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The effect of physical exercise on vital lung capacity in Tapak Suci athletes

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Abstract: Exercise can have a physiological effect on the body, including the work system of the heart and lungs. The lungs have an important role in human life, where there is an exchange of oxygen with carbon dioxide through the respiratory process. In terms of health, exercise needs to be done by every human being, because exercise can increase the work of the lung muscles, whereas if the lung muscles work well, the ability to accommodate oxygen or the vital capacity of the human lungs also increases. The purpose of this study was to determine the effect of physical exercise on vital lung capacity. This research method uses a pre-experimental approach with pre and post-test one-group design. The sampling technique of this study used a random sampling of 30 respondents. The instruments used were observation sheets from the examination of vital lung capacity and spirometry. Analysis Research data analysis using the Wilcoxon Rank Test. The results of the Wilcoxon Rank Test statistical test obtained P = 0.000 with a safety level of = 0.05 meaning P value = < . Conclusion It can be concluded that there is a difference in the vital capacity of the lungs before and after participating in the sacred tapak exercise so this research is expected to be useful for athletics in improving physical fitness, especially by routinely doing sports or physical exercise such as participating in the sacred tapak exercise.

Keywords: vital lung capacity, physical exercise.

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INTRODUCTION

Physical Exercise is a demanding activity that alters various bodily processes, including the respiratory system. The morbidity and death from many diseases are directly correlated with physical inactivity (U. S. Department of Health and Human Services, 2020). As a result, physical exercise is currently advised everywhere as one of the fundamental pillars of good health and well-being. As the number of breaths taken during exercise grows, so does the body's requirement for oxygen (Awad et al., 2017).

The organs that play the most role are the heart and lungs where the heart will beat rapidly with an increased respiratory rate accompanied by rapid work by the lungs (Mihailova & Kaminska, 2016). The value of the vital capacity of adult men is 20-25% higher than that of adult women. This is caused by differences in muscle strength between men and women. The value of vital lung capacity is also strongly influenced by physical characteristics, such as age, height, and weight (Yunitasari et al., 2020). A national style of martial arts called Tapak Suci makes use of the capacity for rational thought, enhances focus, creativity, and mental health, and allows physical functions to be correctly carried out amongst organs that are connected (Chendra & Lontoh, 2019).

The Wrld Health Organization in Hong Kong reports that among people aged 35 years and over, about 20% of all deaths are related to a lack of exercise activity. Most of the world's population lacks exercise to stay healthy, especially among girls and women. Nearly two-thirds of children are also not active to do sports. In America, about 40% of adults do not exercise enough and about half of young

people aged 12-21 years do not exercise regularly. In Indonesia, it is known nationally that almost half of the Indonesian population aged > 10 years (48.2%) do not do sports. Based on 33 provinces, it is known that there are 22 provinces with fewer sports populations whereas West Java province is one of the provinces with less exercise, which is around 25.4%. Age group 15-24 years with a percentage of lack of exercise (33.8%) (Riskesdes, 2010).

Research by Basuki et al., (2017) stated that the vital lung capacity of both groups of female athletes was 7% greater than that of the non-athlete group of women. In men, the results are 4% greater than the non-athlete group of the same sex. The average vital lung capacity before swimming was 1366 ml, whereas the average vital lung capacity after swimming was 1460 ml, according to (Yuniana, 2020). According to a preliminary study done by researchers on September 15, 2018, the majority of the vital lung capacity before participating in the Tapak Suci exercise was 2600 ml for women and 1800 ml for 15 respondents. After participating in the Tapak Suci exercise, the vital lung capacity increased to 2800 ml for men and 2000 ml for women, including 15 respondents. Other studies have demonstrated that children with impairments and those with conditions like asthma may significantly improve their lung function by engaging in physical exercise (Rawashdeh & Alnawaiseh, 2018).

