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OPTIMIZATION OF LUNG VITAL CAPACITY TO IMPROVE ATHLETE FITNESS

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ABSTRACT

Physical training and fitness are important aspects in an athlete's readiness to achieve optimal performance in their sport. One important indicator of fitness is vital lung capacity, which measures the maximum amount of air that can be moved into and out of the lungs. The aim of this study was to investigate the optimization of vital lung capacity as a strategy to improve athlete fitness. This study used qualitative research methods. The data collection technique in this research is literature study. The data that has been collected is then analyzed in three stages, namely data reduction, data presentation and drawing conclusions. The research results show that optimizing lung capacity to improve athlete fitness can be done through several methods, including breathing exercises, physical training and aerobic training. Increasing vital lung capacity can also help minimize the risk of injury, as a stronger respiratory system is able to prevent excessive fatigue. Overall, this can have a positive impact on athletes' achievements, both at national, regional and international levels, as well as representing the country, region or institution they are fighting for.

Keywords: Vital Capacity, Lungs, Fitness, Athlete

INTRODUCTION

Health is very important for every human being. Body health is important to maintain in order to lead a more productive life. One way to maintain health is to exercise (Ruegsegger &; Booth, 2018). Sports are generally useful for maintaining and increasing mobility, independence of motion (healthy, dynamic) to maintain and increase independence in human bio-psycho-socialogy life. Sports are part of physical activity carried out, aiming at the formation of body muscle or physical that is carried out regularly and periodically (Ruegsegger &; Booth, 2018; (Janssen & LeBlanc, 2010)).

Indonesia has a very prestigious event in the world of sports, namely the National Sports Week (PON). The XXI PON edition in 2024 is a historic moment for Aceh and North Sumatra Provinces because for the first time it is set as the host. The National Sports Week (PON) has an important role as the beginning of the foundation for mapping the development of Indonesian athletes.The achievement targets achieved by athletes are the result of hard work carried out continuously and periodically which is systematically programmed to achieve maximum achievement. In achieving this, many factors are influential, one of the main ones is

the preparation of athletes in terms of the level of physical fitness of the athlete (Guntoro et al., 2022).

Physical fitness is a set of physical characteristics that a person possesses or achieves that relate to the ability to perform physical activity. As for someone who is fit in relation to sports and physical activity is defined as a person who is able to run daily life without exceeding the limit of stress resistance in the body and has a healthy body and is not at risk of experiencing diseases caused by low fitness levels or lack of physical activity (Sukamti et al., 2016). The ability to undergo physical activity that is more strenuous than usual can be determined by describing a person's fitness status.

Physical exercise of varying intensity can be used to assess the changes occurring in a person's body, characterized by assessing various parameters. Evaluation can be done after intervention after a certain period of time so that changes in the value of these parameters are obtained (Sukamti et al., 2016); (Carpio-Rivera et al., 2016). Physical exercise will lower the composition of fat and maintain or improve the composition of muscles and bones in the body. Someone who does fitness activities becomes fitter by carrying out three main components, namely exercise, fulfillment of nutrition, and rest (Carpio-Rivera et al., 2016) (Kokkinos, 2014).

Physical exercise and fitness are important aspects in an athlete's readiness to achieve optimal performance in their sport. One important indicator of fitness is the vital capacity of the lungs, which measures the maximum amount of air that can be moved into and out of the lungs. The vital capacity of the lungs is the amount of oxygen that can be put into a person's body or lungs to the maximum. The amount of oxygen that can be put into the lungs is determined by the deflated ability of the respiratory system (David & Sharma, 2019). The better the work of the respiratory system means the greater the volume of oxygen obtained.

Previous research by (Chendra & Lontoh, 2019) shows that from the results of the analysis of the relationship of exercise on the vital lung capacity of medical faculty students who participated in the UKM Universitas Tarumanagara class of 2013-2016 using the Fisher exact test, a p-value of 0.000 or $p<0.05$ was obtained, which can be concluded that there is an influence of exercise on lung vital capacity. Other research by (Lardika & Gazali, 2020) It shows that the results obtained from the vital capacity of the lungs have a significant relationship with the level of physical fitness, with the results obtained by r count (0622) > r table ($\alpha = 0.05$) = 0.456. While the t distribution test obtained the results of t count (3.369) > t table (1.734), then H0 was rejected and Ha was accepted. It can be concluded that there is a significant relationship between the independent variable and the dependent variable, namely the correlation between lung vital capacity (x) and physical fitness level (y).

