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Cardiorespiratory Endurance on College Student Smokers Using Harvard Step Test

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ABSTRACT
Purpose: The aim of this research was to identify the score of Harvard Step Test as indicator of cardiorespiratory endurance on college student smokers. **Method:** This was a descriptive cross-sectional study. There were 40 samples who met inclusion and exclusion criteria were selected using purposive sampling. The instruments of this study were questionnaire, metronome, stop watch, and 19 inches bench. Data were analyzed using descriptive statistics. **Results:** The results showed that 47,5% of subjects had poor level, 42,5% had average level, and 10% had good level of Harvard step test. On average, 65% of subjects were light smokers, 87,5% were filtered cigarette smokers, and 65% had been smoking for 2-5 years. **Conclusion:** It can be concluded nearly half of college student smokers had poor Harvard step test score as indicator of cardiorespiratory endurance.

Keywords: Harvard Step Test, Cardiorespiratory Endurance, College Student Smokers

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INTRODUCTION

World Health Organization (WHO) stated that Indonesia was the third largest country with cigarette consumption. It is estimated that currently around 65 million Indonesians or about 28% of Indonesians become smokers. The estimation of smoker statistics among Indonesian children and adolescents, 24.1% of boys are smokers and 13.5% of teenagers are smokers (Pusat Komunikasi Publik Sekretariat Jenderal Kementerian Kesehatan RI, 2015).

The number of death caused by smoking increases. It has been reported that male smokers have a mortality rate of 70% higher than non-smokers, which was a major cause of death including lung cancer and coronary heart disease. In the United States an estimated 140,000 people per year die from lung cancer and about 85% of them are caused by smoking. Smokers have twice the chance of getting coronary heart disease, higher than nonsmokers and can increase the risk of stroke by about 70% (Hembing, 2008).

Smoking has effects on respiratory and circulatory system so it can affect cardiorespiratory endurance. The most objective measurements to determine the cardiorespiratory endurance of a person is to calculate the maximal uptake of O2 (VO2max) (Hasyim, 1993).

One simple test that can be used to demonstrate a person's cardiorespiratory endurance ability is the Harvard Step Test (Rasyid, 2005). Harvard step test is a method of assessment to identify cardiorespiratory endurance. The test results are based on heartbeat at rest and exercise (Greenberg, 2004).

Basic health research data in South Kalimantan stated that Banjarbaru ranks first (36.8%) for people aged 15-19 years who first smoked and smoked every day (BalitbangkesDepkes RI, 2009). A preliminary study conducted at the University of Lambung Mangkurat obtained data that 70% of male students claimed to have smoked. The aim of this study was to identify the score of Harvard Step Test as indicator of cardiorespiratory endurance on college student smokers.

METHOD

This study used analytic method with cross sectional design to perform variable measurement at one time.40 samples were taken by purposive sampling that met the inclusion criteria (male, smoked ≥ 1 year, healthy, normal body mass index).

Subjects were asked to perform Harvard Step Test by climbing up the bench as high as 19 inches for a maximum of 5 minutes, and required to rest for one minute. After that, the pulse were measured in 30 seconds, which was then calculated in the formula to get the value of harvard step test so that the cardiorespiratory endurance could be categorized (>80 = good, 50–80 = average, <50 = poor). While smokers were divided into two categories. Light smokers were subjects who smoked <10 cigarettes per day, while heavy smokers were those who smoked >10cigarettes per day. This study was conducted in April-July 2016. Data were analyzed using descriptive statistics.

RESULTS AND DISCUSSION

Table 1 showed that 65% of subjects were light smokers, 87,5% of subjects were filtered cigarette smokers. The most dangerous chemicals in cigarettes are nicotine, tar, and carbon monoxide. Tobacco companies responded to the growing public concern over the health effects of smoking by progressively promoting new types of cigarettes, such as cigarettes with filters in the 1950s and "low-tar" cigarettes started in the mid-1960s (Stanton et al, 1998). The cigarette filters were particularly designed to absorb vapors and to accumulate particulate smoke components (Kathleen, 2000). Increasing cellulose acetate in the composition of the cigarette filter could increase tar and nicotine retention and consequently decrease amount of nicotine and tar taken by consumers. This could reduce the harmful effect of these two harmful components (Mohsen, 2018). However, the dangerous substances in cigarette still can interfere with the work of the cardiorespiratory system. The study results indicated the average of 65% subjects had been smoking for 2-5 years. Within 1-2 years of smoking, a young smoker will have inflammatory reactions in the small respiratory tract or even chronic obstructive airway. This condition will return to normal after quitting smoking for 1-2 years. But cigarettes will give a permanent effect if the person smokes it for 5 years (Brodish, 1998).