The vital capacity of the lungs is the maximum amount of air that a person can exhale from the lungs. After first filling the lungs to the maximum and then exhaling as much as possible (± 4600 ml). The capacity of the pulmonary respiratory system to expand and contract determines the volume of oxygen that can be pumped into the lungs (Pearn et al., 2015). The amount of oxygen received also rises when the respiratory system performs better. Adult men have a vital capacity that is 20–25% larger than that of adult women. Men and women have different muscle mass, which contributes to this in part. After the age of 40, the respiratory system starts to deteriorate, although the peak capacity is reached between the ages of 20 and 30. It starts to decline after you get 60 years old. Exercise habits will raise the lungs' vital capacity by 30–40%. The ability of the respiratory muscles will improve as a result of muscular activities that are related to breathing (Schödel & Ratcliffe, 2019). The respiratory muscles' endurance, strength, and efficiency will rise, enhancing their capacity to expand the lungs. Exercise causes us to breathe deeply and press air into the bottom of our lungs, which helps to remove moisture from the lungs (Bédard et al., 2020). Endurance is very dependent on oxygen because the muscles used during sports activities require oxygen intake so as not to quickly experience fatigue (Rismayanthi C, 2022). So oxygen has a very vital role, not only for breathing but also for supplying muscles when a person is doing sports. The vital lung capacity is thought to have a positive correlation with the ability to hold the breath (apnea) (Pitta et al., 2005). If the volume of air that can be accommodated by the lungs is greater, the greater the reserve of oxygen is available to be circulated throughout the body and allows aerobic metabolism (the body's metabolism uses O2 to become ATP) for a longer time. Therefore, it is necessary to study whether the greater the vital capacity of a person, the longer the duration of holding one's breath (Lutfi, 2017).

The capacity of the respiratory muscles to overcome the resistance of respiratory airflow will rise as a result of training the breathing muscles. Additionally, it can improve the respiratory muscles' endurance, strength, and efficiency, which will boost their capacity to expand the lungs. It can also improve blood flow through the lungs, which will allow oxygen to diffuse into the pulmonary capillaries with the greatest possible volume. An alternative sport that may be played, particularly by students in their free time, is tapak suci. When Tapak Suci is practiced, a breathing exercise technique that can increase blood oxygen levels and speed up the flow of oxygen to the brain has been shown to have positive health effects, including an increase in student learning achievement. When receiving oxygen, the brain is better able to focus, be more creative, and retain information without becoming easily sleepy. a lesson since, when engaging in physical activity, the body's systems including the respiratory and cardiovascular systems are also established (LORENSIA et al., 2021).

METHODS

This study uses a pre-experimental approach with a pre and post-test one-group design. the sampling technique used is random sampling with a total of 30 respondents. With its inclusion criteria students who are male and female members of the tapak suci practice, students who are members of the tapak suci practice regularly participate in the exercise for 3 months, student members of the tapak suci practice who are at the basic jasmine level, student members of the tapak suci practice who are between

17-25 years old, student members of the tapak suci practice who are willing to be respondents, students who are members of the tapak suci practice who do not suffer from asthma, heart disease, TB, or are sick.

Meanwhile, the exclusion criteria were students who were members of the tapak suci practice who resigned as respondents for certain reasons. In addition, students who are members of the sacred tread practice do not regularly follow the tapak suci practice. The instruments used were observation sheets from the examination of vital lung capacity and spirometry. The location of research was carried out in the field of the Muhammadiyah University of Surabaya. This research was conducted for ± 7 days starting from 3.00-5.00 pm. All respondents before doing physical exercise took a history of measuring height, weight, and measuring vital lung capacity, then respondents were asked to carry out activities in the holy place for 7 days for 30 minutes. After that, the respondent was re-measured vital lung capacity. This study was analyzed using bivariate analysis which was carried out by knowing whether there was an influence between the two variables through the Wilcoxon Rank Test. To calculate the statistical test, computer software was used.

RESULTS AND DISCUSSION

General Data

Table 1. Frequency Distribution by Gender, Age, Respondent

Description	N	(%)
Gender		
Man	12	40
Woman	18	60
Age (year)		
19-20	14	47
21-22	16	53
Total	30	100

Based on Table 1, it shows that the frequency distribution based on gender found that the male sex was 12 respondents (40%) and the female sex was 18 respondents (60%). In addition, based on age data, the results obtained that the majority of age was 21-22 years as many as 16 respondents (53%), while ages 19-20 were 14 (47%) from a total of 30 respondents.

