ORIGINAL ARTICLE

Effect of School-based Aerobic Exercise Model on Health Fitness Medical Students

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ABSTRACT

Introduction: Most medical students have lower physical activity than non-medical. Medical students lack time to exercise due to busy academic schedules. Physical exercise maintains health and fitness and increases self-confidence as a future patient health counsellor. Therefore, this study aims to determine the effect of aerobic exercise on the fitness of medical students. **Methods:** It was an experimental analytic research using one group pretest posttest design. 25 medical students who met the inclusion and exclusion criteria were selected as subjects. Subjects who did physical activity regularly before the exercise program, had severe fatigue during exercise and didn't follow the training program three times in a row will be excluded. The model of in-school aerobic exercise was designed to be performed in the school using a group of students adjusted to academic hours. A regular aerobic exercise was conducted for 30 minutes per session, five sessions/week for four weeks. Six minutes walking test and VO2max levels were performed twice, before and after treatment, to assess health fitness. Bivariate analysis was conducted with paired t-test. **Results:**The results showed that regular 30 minutes per session, five sessions/week for four weeks aerobic physical exercise positively affected health fitness. This is consistent with the improvement of VO2max. The mean VO2max before and after exercise was 18.9 ml/kg b.w/min and 20.1 ml/kg b.w/min (p=0.005). **Conclusion:** Our study revealed that there was an increase in VO2max after an aerobic exercise intervention in medical students (p= 0.005).

Keywords: Aerobic, Exercise, Medical students, Physical fitness, VO2max

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INTRODUCTION

Research data states that most medical students have lower physical activity than non-medical (1-2). Several studies also noted that the tight academic schedule, lack of free time and limited facilities are the main reasons students cannot indulge in physical activities regularly (1-3).

Physical fitness is the body's ability to adapt organs within physiological limits to environmental conditions. A physically fit person can perform work efficiently without feeling excessively tired. Although many factors influence fitness, one of the critical factors is exercise or sports. Furthermore, physical exercise is needed to improve physical fitness. Exercise is divided into aerobic and anaerobic based on the need for oxygen. Aerobic exercise is a light to moderate sports activity that is carried out continuously, such as walking, running, cycling, and jogging. Aerobic exercise was proven to improve and maintain cardiorespiratory fitness (4-6).
The word "aerobic" means "used oxygen," as this kind of exercise is fueled by the oxygen that we got from breathing(7). According to a study, aerobic exercise should be performed three to five times per week for 25-30 minutes/session. The present results showed a relationship between regular physical activity, cardiovascular fitness, mental health, and well-being among university students (7). According to the World Health Organization, teenagers are recommended to do physical activity, at least 3 x 60 minutes per week to avoid a sedentary lifestyle and reduce recreational screen time (8). The lifestyle of the majority of teenagers at this time were less physical activity. That matter influenced by several things. Some of them are because of busy school and dependency to smartphones (gadgets). A college student mostly spends at least six hours sitting down without a break was doing academic work in front of the computer (9).

The success of a learning process was influenced by the individual's ability to focus on the object being studied. Related to this, concentration is an essential aspect for students in achieving learning success. Therefore, medical students should be given support

and opportunities to exercise because good physical condition leads to success in following a learning program. Several studies have also reported that positive short-term aerobic exercises result in dimensions of fitness, quality of life, memory, intelligence and others. (10-12).

The model of in-school aerobic exercise is one of the interventions to increase physical activity among students without requiring special facilities or specialized equipment, making an affordable and effective method of health intervention in the school-based population (10), (13). In our study, aerobic exercise was designed to be performed in the school setting by students and adjusted to their scheduled academic hours. This study aims to determine the association between school-based model physical aerobic exercise and fitness improvement among medical students. Furthermore, it contributes significantly to setting up school-based health interventions.