Table 2 indicated that almost half of subjects had poor level (47,5%) and average level (42,5%) of Harvard step test. The validity and reliability of Harvard step test has been evaluated to predict the maximum oxygen uptake (Vo2max) and commonly used in students from faculty of physical education (Elsaidy, 2011). The poor value of Harvard step test indicated that the content of CO gas present in cigarettes that are inhaled into the lungs will participate in the bloodstream including the blood flow of the heart. Blood contains a lot of hemoglobin, an important substance for the body to transport oxygen throughout the body. If there is CO gas in the blood, then hemoglobin will be more tied to CO, because the binding capacity of CO with

Table 1. Smoker classification

Classification	Frequency	Percentage (%)
Intensity		
Light	26	65%
Heavy	14	35%
Cigarette type		
Filter	35	87,5%
Non- filter	5	12,5%
Duration (years)		
1-2 years	3	7,5%
>2 – 5 years	26	65%
>5 years	11	27,5%

Table 2. Harvard step test value

Harvard step test value	Frequency	Percentage (%)
Poor	19	47.5%
Average	17	42.5%
Good	4	10%
Total	40	100%

hemoglobin is 200-250 times stronger than the oxygen binding capacity with hemoglobin. If there is excessive CO content in the blood, blood oxygen level will drop drastically (Depkes RI, 2004).

Nicotine in cigarettes leads to increased heart rate, increased LDL that can lead to plaque in the blood vessels and can cause constriction of blood vessels that lead to increased blood pressure in the resting state, so that the body's need for oxygen is also increased and the blood supply to body tissue will be disrupted. While tar in cigarettes is a carcinogenic aromatic polinucline hydrocarbon compounds. The presence of toxic chemicals can damage lung cells and cause various diseases, especially in the respiratory tract (Benowitz, 2015).

These three substances eventually will cause disruption of lung, heart and circulatory system that will affect the withdrawal and delivery of oxygen from the lungs to the tissue (Brodish, 1998). If there is interference in those three systems then the VO2 value of a smoker will decrease because the value of VO2max was influenced by lung function, cardiovascular, and hemoglobin. VO2 values are illustrated at the value of Harvard Step Test.

The results of this study are in line with a study conducted by Chien Liang which indicated that smoking significantly decreased cardiovascular performance and response in exercise foot (Chen, 2015). However, in previous study, it was assumed that cigarettes with different nicotine content might have contributed to the inconsistent results. Another study from Andresa in 2014 had also shown that VO2 max is significantly higher in nonsmokers compared with both active and passive smokers. However, previous study reflected that the VO2max of passive smokers did not differ from active smokers. (Borba, 2014).

CONCLUSION

It can be concluded that 65% of subjects were light smokers, 87,5% were filtered cigarette smokers, and 65% had been smoking for 2-5 years, and almost half of subjects had poor level (47,5%) and average level (42,5%) of Harvard step test. The analysis of correlation between smoking and Harvard step test scores need to be done in further study.

STUDY LIMITATION

It is important to highlight the methodology limitations of this study. Recall bias must be considered. Questionnaires limit the strength of the study because some questions might not be answered truly due to an inability of respondents to remember some aspects of the evaluation or because they unconsciously underestimated or overestimated the answers that were needed.

ETHICAL CLEARANCE

Ethics committee approval from Lambung Mangkurat University was obtained before the study was undertaken.

CONFLICT OF INTEREST

The author declares that present study was conducted in absence of any conflict of interest. This study was supported by grant funding of Faculty of Medicine, Lambung Mangkurat University.

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