Specific Data

Table 2. Frequency Distribution of Respondent's Vital Lung Capacity before Participating in Physical Exercise

No	Classification	N	(%)
1	Less once	-	-
2	Not enough	13	43
3	Currently	-	-
4	Well	17	57
5	Very well	-	-
Total		30	100

Based on Table 2, it shows that the vital lung capacity before participating in the sacred tapak exercise obtained the results of the majority of the lung vital capacity being classified as a good category as many as 17 respondents (57%) while the vital lung capacity was classified as lacking as many as 13 respondents (43%) of the total 30 respondents (100%).

Table 3. Frequency Distribution of The Respondent's Vital Lung Capacity after Participating in Physical Exercise

No	Classification	N	Persentase (%)
1	Less once	-	-
2	Not enough	4	13
3	Currently	9	30
4	Well	17	57
5	Very well	-	-
	Total	30	100

Based on Table 3 shows the vital lung capacity after participating in physical exercise shows that the majority of the lung vital capacity is classified as a good category as many as 17 respondents (57%), while the lung vital capacity is classified as moderate 9 (30%) and less category 4 (13%) of the total respondents 30 (100%).

Table 4. Differences in Lung Vital Capacity before and after Participating in The Sacred Footprint Exercise

No	Classification Less once	Before		After	
		N	%	N	%
1	Not enough	-			
2	Currently	13	43	4	13
3	Well			9	30
4	Very well	17	57	17	57
5	Classification	-			
	Total	30	100	30	100
		P=0.000< α.=0.05 Wilcoxon Signed Ranks Test			

After carrying out the Wilcoxon Signed Ranks Test statistical test, it was obtained from the Table 4 that the vital lung capacity before participating in physical exercise was mostly in the good category 17 (57%) while the lung vital capacity was classified as less than 13 (43%). Based on the vital lung capacity after participating in physical exercise, the majority belonged to the good category of 17 respondents (57%), while the vital lung capacity was classified as moderate 9 (30%) and in the less category 4 (13%) of the total 30 respondents (100%). Based on the table above shows that the results of the analysis with the Wilcoxon Signed Ranks Test statistic test obtained P value = 0.000 with a significance level of (0.05), meaning the P value < 0.05.

Identify the vital capacity of the lungs before participating in the Tapak Suci Exercise

As Table 4, the results of the frequency distribution of the vital lung capacity of respondents before participating in the sacred tapak exercise showed that the respondents were still in the poor category, namely as many as 13 respondents (43%) and in the good category, namely 17 respondents (57%). If the value of the vital capacity of the lungs is less than the standard, then there is no increase in lung expansion, and blood flow through the lungs is not working properly so that oxygen in the lungs does not diffuse into the capillaries optimally (LORENSIA et al., 2021)**.** Additionally, the respondent's age makes a difference in the results of their vital lung capacity. According to the anamnesis results, the majority of respondents were between the ages of 21 and 22. It is said that respiratory function and blood circulation will increase in childhood and reach a maximum at the age of 20-30 years, then will decrease again according to age growth. Pulmonary diffusion capacity, pulmonary ventilation, vital capacity oxygen uptake, and all other lung function parameters will decrease with age, after reaching a maximum point in young adulthood (Hancox & Rasmussen, 2018).

Age has to do with becoming older or the aging process. A person's probability of experiencing a decline in lung function increases with age. Maximum muscular strength occurs between the ages of 20 and 40, after which it declines by 20%. After becoming 40 years old, the desire for energy substances eventually starts to decline. Physical weakness is the cause of lower energy needs. Age typically has an

impact on both the respiratory rate and essential lung capacity (Pitta et al., 2005). Adults breathe about 16 and 18 times per minute, toddlers about 24 times per minute, and newborns about 30 times per minute. Despite the fact that adults' respiratory rates are slower than those of toddlers and babies, the vital capacity of the adult (Purnama et al., 2020).

