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The differences of Peak Expiratory Flow Rate Before and After Vertical Run and Jogging Exercise

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ABSTRACT

Background: Running or jogging is the most popular sports in Indonesia. One of the variants is vertical run, which uses stairs as a running track. Recently in Indonesia, many skyscrapers with lift and escalator existence are constructed and causes less people using stairs. This study aimed to compare peak expiratory flow rate before and after vertical run and jogging exercise within 8 weeks.

Aims: Knowing the differences of peak expiratory flow rate between before and after vertical run and jogging exercise.

Method: This study design is a Quasi Experimental with pre-test and post-test unequal group. Fifteen people joined vertical run exercise and 14 people joined jogging exercise within 8 weeks. Peak expiratory flow rate before and after exercise were measured using mini-wright peak flow meter. Data is analyzed by dependent t-test and independent t-test.

Results: Peak expiratory flow rate before vertical run and jogging exercise are 567,56 ±61,79 L/minute and 534,76 ±72,78 L/minute, respectively. While, peak expiratory flow rate after vertical run and jogging are 592,44±53,77 L/minute and 552,14±70,75 L/minute, respectively. The difference between peak flow rate before and after on both vertical run and jogging exercise are significantly increase (p=0,001 and p=0,002). However, peak expiratory flow rate in vertical run exercise is higher than jogging (p=0,094).

Conclusion: Peak expiratory flow rate is significantly increased either after both vertical run or jogging exercise. However, the magnitude of peak expiratory flow rate after vertical run exercise is higher than jogging.

Keywords: Peak expiratory flow rate, vertical run, jogging

INTRODUCTION

Sport is a physical activity that can strengthen and make body healthier. Physical activities can increase and maintain body health and immune system. Doing exercise regularly can increase respiratory capacity than resting period.¹⁻³

Exercise have been regularly done by 22% of Indonesian people and 21,78% by Central Java civil. Men and school-age groups tend to do exercise routinely. About 63,9% of Indonesian people do exercise once a week. Twenty point two percent of them choose to do jogging as an exercise.⁴ Previous study has shown jogging in 5 sessions, 20 minutes each, per week can increase peak expiratory flow rate by 17%.⁵

One of running variation that recently developed is vertical run/ tower running/ stair

climb. This variation use stairs in tower, skyscraper, or public stairs as running track.⁶

Many vertical run competitions have been held internationally and this sport has already had association such as Towerrunning World Association and Asian-Oceanian Vertical Marathon Association.

Recently, Indonesia has built many skyscrapers. The tallest building in Indonesia has 69 floors and it has been planned to construct 113 floors building. However, the existence of lift and escalator cause less people use stairs. People choose to use stairs or lifts depend on several factors, such as location, height, users, and other factors. Another study shows, people who use stairs will increase 95% if the distance between lift and escalator is increased by 100%.⁷

Previous studies about vertical run/ stair climb showed stairclimbing exercise in sedentary

office workers increase VO_{2max} by 94%.⁸ While, climbing 125 bouts per week in 10 weeks can increase VO_{2max} more than 10 % in adult-men.⁹ Climbing 1 step burns energy as much as 0,11 kcal.¹⁰ Vertical run can increase HDL within sedentary people.¹¹ However, the effect of vertical run to peak expiratory flow rate has not been known. This study will measure peak expiratory flow rate in vertical run exercise.

METHODS

This study has been done using stairs in Faculty of Medicine Diponegoro University's B building and yard during April 2017 among 8 weeks using quasi experimental with pretest, posttest unequal group design. Subjects in this study were males between 16-22 years old medical students Faculty of Medicine Diponegoro University which fulfilled inclusion criteria and do not have any exclusion criteria.

Subjects had to signed an informed consent if agree to join in this study. There were no history of disease in cardiovascular, musculoskeletal, respiratory, and smoking in all subjects. Sampling had been done by purposive

sampling with minimal 22 subjects, which divided into 2 groups (@11), jogging exercise and vertical run exercise groups.

Jogging exercise group was asked to do 230 meters jogging in Faculty of Medicine Diponegoro University's yard. While, vertical run exercise group was asked to run upstairs from first to third floor of Faculty of Medicine Diponegoro University's B building twice, which interrupted by running downstairs between the climbs. Exercises were done within approximately 90 seconds twice a week within 8 weeks.

Before doing the exercise, subjects were asked to filled questionnaires. Heart rate was always measured in the end of exercise. Peak expiratory flow rate was measured before and after 8 weeks of exercise.

