Cardiorespiratory Endurance among End Year Student of Faculty of Pharmacy in Jatinangor, Bandung

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Abstract

Background: Physical fitness indicates the ability of an individual to perform daily physical activities with ease. The major component of physical fitness is the cardiorespiratory endurance, which is assessed through maximal oxygen consumption (VO2 max). A decrease in cardiorespiratory endurance can be associated with a sedentary lifestyle. This study was conducted to determine the cardiorespiratory endurance among young adults in Jatinangor, Bandung.

Methods: This cross-sectional study had used total sampling method, conducted among end year student of Faculty of Pharmacy, Universitas Padjadjaran from October–November 2013. The inclusion criteria wasall end year students who had no health-related problems and the students had to agree to participate in the study. After obtaining written informed consent from the participants, Astrand-Rhyming Step Test was performed to measure the level of VO2max.

Results: In total, 32 students were included of whom 14 students (43.7%) had an average level of VO2 max and 9 (28.2%) had just below average level. Chi-square test results showed that there was no significant relationship ($p>0.05$) between VO2 max level and gender, BMI level, and smoking habit, but showed a significant relationship ($p< 0.05$) with exercising habit.

Conclusions: The majority of the participants had an average level of VO2 max. A significant relationship between the level of VO2 max and exercising habit, suggesting a regular exercise for a better lifestyle.

Keywords: Cardiorespiratory endurance, pharmacy students, VO2 max

Introduction

Physical fitness is an important health marker that relates to the ability of a person to perform physical activity.[1] Components of physical fitness such as cardiorespiratory endurance are essential for total fitness of the body and mind.[2] Cardiorespiratory endurance is the body's ability to supply the needed oxygen to large working muscles for an extended period of time.[3] The degree of cardiorespiratory endurance shows how the heart and lungs respond to movement.[4] There are three things that can affect a person's cardiorespiratory endurance. These are how often they exercise, how intensely they exercise, and how long each workout lasts.[5] The maximal oxygen consumption (VO2 max) is quantified in L min-1 or ml kg-1 min-1 as a measure of cardiorespiratory endurance.[1,6]

According to previous studies, about 40% to 50% of higher institute students are physically inactive.[7] There have been consistent declines in cardiorespiratory endurance fitness performance across all studied Asian nations over the past 10–15 years.[8] Several countries, including Indonesia, have approximately 60–85% of adults that perform less physical activity to maintain their physical fitness.[9] As higher institute students move toward their senior year, they significantly have a more sedentary lifestyle.[10]

The sedentary lifestyle may replace physical activity, promoting an energy imbalance, and subsequently, an increased risk for obesity with low cardiorespiratory endurance.[11] Generally, fresh graduates of higher-learning institutions are physically less active and weigh more compared to their freshman

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year.[10] Therefore, this study was conducted to determine the cardiorespiratory endurance of end year students from Universitas Padjadjaran, Jatinangor.

Methods

This study was a cross sectional study performed among all end year students in the Faculty of Pharmacy, Universitas Padjadjaran, Jatinangor, conducted from October–November 2013 after the ethical clearance was given After considering the inclusion and exclusion criteria, 32 students were recruited. The inclusion criteria were all end year students , and the exclusion criteria were students who had health-related problems according to a physical activity readiness questionnaire. The students must agree to participate in this study.

After filled in questions regarding their health background, students were weighed using a weighing scale with precisely measurement to the nearest 0.1 kg. Furthermore, height was measured using a stadiometer, precise to the nearest centimeter. Using those values, body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters.[12] Resting pulse rate was measured for 15 seconds and multiplied by 4 to calculate the pulse rate in beats per minute. Resting blood pressure of the participants was measured using sphygmomanometer and stethoscope with them while resting in sitting position. Then, the participants performed Astrand-Rhyming Step Test; as for the male participants step up and down on a 40-centimeter bench and for female participants on a 33 cm bench both, for 5 minutes at the rate of 90 steps per minute. According to the metronome rhythm, the participant's right leg had to be on the bench at the first sound followed by the left leg at the second sound. During the third sound, the right leg had to be down on the floor followed by the left leg at the fourth sound. Throughout this procedure, the participant's posture had to be upright. Heart rate was measured from exactly 15–30 seconds following the completion of the test. Recovery heart rate was measured each minute for five minutes and blood pressure was measured again at the end after completion of the test.

The VO2 max of the participants were calculated using the Astrand-Rhyming Nomogram.[13] Data were collected and analyzed to seek any significance relationship ($p<0.05$) between level of VO2max and gender, level of BMI, smoking and exercising habit, using the Windows Statistical Product and Service Solutions 17.0 and Microsoft Excel program. The results were presented in tables for better view.

Table 1 Characteristic of end Year Students from Faculty of Pharmacy Jatinangor, Bandung

	Frequency (n)	Percentage (%)
Gender		
Female	18	56.25
Male	14	43.75
BMI (kg/m^2)		
Underweight	2	6.25
Normal	24	75
Overweight	4	12.5
Obese	2	6.25
Smoking habit		
No	26	81.25
Yes	6	18.75
Exercise regularly		
No	12	37.5
Yes	20	62.5

Table 2 Classification of Level of VO2 max among end Year Students from Faculty of Pharmacy, Jatinangor, Bandung

VO2 max	Frequency (n)	Percentage (%)
Very High	4	12.5
High	4	12.5
Average	14	43.7
Below Average	9	28.2
Very Low	1	3.1

Table 3 Classification of Level of VO2 max among end year students from Faculty of Pharmacy, Jatinangor, Bandung based on Gender

VO2 max	Gender		Total (n)
	Female (n)	Male (N)	
Very High	4	0	4
High	3	1	4
Average	7	7	14
Below Average	4	5	9
Low	0	1	1
Total	18	14	32

Results

Based on the data obtained, the 32 participants in this study had an age range of 21–27 years old and the majority were female. Most of the participants had normal BMI. Majority of the participants did not smokeand more than half of them exercised regularly (Table 1).