People who are trained by physical exercise, if doing activities have the ability to inhale more air and longer time, also able to blow out the remnants of combustion more, because the muscles around their lungs have been trained to do more work (Ramon et al., 2016). The frequency of exercise is closely related to exercise intensity and duration of exercise. In doing the exercise, it is best to exercise frequently is carried out at least three times a week, good for health sports as well as for sports achievements. To increase fitness needs to exercise 3-5 times per week (Sanusi R, 2018, Nasrulloh et al., 2022).

Identification of Lung Vital Capacity After Following the Tapak Suci Physical Exercise

Based on the results of research from 30 respondents, it showed that the vital lung capacity of the majority after participating in the physical exercise of Tapak Suci obtained results of 4300-4400 ml as many as 17 (57%) respondents.

As a result of the Tapak Suci exercise, which changed the volume of the lungs, the majority of respondents' lung vital capacity rose, according to the data. In order to enhance air pressure in the lungs and gas exchange between O2 and CO2, breathing becomes deeper, respiratory frequency, and tidal volume rise during exercise. Exercise on a regular basis might lead to an increase in oxygen demand in the body. The body will burn more calories during activity to provide the energy we require. Additionally, there will be an increase in the requirement for oxygen for cellular respiration. As a result, the lungs will enlarge to hold more air. Only when we engage in activities does this growth happen. The lungs will revert to their initial condition after they have calmed down (Wu dkk., 2020). The ventilation (air intake for one minute) will increase along with the tidal volume and respiratory rate. As exercise intensity increases, respiratory frequency likewise rises, causing ventilation to rise as well (Ichinose M, 2018).

Additionally, performing the holy tread exercise or any activity that indirectly trains the respiratory muscles will improve their capacity and endurance. An increase in respiratory function will result from stronger respiratory muscles producing enough inspiratory pressure to conduct maximal ventilation. Every action that develops the respiratory muscles during the holy tread exercise has the potential to boost blood oxygen levels, quicken blood flow to the brain, and swiftly expel carbon dioxide from the lungs and replace it with oxygen (Yuniana, 2020). The maintenance of a person's functional independence is aided by regular exercise. In particular, their arterial blood pressure is more steady and their lungs' vital capacity is increasing. It may also increase functional skills and have superior physiological metrics (Andrieieva, 2019).

Because the muscles around the lungs have been trained to perform more work, people who are trained via physical activity and activities are able to inhale more air and for longer periods of time. They are also able to exhale more burning residue (Basuki et al., 2017).

Analysis of the Differences in Lung Vital Capacity Before and After Following the Tapak Suci Exercise

Wilcoxon test findings with a significance threshold of (0.05) produced significant results (P value = 0.000), which implies the P value was significant. Conclusion: H0 is rejected and H1 is approved, indicating that there is a difference in lung vital capacity prior to and following participation in the sacred footprint exercise at the University of Muhammadiyah Surabaya's Student Activity Unit.

According to (Yunitasari et al., 2020), physical exercise is unquestionably beneficial to health. The human soul benefits from it as well. According to WHO (2021), physical activity is any skeletal muscle-driven movement that involves the use of energy. All motions, whether done for fun, to go to and from locations, or as part of one's job duties, are considered to be physical exercise. Physical activity that is done at a moderate or high intensity is good for your health. According to WHO, popular forms of exercise include walking, cycling, exercising, active recreation, and play. These activities may be performed by anybody of any ability level and are fun for everyone. Regular exercise is sufficient. Obtaining movement and organ function will improve one's capacity for joint and physical growth.

A person's lung capacity can be impacted by exercise. The respiratory system is responsible for removing extra carbon dioxide. In order to enhance pulmonary ventilation during intense activity, the frequency and depth of breathing will increase. While their respiratory rate is not as significant, trained athletes have a tendency to breathe deeper (Burhanuddin et al., n.d.2021). The maximum volume that can be measured using a spirometer is the lung vital capacity. The measurement of lung vital capacity is used to provide a picture of a person's respiratory health and to describe the state of the lungs in relation to potential changes in maximum volume (Your Lungs and Exercise, 2021). Exercise and lung function are inversely correlated; lung function issues will impact exercise. On the other hand, consistent physical activity or exercise can enhance lung function. A person who exercises regularly will have improved fitness, greater aerobic capacity, and enhanced vital capacity (Dugral et al., 2019).