MATERIALS AND METHODS

Research Design

This is an experimental study with a pre and post-model analyses. The research subjects were 25 medical students both male and female aged 17 to 21 years of the Faculty of Medicine, University X, in Jakarta, Indonesia, Inclusion criteria were medical students, sedentary behaviour (sitting time > five hours/day outside bedtime) (14), healthy, willingness to participate and signed the informed consent form. Exclusion criteria were a history of severe asthma, vertigo, heart disease, lung disease, professional athletes or subjects who did physical activity regularly before the exercise program. Subjects who had severe fatigue during exercise and subjects who cannot complete the study (didn't follow the training program three times in a row) were be excluded. Healthy criteria were assessed with a physical examination by a licensed general practitioner. Physical examination included weight, height, blood pressure, body temperature, heart rate, respiratory rate and general physical examination of the head, neck, thorax, abdomen and extremities regio.

Each subject was asked to fill out a questionnaire with the google platform to obtain basic data and identify inclusion and exclusion criteria at the beginning of the study. Subjects who met the inclusion criteria underwent a physical examination to assess their health status. Furthermore, the subjects were given information about the research procedure and stated their approval by signing the informed consent. This research has received ethical approval from the Health Research Ethics Committee, Faculty of Medicine, Syarif Hidayatullah State Islamic University, Jakarta.

The School-Based Aerobic Exercise Procedure

The subjects did a school-based aerobic exercise in continuous walking for 30 minutes per session, five sessions per week, for four weeks. The walking procedure is carried out in the school lobby and hallway. Physical activity time is adjusted to the student's class schedule. The reason for selecting the school was to increase the subject's compliance and engagement with regular school-based exercise. Health fitness was assessed before and after the treatment using six minutes walking test (6MWT) method and VO2 max prediction formula.

Six Minutes Walking Test (6MWT) and VO2max Prediction Protocol

The 6-minute walking test (6MWT) was conducted twice, at the beginning and end of the study, and the experiment was referred to the walking test protocol (15). The walking track was a meter wide and 15 meters long, marked by a cone at the end where the subject made a U-turn. The midline was observed every 50 cm to quickly determine the final walking position. The test procedure allows the subject to walk continuously on the track for 6 minutes. Subjects are instructed to stop walking when the time expires, and an assistance mark is subsequently added to their walking position. The total distance calculates the result of 6MWT travelled by the subject for 6 minutes (in meters). These results are then used to calculate the VO2max prediction with the following formula.

VO2 max = 0.053 (distance) + 0.022 (age) + 0.032 (body height) - 0,164 (body weight) – 2.228 (sex*) – 2.287

Notes:
VO2max in kg/b.w/min, Distance in meters, Age in years Body height in cm, Bodyweight in kg, Sex : male = 0 and Female = 1

Statistical Analysis

Descriptive analysis was performed on all variables by calculating the frequency, mean and standard deviation. In addition, paired T-test was used to determine the difference between pre and post-treatment scores. The association between VO2max improvement with various variables was assessed using the t-test with a significance level of $p<0.05$. Statistical analysis was carried out using SPSS 20.00 version software.

RESULTS

All subjects haved finished the training, and Table I contains the descriptive sociodemographic results. The research subjects consisted of 23 female and two male students aged 17 to 21 years. Most of the subjects (52%) had a normal body mass index. The variables of gender, age, body height, and body weight were examined because they significantly affect physical fitness. In the pre-test and post test examination, All students had low fitness status with the predicted VO2 max <34 ml/kg b.w/min (100%) (16). Table II and III showed the result of six minute walking test (6MWT) and VO2max pre and post

Table I: Sociodemographic Research Result (N=25)

Variables	Frequency	%
Age		
17	1	4
18	12	48
19	10	40
20	1	4
21	1	4
Gender		
Male	2	8
Female	23	92
Height		
≥160	6	24
<160	19	76
Body Mass Index (BMI)		
>18.5 (Underweight)	4	16
18.5-22.9 (Normal)	13	52
23-24.9 (Overweight)	5	20
25-29.9 (Obesity Class I)	3	12
30.0 – 34.9 (Obesity Class II)	0	0
Predicted VO2max (Pre-test)		
≥ 34	0	0
<34	25	100
Predicted VO2max (Post-test)		
≥ 34	0	0
<34	25	100
VO2max improvement		
Yes	21	84
No	4	16