Most of the participants had an average level of VO2 max (43.7%) and just below the average (28.2%) (Table 2). Both male and female participants belong to the average category of VO2 max (Table 3). Based on chi-square analysis, there was no significant relationship between gender and level of VO2max ($X2 = 5.70$; $df = 4$; $p = 0.22$).

Of all the levels of VO2 max, a high number of participants have normal BMI (Table 4). No significant relationship between level of BMI and level of VO2 max ($X2 = 14.58$; $df = 12$; $p =$

Table 4 Classification of Level of VO2 max among end year students from Faculty of Pharmacy, Jatinangor, Bandung based on BMI

VO2 max	BMI (kg/m^2)				Total (n)
	Underweight	Normal	Overweight	Obese	
	n	N	N	n	
Very High	-	4	-	-	4
High	1	3	-	-	4
Average	1	12	1	-	14
Below Average	-	4	3	2	9
Low	-	1	-	-	1
Total	2	24	4	2	32

Table 5 Classification of Level of VO2 max based on Smoking Habit

VO2 max	Smoke		Total (n)
	No	Yes	
	n	n	
Very High	4	-	4
High	4	-	4
Average	11	3	14
Below Average	7	2	9
Low	-	1	1
Total	26	6	32

Table 6 Classification of Level of VO2 max based on the Habit of Exercising

VO2 max	Regular Exercise		Total (n)
	No	Yes	
	n	n	
Very High	-	4	4
High	-	4	4
Average	3	11	14
Below Average	9	-	9
Low	-	1	1
Total	12	20	32

0.27). Most of the participants with no smoking habit had an average and just below average levels of VO2 max (Table 5). The chi-square test did not show any significant differences between smoking habit and level of VO2max ($X2 = 6.26$; $df = 4$; $p = 0.18$).

Most of the participants that exercise regularly had an average level of VO2 max. Very high and high level of VO2 max could only be seen in participants that had the habit of exercising regularly, albeit there was one participant that exercised regularly but had a low level of VO2 max. Below average VO2 max could only be seen in participants that did not exercise regularly (Table 6). Statistically, there was a significant relationship between habit of exercising and level of VO2 max ($X2 = 21.94$; $df = 4$; $p = 0.00$).

Discussion

The data were collected to measure the level of cardiorespiratory endurance as expressed in VO2 max values, and to stratify according to gender, BMI, smoking habit and habit of exercising regularly. Result shows that most of the end year students have an average level and just below the average level of VO2 max, despite that the end year students were involved in fewer physical activities, since they were more preoccupied with assignments and other academic work compared to their junior peers.

In terms of gender, female participants have a generally higher VO2 max. Females have 20 percent lower VO2 max than males, however, many female athletes have higher VO2 max values than most male.[14] Interestingly, our study result showed that no significant relationship between gender, level of BMI, smoking habit and level of VO2 max. In our study, female participants engage themselves in exercise more often than male participants. Besides engaging in regular exercise, the female participants also filled their leisure time with dancing as well, which in itself is a vigorous physical activity as well. Furthermore, most of the female participants walk to campus every day unlike most of the male participants who ride motorbikes to campus. Unfortunately,

there were no further inquiries made about this activity, but it has been observed during the study.

In accordance with our study, BMI may not be associated with cardiorespiratory fitness.[15] On the other hand, lower waist circumference may be correlated with better cardiorespiratory fitness.[15] This result agrees with the findings of other studies in which waist circumference was a superior predictor for cardiovascular disease and cancer risk.[16,17] Unfortunately, in our study, the waist circumference is not measured, that limits our analysis. Other previous studies have found that level of VO2 max is most affected in heavy smokers group.[18,19] Interestingly, our finding has unexpected result; there is no significant relationship between smoking habit and level of VO2 max. A possible explanation for this might be that the smoking participants in this study are light or moderate/regular smokers, defined as 1-10 pack-y (packs•day * year(s) smoking) or 11-20 pack-y, respectively.

A significant relationship confirmed in our study is that the exercising habit and the level of VO2 max. It has been suggested that doing exercise regularly improves cardiorespiratory endurance. Exercise has significant improvement in VO2 max.[20] Regular exercise done by healthy sedentary and active adults show an improvement of their VO2 max.[21]

This study was limited by the absence of daily physical activity and waist circumference data. Information about the number of cigarette's packs and smoking duration of smoker's participants were also not obtained, that makes further analysis about the relationship of the gender, body composition, and the smoking habit is lacking.

To conclude, our findings indicate that in order to have a better level of VO2 max, participants must engage themselves in regular exercise. Here we suggest for at least three times in a week with each session being more than 60 minutes. Future research needs to examine more closely the relationship between VO2 max level and known factors affecting the VO2 max level increase.

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