Regular exercise routines might have an impact on lung function. Exercise can enhance blood flow through the lungs, resulting in a higher or maximal volume of oxygen diffusing into the pulmonary capillaries. Exercise strengthens and increases the effectiveness of muscles, which has the impact of training respiratory muscles. People who routinely exercise will have a higher vital capacity than individuals who rarely or never exercise. When people engage in sports, their bodies move instinctively, which may trigger reflexes (Lazovic-Popovic et al., 2016). The respiratory center is impacted by cells that convey reactions in joints and muscles that are triggered during movement of the body, which causes an abrupt rise in ventilation. Additionally, exercise will cause epinephrine to be released (a hormone that affects the respiration process). The neurological system becomes more active as a result of greater body activity and rising epinephrine levels, which in turn raises the stimulus for breathing. When there is movement of the body, breathing parameters change (Minakata et al., 2015). When someone moves their body, their body will typically compress by making more oxygen available and aggressively expel carbon dioxide (Dugral et al., 2019).

Tapak Suci can increase the vital capacity of the lungs by doing physical exercises related to aerobic metabolism. Aerobic metabolism is a metabolism that uses oxygen to produce ATP (Roman et al., 2016). Aerobic physical activity is a physical activity that depends on the availability of oxygen as an ingredient for glucose metabolism processes, so that the activities carried out also depend on the optimal work of the organs of the respiratory and cardio systems such as the heart, lungs and blood vessels in the distribution of oxygen for metabolic processes to occur with optimally (Hartman et al., 2013). Through aerobic exercise efforts, the strength of the external intercostal muscles in the ribs will increase, the stronger it will be to pull the ribs and enlarge the chest cavity so that the more oxygen enters the lungs, thus the vital capacity of the lungs will increase and the alveoli will also grow bigger and bigger. a lot (Jusuf Kurnia BJ, 2020). Current professional freediving divers can do longer dives because they have prepared themselves by adding aerobic activity to their training program (Park & Han, 2017).

Physical activity can improve the lungs' capacity to transport oxygen throughout the body and convert it to metabolic fuel. According to a research (Bédard et al., 2020), lifting weights for a specific amount of time can raise FEV (forced expiratory volume), FVC (forced vital capacity), and MEFR (Maximal Expiratory Flow Rate). The lungs are able to move a lot of respiratory air around while you exercise. People who engage in increased physical exercise see an increase in the lungs' vital capacity. Compared to people who do not engage in any physical exercise, those who engage in rigorous activity require more oxygen. physique.

The findings of a study by (Yuniana, 2020), which examined variations in lung vital capacity before and after swimming in the Rembang Kartini Recreational Park, also support this research ($p = 0.000$). The outcomes of this research concur with Romadhona's investigation into how badminton affects essential lung capacity. There were 10 individuals, according to Romadhona, who exercised yet had weak lung vital capacity (80%) (16.7 percent). According to the research results of the aforementioned study, the researcher makes the case that regular exercise is necessary to maintain the lungs' vital capacity in accordance with the standard. This will allow oxygen in the blood to flow freely throughout the body and significantly improve the body's overall health. Exercise and essential lung capacity have a connection. The number of persons with healthy vital lung capacity increases if they exercise consistently. obtained by 18.07, indicating that non-exercisers have an 18.07-fold higher chance than athletes of having poor vital lung function (>80%) than athletes (Cheng et al., n.d.2021).

CONCLUSIONS

There is an effect in the vital capacity of the lungs before and after participating in the tapak suci exercise, which changed the volume of the lungs, the majority of respondents' lung vital capacity rose, according to the data. in order to enhance air pressure in the lungs and gas exchange between o2 and co2, breathing becomes deeper, respiratory frequency, and tidal volume rise during exercise. Tapak Suci exercise is a type of exercise that can increase the ability of the lungs to send oxygen throughout the body and turn it into metabolic fuel, so that this research is expected to be useful for athletics in improving physical fitness, especially by routinely doing sports or physical exercise such as participating in the sacred tapak exercise.

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