Normality of data was tested using Shapiro-Wilk test. Then, difference of peak expiratory flow rates between before and after exercise for each group was tested using dependent T-test. The difference between groups was tested using independent T-test. If $p < 0,05$, it means the difference between groups is significant.

RESULT

Characteristics of each groups are showed by table below

Table 1. Subjects' characteristics

Characteristics	Mean ± Standard Deviation (minimum-maximum)	
	Vertical run exercise	Jogging exercise
Body height	1,69±0,07 (1,57-1,81) meter	1,68±0,05 (1,62-1,76) meter
Body weight	66,20±7,44 (55,00-80,50) Kg	59,71±5,28 (55,00-69,00) Kg
BMI	23,08±1,58 (19,82-24,62) Kg/m ²	21,11±1,91 (18,61-24,68) Kg/m ²
Age	20,47±0,64 (19,00-21,00) years	20,07±0,91 (18,00-21,00) years
Heart rate before exercise	79,69±4,64 (68,27-85,93) per minutes	79,51±5,33 (66,00-85,14) beat minutes
Heart rate after exercise	163,10±10,29 (144,43- 182,86) per minutes	158,50±11,30 (136,86-173,79) per minutes
Time	91,37±0,81 (90,49± 93,08) seconds	93,53±1,46 (90,37-95,39) seconds

Based on table above, vertical run exercise group has a higher value on body height, body weight, BMI, age, heart rate, before and after

Peak expiratory flow rate, measured using mini-wright peak flow meter, for each groups is showed by table below

exercise. Jogging exercise need a longer time to be done.

Characteristics	Mean ± Standard Deviation (L/minute)		Normality p*
	<i>Vertical run exercise</i>	<i>Jogging Exercise</i>	
Peak expiratory flow rate before exercise	567,56±61,79	534,76±72,78	0,09
Peak expiratory flow rate after exercise	592,44±53,77	552,14±70,75	0,132

Significant ($p < 0,05$)

Table 2. Mean Peak Expiratory Flow Rates for Each Groups

Vertical run exercise group's peak expiratory flow rates before and after exercise are higher than jogging exercise group. Datas are normally distributed ($p > 0,05$) after tested using Shapiro-Wilk test.

Groups	Mean ± Standard Deviation (L/menit)		p*
	Peak expiratory flow rate before exercise	Peak expiratory flow rate after exercise	
<i>Vertical run exercise</i>	567, 56 ±61,79	592,44±53,77	0,001
<i>Jogging exercise</i>	534, 76 ±72,78	552,14±70,75	0,002

Significancy ($p < 0,05$)

Table 3. The difference of PEFR before and after exercise for each groups

Dependent T-test show the significant peak expiratory flow rate increment in both jogging ($p = 0,002$) and vertical run ($p = 0,001$) exercises.

Characteristics	Mean ± Standard Deviation (L/menit)		p*
	<i>Vertical run exercise</i>	<i>Jogging exercise</i>	
Peak expiratory flow rate before exercise	567, 56 ±61,79	534, 76 ±72,78	0,201
Peak expiratory flow rate after exercise	592,44±53,77	552,14±70,75	0,094

Significancy ($p < 0,05$)

Table 4. The difference of PEFR between group

Independent T-test show, vertical run exercise group's peak expiratory flow rates both before and after exercise are higher than jogging group.

DISCUSSION

Jogging exercise can increase peak expiratory flow rate (PEFR) by making expiratory and inspiratory mechanism stronger and more efficient.⁵ Vertical run exercise, which is an anaerob exercise can increase VO_{2max} and FEV_1 .¹²⁻¹⁶ Previous study reported that FEV_1 has a positive correlation with PEFR.¹⁷

Peak expiratory flow rate in vertical run exercise group is higher due to higher heart rate after exercise achieved. As mentioned in previous study, VO_{2max} during exercise is positively correlated with heart rate after exercise.¹⁸ Higher VO_{2max} within vertical run exercise group will have higher FEV_1 and higher PEFR. However, positive correlation between FEV_1 and

PEFR is not strong.¹⁸ It explains why the difference between groups are not significant.

Limitations to this study are the control of subjects' activities, fitness, and the frequency of the exercise which is only twice a week. Therefore, there may be different result.

CONCLUSION & SUGGESTION

Conclusion

Peak expiratory flow rate is significantly increased either after both vertical run or jogging exercise. However, the magnitude of peak expiratory flow rate after vertical run exercise is higher than jogging.

Suggestion

Further studies are needed to know other anaerob exercises effect on peak expiratory flow rate and vertical run effects on other parameters. The data of this study can be used by public to consider using stairs in daily activities.

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