Descriptive results of age (years old), gender, Height (cm), Body mass index ((Kg/m²) and VO2max lecel (ml/kg b.w/min)

Table II: The result of six minute walking test (6MWT)

6MWT (Meter)	Mean	Standar deviasi (SD)	Min	Max	N
Pre-Aerobic Exercise	497.8	42.449	442,6	651,0	25
Post-Aerobic Exercise	520,9	34.542	479,9	608,0	

The Mean 6mwt pre aerobic exercise was 497.8 meters and post aerobic exercise was 520.9 meters

aerobic exercise. The mean 6mwt pre aerobic exercise was 497.8 meters and post aerobic exercise was 520.9 meters. As shown in table III, there was an increase in VO2max level after the aerobic exercise program. The mean of VO2max level before exercise was 18.91 ml/kg b.w/min (the minimum level was 14,30 ml/kg b.w/min.and the maximum was 26,70 ml/kg b.w/min). The mean VO2max level after exercise was 20.12 ml/kg b.w/min (the minimum level was 15,30 ml/kg b.w/min and the maximum level was 24,50 ml/kg b.w/min). Table IV showed the results of a bivariate analysis of age, gender, height and BMI factors. Age, gender, height, and body mass index did not significantly affect VO2max. Table V showed the significancy of VO2max improvement after four weeks in school aerobic exercise (p=0.005).

Table III: The result of VO2max

VO2 Max (ml/kg b.w/min)	Mean	Standar deviasi (SD)	95% Confidance Interval		Min	Max	N
			Lower	Upper			
Pre-Aerobic Exercise	18.91	2,449	17,90	19,92	14,30	26,70	25
Post-Aerobic Exercise	20,12	2,407	19,13	21,12	15,30	24,50	

The Vo2max level was measured Pre and post aerobic exercise (30 minutes per session, five sessions per week, for four weeks). The mean VO2max pre exercise was 18,91 ml/kg b.w/min and the mean VO2max post exercise was 20,12 ml/kg b.w/min.

Table IV: Another Factors that affect VO2max after aerobic exercise program

Variable	VO2max Improvement				OR	95% CI		p-value
	No		*Yes*					
	n	*%*	*n*	*%*		*Lower*	*Upper*	
Age (y.o)								
< 18	11	84.6	2	15.4	1	0.130	9.339	1.000
≥ 18	10	83.3	2	16.7	1.100			
Gender								
Male	1	50	1	50	1	0.007	3.092	0.300
Female	20	87	3	13	0.150			
Height								
≥160	4	66.7	2	33.3	1	0.025	2.215	0.234
<160	17	89.5	2	10.5	0.235			
BMI								
Normal	12	92.3	1	7.7	1	0.355	45.100	0.322
Abnormal	9	75.0	3	25.0	4.00			

Age = years old, Height = cm, BMI = Kg/m² . Age, gender, height, and body mass index did not significantly affect VO2max (T-test Bivariate analysis)

DISCUSSION

In the pre-test and post test examination, All students had low fitness status with the predicted VO2 max <34 ml/kg b.w/min (100%) (16). Table II and III showed the result of six minute walking test (6MWT) and VO2max pre and post aerobic exercise. This result aligns with research where most medical students have lower physical activity than non-medical (1), (17). Furthermore, several studies have stated that the tight academic schedule, lack of free time and limited facilities are the reasons students cannot carry out physical activities regularly (2), (18). The model of in-school aerobic exercise is the main idea proposed to be a solution to the problems above. The physical activity was designed to perform in the school, conducted in a group of students and

Table V: Pre and Post Aerobic Exercise Program Comparisons of VO2 Max

VO2 Max (ml/kg b.w/min)	N	Mean	Standar deviasi (SD)	95% Convidence interval		Paired Diffrence	Sig.(2 Tailed)	
				Lower	Upper	Mean	Sd.	
Pre- Aerobic Exercise	25	18.9	2,24	-2,025	-0,400	-1,21	1,97	0.005
Post-Aerobic Exercise		20,1	2,41					

The correlation of VO2max level between pre and post aerobic exercise showed a significant positive correlation (p=0.005) (T-test Bivariate analysis)

adjusted to academic hours to increase medical student engagement. This method did not require special facilities or expensive gym equipment, making it a cheap and effective method of health intervention in medical school.