The novelty of this research is from the object of his research, namely the optimization of lung vital capacity as a strategy to improve athlete fitness that has never been studied before. This research can help identify factors that contribute to athletes' fitness, specifically lung vital capacity. A deeper understanding of these factors can provide new insights into exercise and fitness theory. The aim of this study was to investigate the optimization of lung vital capacity as a strategy to improve athlete fitness.

METHOD

This study used qualitative research methods. Qualitative research methods are scientific approaches used to understand phenomena in depth with a focus on the context, meaning, and subjective experience involved (Zaluchu, 2020). In this method, researchers seek to understand the complexity and diversity of the phenomenon under study through the collection and analysis of data that is descriptive and interpretive. The data collection technique in this study is by literature study. Literature study data collection techniques involve collecting information and knowledge from various literature sources relevant to the research topic being studied (Rukin, 2019). The data that has been collected is then analyzed in three stages, namely data reduction, data presentation and conclusions.

RESULTS AND DISCUSSION

The lungs are one of the vital organs in the human body that have an important role in the respiratory system. Where the respiratory system holds the main control in human life after the Heart. The main function of the lung organs is to accommodate and supply oxygen into the body and filter the incoming air, so that the air coming out of the lungs is clean and rich in oxygen. This allows all organs of the human body to receive the oxygen needed and in the end all organs of the body can function properly (Wenda et al., 2023).

Lung health is very important for everyone because disorders of the respiratory system can be fatal, even leading to death (Karimah et al., 2019). This shows how vital the role of the lungs is in maintaining the functioning of the human body. This applies not only to the general public, but also to athletes. The athletes are sportsmen and women who train their special skills to compete in the competition. One of the tasks of an athlete is to achieve the highest possible achievement, this achievement is not only a matter of pride for themselves, but also for the country, region, or institution they represent (Taftazani & Fauziah, 2019). To achieve maximum results, an athlete needs to have optimal fitness, one of which is the health of his lungs.

Optimal lung health allows athletes to have greater and efficient breathing capacity, which is directly related to the high vital capacity of the lungs. Lung vital capacity (KVP) according to Pinzon (1999), is the maximum volume of air that can be exhaled after maximum inspiration. These include tidal volume (the amount of air that usually enters and exits the lungs during normal breathing), the volume of inspirational reserve (the additional amount of air that can be inhaled after normal inspiration), and the volume of expiratory reserve (the amount of additional air that can be expelled after normal expiration). Or in other words, the vital capacity of the lungs reflects the ability of a person's lungs to accommodate and expel air to the maximum. This condition varies greatly depending on factors such as age, height, weight, and overall health condition (ROMADHONA, n.d.).

For an athlete, having a good lung vital capacity is very important because it allows them to have stable endurance while competing (Syahda et al., 2016). Endurance, or endurance, is the ability of athletes' organs to defend against fatigue during physical activity. In the world of sports, resistance training is very important because it affects the quality of the athlete's breathing and circulatory system, so they can cope with high physical stress and reduce the risk of excessive fatigue. This allows them to last longer on the field, deliver better results, and even outperform their opponents (Shaleh et al., 2014).

In aerobic sports, where the need for oxygen is very high to support distribution to the muscles during the game, good lung capacity is key. Aerobics is a type of exercise that specifically requires an abundant supply of oxygen, because the activity depends on aerobic metabolic processes that require oxygen to produce energy. To achieve good aerobic endurance, one needs to have adequate lung capacity to accommodate and distribute oxygen throughout the body efficiently. This is important because during aerobic exercise, the body needs a consistent supply of oxygen to maintain optimal muscle performance. If a person experiences fatigue during aerobic exercise, this can lead to a buildup of lactic acid within the muscles. Lactic acid can cause discomfort and decreased performance, and increase the risk of injury. This occurs due to lack of sufficient oxygen to support efficient aerobic metabolic processes within the muscles (Syahda et al., 2016).

