control Group was 93.6±6.3%. There was no significant difference of decline of %FEV1 between Treatment and Control Group with p value 0.427 respectively as showed in Table 2.

Table 2: Mean Comparison of %FEV1 between Pretest and Posttest in Treatment Group and Control Group

	Treatment Group			Control Group		
	Mean %FEV1	t	p	Mean %FEV1	t	p
Pretest	92.8±6.9	0.829	0.427	93.8±6.1	0.514	0.618
Posttest	92.2±5.9			93.6±6.3		

Comparison test of %FVC between pretest and posttest in Treatment Group and %FVC between pretest and posttest in Control Group used paired samples t-test. The average of %FVC pretest in Treatment Group was 83.7±4.5%, %FVC posttest in Control Group was 84.4±4.6%. There was significant difference of slightly increase of %FVC after oral tamarillo juice about 0.7% (95%CI 0.2-1.1%) with p value 0.007 respectively as showed in Table 3. The average of %FVC pretest in Control Group was 83.2±5.1%, %FVC posttest in Control Group was 80.7±5.7%. There was significantly decrease of %FVC posttest (crossweek) in Control Group about 2.5% (95%CI 0.7-4.2%) with p value 0.012 respectively as showed in Table 3.

Table 3: Mean Comparison of %FVC Between Pretest and Posttest in Treatment Group and Control Group

	Treatment Group			Control Group		
	Mean %FVC	t	p	Mean %FVC	t	p
Pretest	83.7±4.5	-3.355	0.007	83.2±5.1	3.055	0.012
Posttest	84.4±4.6			80.7±5.7		

In the combustion process of motor vehicle exhaust, there are various pollutants produced with respiratory acute effects. These are oxides of nitrogen (NO_x), ozone (O₃), particulate matter, and Polycyclic aromatic hydrocarbons (PAHs) [1]. In the combustion process, there are a variety of chemical reactions that produce reactive oxygen species (ROS) and reactive nitrogen species (RNS) or reactive nitrogen species. At the time of hydrocarbons burned, a number of oxygen radicals are involved in it. Free radicals are produced during combustion include hydroxyl radical, hidroperoksil, methyl, singlet oxygen, and hydrogen. Research conducted in East Java, it was found that the levels of NO₂ and particulate matter on the street in Surabaya above the threshold level [2].

Reactive oxygen species (ROS) and RNS produced in vehicle exhaust will cause oxidative stress in people who are exposed as the parking workers. A research has been reported that an increase of oxidative stress among people who move near the highway [3]. A research has conducted and it was found that restrictive lung function about 38.1% among traffic policemen [2]. Acute respiratory effect of free radical among welders was found that characterized by a decline of %FVC about 7.6% at cross week. Acute respiratory effect can be prevented by oral vitamin C [4].

Tamarillo contains several types of antioxidants include Vitamin C, Vitamin E, beta carotene, anthocyanins, flavonols, and phenolic acids [5]. Flavonols, anthocyanins, and phenolic acids classified as flavonoids. Flavonoids are well used to counter the effects of free radicals, such as hydroxyl radicals, superoxide anion, lipid peroxy radicals, nitric oxide, singlet oxygen, and peroksinitrat [6]. Flavonoids act as antioxidants by means oxidized by radicals resulting in less reactive chemical substances.

Biological molecules including respiratory membranes are susceptible to attacked by free radicals. Cell membrane is rich of PUFAs and susceptible to damaged by free radical that induce radical chain reaction or lipid peroxidation [7]. Ascorbate is an antioxidant for some types of free radicals/oxidants, such as hydroxyl radical, hidroperoksil, and singlet oxygen. Ascorbate protects cell membranes and lipoproteins from lipid peroxidation [8].

Anthocyanin as an antioxidant found in tamarillo fruit about 82 mg/100 grams of fruit [5]. The maximum concentration of anthocyanin in plasma reported between 1 and 3 hours average of 1.5 hours [9]. Blood and urine were taken between 0 h and 4 h after consuming 480 ml of cranberry juice. Plasma anthocyanin concentration reported between 0.56 and 4.64 nmol/L. Although low concentrations in plasma, but those levels are strong enough to cause an effect as an antioxidant [10].

4. Conclusion

From this study it can be concluded that the provision of oral tamarillo juice preventable to decline lung function mainly the force vital capacity (%FVC).

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