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Pilates as Low – Impact Exercise: Improved Health Related Fitness and Functional Lung Capacity

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ABSTRACT

Physical activity is any form of physical movement that requires the expenditure of energy produced by the body, such as activities carried out during work and daily activities. Lack of regular physical activity increases the risk of non-communicable diseases such as decreased cardiopulmonary capacity, muscle strength and endurance in activity, flexibility, and decreased immunity. Exercise is a form of physical activity that is structured and performed with goals such as improving fitness, health, or physical performance. Physical activity includes any form of body movement that involves muscle contraction and energy expenditure, whether done formally as usual sports activities. Researchers conducted sports activities in the form of Pilates exercises. Pilates exercise is a mind-body exercise that focuses on stability, flexibility, strength, muscle control, posture and breathing. Exercise can be mat-based. Pilates exercise can produce statistically significant improvements in abdominal endurance, muscle flexibility, and endurance of the human body. The benefits of Pilates exercise can increase the strength of the heart and lung muscles, increase flexibility and fitness, improve immunity and can improve posture correction. The aim of this study was to know the impact of pilates exercise to health related fitness and lung capacity.

KEYWORDS: Pilates Exercise, Health Related Physical Fitness, Lung Capacity

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1. BACKGROUND

Physical fitness is a reflection of the body's ability to perform physical activities and is an important indicator of health. Regular participation in sports activities is important in physical activity for children and adolescents (1). According to the World Health Organisation (WHO), physical activity is body movement that is produced by skeletal muscles and requires energy and can be done with different intensities, while physical fitness is a characteristic that affects sports performance and the ability to perform physical activities with certain skills (2,3).

Physical fitness is a person's ability to carry out various kinds of daily activities without feeling significant fatigue and still have enough energy to enjoy leisure time and respond to emergencies. Physical fitness can be divided into two components, namely, health related fitness and skill related fitness (4). Physical fitness can be obtained through a series of efforts, one of which is exercise. Exercise can have a positive impact on the body, so it is said to be able to restore various body compositions, such as body fat, muscle mass and strength, bone health, increase flexibility and endurance, affect the respiratory system, blood circulation, and respiratory system. So it can reduce the risk of various diseases such as diabetes mellitus, hypertension and heart disease (5). One way to anticipate that physical fitness increases is to hold sports such as aerobic exercise. Aerobic exercise is a type of physical exercise that is used as a means of preventing and losing weight. There are so many benefits of aerobic exercise ranging from increasing muscle strength, burning fat, and other benefits for the body (6) One of the aerobic exercises used in improving fitness is Pilates exercise.

Pilates mat exercises are low-impact aerobic exercises performed on a mat. The exercise can be done without additional aids. Pilates mat exercises are safe because they do not have jumping or running movements that can increase the occurrence of trauma to the joints or increase the occurrence of pain due to excessive loading on the joints. Pilates exercises are beneficial for weight loss, improving posture and cardiovascular conditions, making muscles firmer and joints more stable. Pilates mat exercises can increase muscle flexibility, especially the back and abdomen (7).

2. PILATES

Pilates was first developed by Joseph H Pilates a physical trainer from The New York Pilates Studio in 1920. Pilates is a rehabilitation method that aims to improve coordination and stability of the muscles in the body. Pilates exercises focus on building or increasing strength without excessive effort, improving flexibility and agility, and helping with injuries. Pilates method exercises are performed by combining flexibility and strength training, breathing and relaxation (8). Pilates is a mind-body exercise that focuses on stability, flexibility, strength, muscle control, posture and breathing. Exercises can be mat-based or specialised equipment (9).

2. 1. Classification of pylates

Mat Pilates

Mat Pilates exercises are a form of physical activity that focuses on strengthening the abdominal muscles, improving range or motion, and body posture. These exercises are performed on a mat, using body weight as resistance. Mat Pilates is an effective way to address various health issues, as it targets specific muscle groups and promotes overall body strength and stability (10).