How vital the contribution of oxygen needed in exercise to support endurance during the game, athletes must have good lungs and large lung vital capacity. According to Chotimah (2015) in the study (Tumiwa, 2016) A high KVP is key because it is directly related to the athlete's ability to absorb and use oxygen efficiently during physical activity. A person's fatigue level can be predicted from a low VO2Max capacity, which indicates a less efficient amount of oxygen used by muscles during both strenuous and light activities. The higher the amount of oxygen absorbed by the body, the better the performance of the muscles in working, so the amount of remnants that cause fatigue becomes reduced. People who have good endurance and stamina tend to have high VO2Max values. So based on this expression, it can be concluded that the vital capacity of the lungs plays an important role in improving athlete fitness because it can reduce the level of fatigue experienced by athletes. According to Evelyn C. Pearce (1995) in (Anugrah, 2014) There are several factors that affect a person's vital lung capacity, such as:

1. Age
   The vital capacity of the lungs tends to decrease with age. This is due to changes in the structure and elasticity of lung tissue as well as a decrease in respiratory muscle strength with aging.
2. Gender
   In general, the vital capacity of the lungs in men tends to be greater than in women. This is partly due to differences in body size and lung volume between the sexes.
3. Health conditions
   Factors such as respiratory infections, chronic lung diseases and other health conditions can affect a person's vital lung capacity. Diseases or conditions that affect the structure or function of the lungs can cause a decrease in vital capacity.
4. History of disease and occupation
   Exposure to harmful substances or air pollutants in the workplace or surrounding environment can damage the lungs and reduce vital capacity. In addition, a history of lung diseases such as tuberculosis or pneumonia can also affect a person's vital capacity.
5. Lifestyle factors
   Lifestyle factors also play a role in determining the vital capacity of the lungs. For example, smoking habits can damage the lungs and reduce the vital capacity of the lungs. Conversely, exercise habits can increase the vital capacity of the lungs by strengthening the respiratory muscles and increasing respiratory efficiency.
6. Nutritional Status

Nutritional status is also an important factor in influencing the vital capacity of the lungs. Being malnourished or overweight can affect lung function and its vital capacity.

The vital capacity of human lungs is usually around 4600 ml, studies show that the vital capacity of the lungs of adult men tends to be 20-25% higher than that of adult women with a commonly used tool to measure the vital capacity of the lungs is a spirometer (Juarfianti et al., 2015). Research conducted by (Tanzila & Febriani, 2019), Athletes at Sriwijaya National Sports School Palembang showed that the vital capacity of the lungs varies depending on the sport followed. For example, swimming athletes have an average lung vital capacity of around 4450 ml, while volleyball athletes have an average of around 4005 ml. The lowest average was recorded in martial arts athletes, which was around 3632 ml. Furthermore, research explains that water-based exercise has the potential to increase lung vital capacity more than land-based exercise. This is due to underwater exercises and the ability to hold your breath for long periods, which results in high water pressure in the respiratory muscles and diaphragm. As a result, these muscles experience functional strengthening and increased elasticity of the chest wall.

Meanwhile, there are studies showing the average lung vital capacity of PS football athletes. Bank Sulutgo reaches 4.1 liters or equivalent to 4100 milliliters (Tumiwa, 2016). From these results, it can be seen that the vital capacity of the lungs cannot be directly equated or considered similar among every athlete. This is due to individual differences and factors that affect the vital lung capacity of each athlete. So to improve the performance of athletes optimally, strategies are needed that can increase the vital capacity of their lungs individually. This means that a personalized approach tailored to each athlete's needs is essential, encompassing a variety of methods such as, first through breathing exercises.

Breathing exercises are an important method in achieving an optimal respiratory system, because they are closely related to achieving maximum lung vital capacity (Afrian, 2023). One breathing exercise technique that is known to be effective is Diaphragm Breathing Exercise. In this exercise, relaxation of the respiratory muscles occurs during the inspiratory phase, focusing on the activation of the diaphragm muscles to increase the volume of inspiration. This breath exercise focuses on the abdominal cavity and chest that are enlarged by the presence of air. This exercise is effective for training the diaphragm muscle, so that the process of inspiration and expiration becomes optimal. Studies by (Nohantara et al., 2021) show that Diaphragmatic Breathing Exercise is effective in increasing lung vital capacity (KVP), especially in male taekwondo athletes from the Denpasar Navy Service club, Bali. Therefore, breathing exercises like these have the potential to improve the lung abilities of athletes, which can then contribute to the improvement of their performance in different types of sports.