After completing the in-school aerobic exercise program for four weeks, there was an improvement in the student's fitness status, marked by an increase in Vo2max prediction status. Pre- and post-exercise data of VO2max component showed a significant difference between the conditions with p=0.005 (Table V). This result indicates that regular aerobic exercise can improve fitness since the first month of implementation. Several studies have also reported positive short-term aerobic exercise results in fitness, quality of life, memory, intelligence, and others (19–21). Therefore, the in-school aerobic exercise method is crucial for regular exercise engagement and positive impact. By regularly conducting a in-school based physical activity, it is hoped to improve medical students' physical activity outcomes and academic outcomes.

Table IV showed the results of a bivariate analysis of various factors associated with VO2max. can be seen from the analysis of the VO2max variable as shown on table V, which significantly improved the VO2max component p=0.005. It is consistent with the study before (12, 21), which state that prior fitness status affects various health aspect improvements. However, the results did not significantly affect age, gender, height, and body mass index variables with VO2max improvement. This is different from several research results, which state a positive association between older age, male gender, and BMI over to VO2max improvement (1), (11), (12), (22).

The positive results provide additional evidence that aerobic exercise benefits body health. According to the world health organization, teenagers are recommended to do physical activity, primarily aerobic, at least 3 x 60 minutes per week. Another recommendation is to avoid a sedentary lifestyle and reduce recreational screen time (8). The data indicate that the mean VO2 Max after a aerobic exercise program is 20.12 ml/b.w/minute. This result is still in the very low category even though there has been an improvement after the exercise program. A sedentary lifestyle and high recreational screen time are the determinants of low fitness in medical students.

Medical students have a considerable lack of time to exercise due to their busy academic schedules. As a result, they tend to be physically inactive compared to non-medical students. The tight schedule requires students always to be fit to follow the lessons well. Physical activity has a significant positive relationship between academic achievement, concentration, memory, and self-confidence. Regular aerobic physical exercise is also essential to reduce burnout syndrome episodes and the incidence of depression and sleep deprivation that can interfere with the smooth running of lectures. Medical school interventions such as the in-school aerobic exercise model have a considerable positive effect on improving physical activity practice and outcomes. As a medical student, aerobic exercise is essential to maintain health fitness and increase self-confidence as a future patient health counsellor.

The in-school aerobic exercise that we design is an exercise program that we design as effectively as possible both in location and time, so that it can be carried out by students. The place we use is in the school field which of course they can access at any time. We chose the practice time in the afternoon after all lecture activities ended. while the frequency and duration of our training is designed only 3x/week, 30 minutes per session. we designed a minimal exercise program but increased student fitness so that students did not feel too heavy to run it. With a program that is considered light, we hope that the aerobic exercise program can be carried out continuously.

Students should be given support and opportunities to be involved in sports. This is very important because a fit body indicates that good cardiovascular fitness will increase concentration and cognitive function, compared to medications, aerobic exercise is easier to carry out and has fewer side effects. Students should be able to squeeze in some physical activity during their free time, given the overwhelming evidence on health and well-being. This result is significant for students and the overall medical education system. The support system for medical education processes is vital to ensure quality and sustainability in the future.

CONCLUSION

This study concluded that regular school-based aerobic exercise, walking for 30 minutes per session, five sessions per week, for four weeks, had a positive effect on VO2 max among medical students (p=0.005). It is significantly affected by the VO2 max level of the subjects. Even though the fitness level of students as described by the VO2 max is relatively low, there was an increase after conducting in-school aerobic exercise with an mean value of 18.9 ml/kg b.w/min and 20.1 ml/kg b.w/min before and after the exercise. The model of in-school aerobic exercise was designed to be performed in the school using a group of students adjusted to academic hours. This method did not require special facilities or expensive gym equipment, making it a cheap and effective method of health intervention. The result can be a reference for medical schools to set up school-based health interventions.

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