Equipment-Based Pilates

Equipment-based Pilates incorporates a range of other apparatus such as the Cadillac, Wunda Chair, and Ladder Barrel (11). These apparatuses offer additional variations and challenges to traditional Pilates exercises. Equipment-based Pilates is often practiced in a studio under the guidance of a trained instructor. It provides a comprehensive workout that targets different muscle groups, improves balance, and enhances overall body awareness. One of the key benefits of equipment-based Pilates exercises is their ability to improve posture and alleviate pain associated with poor posture. By targeting the muscles responsible for maintaining proper alignment, these exercises can help individuals with conditions such as scoliosis, kyphosis, and lordosis (11). This can be effective for individuals recovering from injuries or surgeries, as it allows for low-impact movements and particularly beneficial for individuals with conditions such as arthritis, osteoporosis, and fibromyalgia, as it can help to alleviate pain and improve overall quality of life (12)

Reformer Pilates

Reformer Pilates exercises have gained significant recognition in recent years due to their potential benefits for addressing various health issues. It is one type of equipment-based Pilates exercises. These exercises involve the use of a specialized apparatus called a reformer, which consists of a sliding carriage, springs, and adjustable straps (13). These exercises are performed lying down, sitting, or standing on the reformer, and they provide resistance and support to the body (14). Reformer Pilates makes it suitable for an individual's rehabilitation process or those with chronic conditions, providing a safe and effective form of exercise.

3. PHYSICAL FITNESS

Physical Fitness is defined as a set of attributes or characteristics that a person possesses or achieves that relate to the ability to perform physical activities. These characteristics are classified into two categories: *health-related fitness* (HRPF) and *skill-related fitness* (15). HRPF can also be defined as a multidimensional construct comprising the following components: cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and body composition (16).

3.1. Cardiorespiratory endurance

Cardiovascular endurance is frequently designated as vascular fitness, cardiorespiratory fitness, cardiorespiratory endurance, or cardiac pulmonary endurance. Another term that is frequently employed is 'aerobic fitness', given that aerobic capacity represents the most reliable indicator of overall cardiovascular fitness. Cardiorespiratory endurance can be defined as a form of endurance of the cardiopulmonary system and blood vessels in the uptake and distribution of oxygen throughout the body, particularly to active tissues, for utilisation in the body's metabolic processes (17).

3.2 Muscle Strength

Muscle strength is the ability of a person's muscles to produce force. Muscle strength is often measured by how much weight a person can lift. People with muscle strength tend to have fewer back problems and can perform daily tasks efficiently. (18). Muscle strength and endurance are the two components that make up muscular fitness. These two components are needed to improve a person's ability to work, including reducing the risk of injury, preventing back pain, preventing poor posture and preventing problems from other hypokinetic conditions (18).

3.3 Muscle Endurance

Muscular endurance can be defined as the capacity to repeatedly engage the muscles attached to the bones without experiencing fatigue. Individuals with superior muscle endurance often exhibit enhanced postural alignment, a reduced incidence of back-related issues, and an augmented capacity to withstand fatigue when compared to those with diminished muscle endurance (18). Muscular endurance can be defined as the ability of a muscle to utilise itself in an optimal manner. This concept is associated with the strength and capacity of muscles to perform activities over an extended duration. The human body comprises three primary muscle types, distinguished by their functional and structural

characteristics. These include smooth muscle, skeletal muscle, and heart muscle. Smooth muscle and heart muscle are involuntary muscles, whereas skeletal muscles are voluntary muscles (17)

3.4 Flexibility

Flexibility can be defined as the ability to utilise joints to their full potential. An individual is considered flexible when the muscles are sufficiently elongated and the joints are sufficiently mobile, thereby facilitating movement. Those with enhanced flexibility tend to experience reduced muscle soreness and a lower incidence of injuries. Regular stretching prior to and following physical activity can facilitate the enhancement of flexibility. The sit-and-reach test and body lift are two tests that are commonly employed to assess flexibility (18).

3.5 Body Composition

Body composition can be defined as the ratio of fat and fat-free body mass, which is often expressed as a percentage of body fat. Body composition is defined as the relative percentage of muscle, bone, fat, and the tissues that comprise the human body. The body composition aspect of health-related fitness is associated with the distribution of adipose tissue in the body. The accumulation of excess body fat can lead to various degenerative diseases, such as heart disease, hypertension, and diabetes mellitus. However, it is essential for all individuals to consume a minimum amount of essential fats for optimal health. This type of fat serves as a regulator of body temperature, cushioning the body from impact, and a regulator of several important nutrients, including vitamins A, D, E, and K (17).