The second method is through physical exercise, according to Cooper (1983) in (Basuki & Jeny, 2018), People trained through physical exercise have the ability to suck in more air and over a longer period of time. This is due to the fact that the muscles around his lungs have been trained to do more work. In addition, trained individuals are also able to exhale more remnants of burning. Further research reveals that during a person's physical activity, muscles require a smooth and stable supply of energy. To support this process, oxygen is needed as the main fuel for optimal energy generation. Thus, to ensure adequate oxygen supply the frequency of respiration (breathing) increases. Through increasing the frequency of respiration, it is related to the performance of lung ventilation, which is the amount of air that enters and exits the lungs every minute. This creates conditions where the lungs are more efficient at taking

oxygen from the air and removing carbon dioxide. Over time, this increase in ventilation efficiency contributes to an increase in the vital capacity of the lungs.

The third method through aerobic exercise, the aerobic exercise method is a type of exercise activity that is carried out systematically with a gradual and continuous increase in intensity. This activity uses energy derived from the combustion process using oxygen, and requires oxygen supply without causing excessive fatigue. Examples of aerobic exercise include various activities such as walking, jogging, running, cycling, and swimming (Palar et al., 2015).

Aerobic exercise can provide a variety of benefits for lung function, especially in children with intellectual disabilities. This exercise has been shown to improve the performance of the respiratory muscles, as well as produce positive effects such as a decrease in the composition of fat in the chest wall and an increase in lung circulation. In addition, aerobic exercise can increase oxygen uptake and blood capacity to transport oxygen, as well as lower pulse rate both at rest and during activity. Research has also shown that aerobic exercise can increase capillary count, lower fat levels in the blood, and increase fat-burning enzymes. In addition, aerobic exercise tends to have higher values of lung vital capacity (KVP) and first forced expiratory volume (VEP1) compared to anaerobic sports (Abdullah, n.d.).

Furthermore, according to (Afrian, 2023), one of the factors that has a significant impact on the vital capacity of the lungs is smoking behavior. Smoking can accelerate the decline in lung function as well as change the anatomy, structure, and function of the respiratory system as a whole. Therefore, one of the last methods that can be done to increase the vital capacity of the lungs is to change lifestyle. Lifestyle changes by reducing the intensity of smoking or even quitting altogether can have a positive impact on lung health. So by stopping smoking, individuals can reduce the risk of lung damage and allow the lungs to function better.

In addition, because a person's nutritional status is included in factors that affect vital lung capacity, balanced nutritional intake is an important key in maintaining a healthy respiratory system. In research by (Yusuf & Nurleli, 2018), It was concluded that nutritional status affects the incidence of lung diseases such as tuberculosis (TB). Therefore, it is recommended that people maintain a balanced and healthy diet, which not only consists of rice or flour-based foods, but also includes side dishes such as fish, vegetables, and fruits. Eating foods rich in nutrients, individuals can meet the needs of their bodies to maintain the health of the lungs and respiratory system as a whole, this emphasizes the importance of a balanced diet and a healthy lifestyle in maintaining the health of the respiratory system and vital lung capacity.

Based on the results of the study, by applying various types of exercises such as breathing exercises, physical exercise, aerobic exercise, and lifestyle changes can increase lung vital capacity (KVP) for athletes. This research highlights the importance of a holistic approach in preparing athletes, which not only focuses on the physical aspects but also on other factors that affect athletes' performance. Increasing the vital capacity of the lungs is very beneficial for athletes because it has a direct impact on their endurance and endurance during competition. In addition, an increase in the vital capacity of the lungs can also help minimize the risk of injury, as a stronger respiratory system is able to prevent excessive fatigue. This overall can have a positive impact on athletes' achievements, both at the national, regional, and international levels, as well as representing the country, region, or institution they stand for.

CONCLUSION

Efforts to improve athlete fitness through lung capacity optimization can be done through various means. One of them is to carry out directed breathing exercises, planned physical exercise, and regular aerobic exercise. So by doing this exercise, the vital capacity of the lungs can be significantly increased. In addition, increasing the vital capacity of the lungs also has the added benefit of helping in reducing the risk of injury. With a stronger respiratory system, athletes tend to be able to avoid excessive fatigue and maintain optimal performance during training and competition. This overall positive impact can improve athletes' achievements at various levels, be it at the national, regional, or international levels. In addition, the achievements of superior athletes can also be a matter of pride for the country, region, or institution they represent, so efforts to optimize lung capacity have far-reaching implications in the world of sports.

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