

## Effect of Direct Smoking on Youth Smoker's Physical Fitness Based on 3-Minute Step Test

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### Abstrak

Jumlah perokok di kalangan kaum muda meningkat beberapa tahun terakhir ini. Populasi kaum muda sebagai penduduk usia produktif memerlukan kebugaran/ kekuatan fisik yang baik untuk kinerja pekerjaan mereka, dan merokok memiliki efek negatif pada kebugaran/ kekuatan fisik mereka. Penelitian ini mengamati besarnya efek merokok akut pada kebugaran/kekuatan fisik dengan melakukan langkah uji 3 menit (*three minute step test*) dalam dua kelompok, yani kelompok perokok dan kelompok non perokok. Setiap peserta diminta untuk melakukan 3 menit tes melangkah pada anak tangga. Kelompok perokok diminta untuk merokok setidaknya enam jam sebelum tes. Hasil post test dibandingkan antara dua kelompok. Data dianalisis menggunakan program T -Test SPSS. Dari hasil SPSS terungkap bahwa tidak ada perbedaan yang signifikan antara perokok dan non perokok di nilai pasca latihan. Sehingga dapat disimpulkan bahwa merokok memiliki dampak sigificant pada 3 menit hasil langkah tes peserta kami

**Kata kunci:** *Populasi kaum muda, efek merokok, kebugaran fisik, 3 minutes step test, T-Test*

### Abstract

*Number of smokers among youth population are increased in recent year. Youth population as productive population need good physical fitness for their work performance, and smoking has negative effect on physical fitness. This study observed the magnitude of acute smoking effect on physical fitness by doing 3-minute step test in two groups, smoker and non smoker group. Each participants were asking to do 3 minutes step test. Smoker group were asked to smoke at least six hours before test. Post test pulse were compared between two groups. Data were analysed using T-Test SPSS program. It was revealed that there were no significant difference between smoker and non smoker in post exercise pulse value. It Conclude that smoking has no sigificant impact on our participant's 3 minutes step test result.*

**Keywords:** *youth population, smoking effect, physical fitness, 3 minutes step test, T-Test.*

### Introduction

Number of smokers in low income country tend to increase particularly in youth population<sup>1</sup>. According to Indonesia Ministry of Health data, smoker prevalence among adult (> 15 years old) increase in every year from 27.2 % in 1995 to 36.3% in 2013<sup>2</sup>. Smoking has many acute effect on work performance. It alters respiratory work by decreasing airway conductance, enhancing broncoconstriction and reducing VO<sub>2</sub> max. Effect on VO<sub>2</sub> max due to CO saturation of blood, decreasing Blood's

oxygen capacity and increasing effort to breath, increase heart rate, blood pressure, and reduce coronary microcirculation.

Youth population have important contribution on country development, and factors that can reduce their work performance, wil affect country development too. Smoking has many effects on work performance. The magnitude of its effect on work performance in youth population are needed to be evaluated. Many fitness test such as treadmill test, cycle ergonometri, and 3 minutes step test probably have role in determination of smoking effect.

The smokers were also found on campus, not exception in the department of Engineering and department of Design in Polytechnic of Samarinda. Young smoker as beginner may not show any disease related to smoking habits. But for their daily activity, smoking may have impact on their fitness, particularly in long endurance or weight activity. This study observed the magnitude of smoking effect on physical fitness by doing 3-minute step test method with the student of Polytechnic as participant.

## Research Methodology

### Exercise Physiology

Aerobic and resistance exercise increase body's oxygen requirement to supply energy to the exercising muscle. Oxygen requirement measured indirectly as the amount of oxygen consumed/ ventilatory oxygen consumption ( $VO_2$ ). According to Fick Equation :

$$VO_2 = \text{Cardiac Output} \times (\text{Arterial} - \text{venous } O_2 \text{ difference})$$

$$\text{Arterial} - \text{Venous } O_2 \text{ difference} = (A - \Delta VO_2)$$

$(A - \Delta VO_2)$  increase during exercise by three ways :

1. Blood flow redistribution from non exercising tissue to exercise muscle
2. Increased oxygen extraction in exercising muscle
3. Hemoconcentration of blood due to plasma fluid losses into interstitial space.

Maximal increase in  $(A - \Delta VO_2)$  is fixed at 15 to 17 volume percentage. So, maximal  $VO_2$  determined by maximum cardiac output (heart pump capacity). Exercise  $VO_2$  requirement are determined by cardiac output. Cardiac output are determined by heart rate and cardiac stroke volume. Individual with larger  $VO_2$  max (ventilatory oxygen consumption maximum) use less of his or her maximal capacity and produce lower heart rate than individual with smaller  $VO_2$  max to perform same physical activity.  $VO_2$  max value are determined by many factors such as age, sex, body weight, training, nutrition and smoking habit.

### Smoking and Physical Activity

Smoking has many acute effect on work performance. It alters respiratory work by decreasing airway conductance, enhancing

bronchoconstriction and reducing  $VO_2$  max. Effect on  $VO_2$  max due to CO saturation of blood, decreasing Blood's oxygen capacity and increasing effort to breath. It also increase heart rate, blood pressure, and reduce coronary microcirculation. All of these combining effects will reduce physical endurance and readiness even in healthy young person.