4. IMPACT OF PYLATES TO HEALTH RELATED FITNESS

Based on research by Devi LAS (2022) with the title the effect of mat pilates training to reduce fat percentage and increase muscle mass in adult women with obesity. with results Based on the results of statistical tests, the average percentage of muscle mass of the subject has increased after the exercise is carried out. The percentage of muscle mass of the subject before training has an average of 38.55%, changing to 38.75% and an increase in the average value (0.2 ± 0.04). Measurement of the percentage of muscle mass before doing the exercise obtained the results of 2 subjects (9.1%) with a high percentage and 26 subjects (92.9%) had a very high percentage of muscle mass. The results of the parametric paired subject t-test, showed a significance of p=0.000 (<0.05). Significant differences occurred in the percentage of muscle mass before and after training. So the result of this study is that mat pilates training in adult women aged 18-40 years has a significant effect on reducing the percentage of body fat and increasing the percentage of muscle mass (19)

5. LUNG CAPACITY

Vital lung capacity or Vital Capacity is the maximum amount of air in a person that moves on one breath. This capacity includes inspiratory reserve volume, tidal volume and expiratory reserve. Pulmonary function capacity is the sum of two or more lung volumes, which includes examination of lung function capacity, the volume of air released through maximum expiration after previously performing maximum inspiration. The vital capacity is equal to the reserve inspiratory volume plus the tidal volume (VC=IRV+ERV+TV). Lung vital capacity is around 4600 ML (20).

6. PILATES BENEFITS FOR FITNESS

In Trisnowiyanto (2016) entitled "The Effect of Mat Pilates Exercise on Body Flexibility" states that pilates exercise is a combination of static and dynamic stretching done slowly so that muscle lengthening occurs followed by joints, ligaments and intervertebral discs. Muscles are composed of myofibrils in which there are sarcomeres that are parallel to each other. Sarcomeres are contractile units consisting of overlapping actin and myosin. With the stretching movement, the actin and myosin that initially overlapped will move away from each other so that there is a distance between the filaments. In addition, changes in muscle tension due to stretching movements will activate the golgi tendon organs (GTO) in tendons and muscles. When stretching is done almost beyond normal limits, the GTO will be activated to prevent injury to muscles and tendons. Impulses from the GTO are carried by the Iβ to proceed to the cerebral cortex to be perceived. Impulses from the GTO are also channeled from the spinal cord to interneurons which cause a decrease in neuron alpamotor activity so that muscle tension is reduced in the form of elongated sarcomeres. If the stretching movement is stopped, the sarcomere will still lengthen as an adaptation process for new tissue lengthening. In joint cartilage, stretching movements will stimulate the secretion of glycosaminoglycans (GAG) and hyaluronic acid which will then form the enzyme hyaluronidase. Stretching movements will also cause an increase in water concentration in the intervertebral disc. Furthermore, GAG, hyaluronic acid and water will cause the distance between fibers to increase, increase lubrication (lubrication) and decrease collagen tissue which is filled by fibrous tissue so that the flexibility of the body can increase (21)

7. BENEFITS OF PILATES FOR LUNG FUNCTION CAPACITY

The effect of pilates exercises on the respiratory system is an increase in the efficiency and strength of the respiratory system that occurs due to venous blood filling from peripheral to central circulation and increased hydrostatic pressure on the chest wall. The regulation of breathing in Pilates exercises also increases oxygen intake and oxygen-filled blood circulation which is then flowed to all breathing which

is done consciously and thoroughly is the key to adequate oxygen intake because without adequate oxygen intake, the body's tissues and organs will lack energy. Pilates exercises can increase lung capacity which will result in an increase in peak expiratory flow (APE) and is also good for training concentration, increasing flexibility, and reducing stress. A cardiologist named Joel Kahn, MD said that stress is related to breathing. Indirectly, all pilates movements require consistent breath control. Therefore, pilates exercise is good for lung capacity because the exercise is not only on body flexibility, but also on improving breathing which will increase lung function capacity which can be measured by lung volume and capacity.

8. CONCLUSION

Pilates is a low impact exercise, focus with posture can help to improve cardiorespiratory fitness, muscle strength, muscle endurance, flexibility and body composition. Pilates also can increase lung capacity by the effect of expand thoracic volume.

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