To achieve peak performance, heart, lung and muscles need oxygen rich blood. Tobacco in other way contains CO that are bounded to red blood cells, and prevent  $O_2$  to bound on it. Reduce Oxygen delivery will reduce physical endurance for sport and daily activity. Decrease oxygenation cause smokers resting heart rate higher than a non smokers.

Decrease oxygenation also have impact on  $VO_2$  max and physical fitness. There are so many ways to measure  $VO_2$  max. Direct measurement of  $VO_2$  max can be performed by maximal exercise test methods, such as treadmill test and cycle ergometry. These test purposes to calculate maximum aerobic capacity by push subjects to reach maximal muscle work where body's  $O_2$  consumption maximal and cannot increase anymore.  $O_2$  consumption at this level are measured using douglas bag. These methods produce fatigue and any side effect such as shortness of breath, nausea, chest pain, and even syncope. To avoid these side effect, submaximal test methods are offered as substitution to maximal test methods. One simple way to measure  $VO_2$  max and physical fitness is 3-minute step test method.

### Methods

Participant for this research recruited from 30 student of Polytechnic of Samarinda with open recruitment. Participatory in this research, recruited and separated into two groups, smoker and non smoker. Participant were exclude, if only there were any medical problems. All participant were ordered to do 3-minute step test. Smoker participant were asked to smoke at least six hours before test. We also measured participant's height, weight, and resting pulse. After participant finished 3 minute step test, 1 minute pulse were recorded. 3-minute step test according to YMCA, is a simple way to test cardiovascular fitness. First participant were asked to step on and off following metronom on 12 inch tall step bench with speed about 96 beat per minute. After 3 minute, participants were asked to seat and pulses were recorded for 1 minute.

The data were calculating with descriptive statistic methods. The t-test assesses whether the means of two groups

are statistically different from each other. This analysis is appropriate whenever we want to compare the means of two groups, and especially appropriate as the analysis for the posttest-only two-group randomized experimental design. The Independent-Samples T Test procedure compares means for two groups of cases. Ideally, for this test, the subjects should be randomly assigned to two groups, so that any difference in response is due to the experiment and not to other factors. But it is not ethically allowed to ask a non smoker to smoke. So allocation for each groups were not randomly assigned. To avoid bias, we measured objective data such as pulse, height, and weight. Post exercise pulse data were calculated as the main data for this research.

$$s_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \quad t = \frac{\bar{x}_1 - \bar{x}_2}{s_{\bar{x}_1 - \bar{x}_2}}$$

**Result and Conclusion**

The result of the experimental 3-minute step test :

**Tabel 1. Data mean 3-minute step test of smoker than non smoker**

No	Item	Smoker	Non-Smoker
1	Mean of age	19.73	19.73
2	Mean of height	167.87	170.53
3	Mean of weight	63.67	58.4
4	Mean of resting pulse	88.33	90.8
5	Mean of after exercising pulse	127	124



**Figure 1. Heart pulse calculating**



**Figure 2. 3-Minute step test measurement**

Hypothesis :

- H<sub>0</sub> = Both group varians are identic (after exercise pulse group varian between smoker and non smoker are similar)
- H<sub>1</sub> = Both group varians are not identic (after exercise pulse group varian between smoker and non smoker are not similar)

H<sub>0</sub> is accept if only probability > 0.05

H<sub>0</sub> is refuse if only probability < 0.05

**Conclusion**

**Tabel 2. SPSS Analysis**

Group Statistics					
	Group	N	Mean	Std.	Std. Error
				Deviation	Mean
Pulss	non_smoker	15	124.0000	12.43268	3.21010
	smoker	15	127.0000	13.45362	3.47371

**Independent Samples Test**

	Leven's Test for Equality of Variances		t-test for Equality of Means						
							95% Confidence Interval of the Difference		
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper

pul	Equal	.15	.73	-	28	.53	-	4.7298	-	6.68
ls	varian			.6			3.0000		12.68	865
	ces									
	assum									
	ed									
	Equal									
	varian			.6	27	.53	-	4.7298	-	6.69
	ces						3.0000		12.69	136
	not									
	assum									
	ed									

Data were analysed using T-Test SPSS program. From the result of reasearch in 30 student of Polythecnic of Samarinda who perform physical fitness test with 3-minute step test methods. It was revealed that there were no significant difference between smoker and non smoker in post exercise pulse value.

$F_{calc}$  is 0.115 with probability = 0.737. Because of probability > 0.05, so  $H_0$  accept. In other word, both group variance are similar, after exercise pulse group varian between smoker and non smoker are similar. It means that the data cannot continue for next evaluation. From this result, we conclude that there were no significant impact of acute smoking on our participant performance to do 3 minutes step test protocol.

This result may be influenced by many factors such as body height, trained-non trained subject difference, and sub maximal test that failed to recognize reducing physical fitness in subject . It probably due to protocol at test, which not allow subject to reach their maximal work performance. The further researches in this matter are needed with different protocol, that can acurately reflex  $VO_{2max}$  and physical fitness

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