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THE EFFECT OF TRAINING ON MUSCLE MASS DEVELOPMENT IN KONI DKI JAKARTA WUSHU ATHLETES

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ABSTRACT Muscle mass is a part of body composition that is important for athletes' health and performance, especially Wushu athletes. An optimal training program can increase athlete's muscle mass, so it is necessary to evaluate muscle mass changing before and after the exercise program. The purpose of this program is to determine the effect of training on muscle mass development in PELATDA KONI DKI Jakarta Wushu athletes. Anthropometric and body composition examinations (muscle mass, skeletal muscle, and segmental muscle mass) were carried out before and after the exercise program. Examinations were carried out in June and September 2023. 20 of the 22 Wushu athletes took part in anthropometric and body composition examinations. Data was analyzed using the Paired Sample T test. Results showed that there was no significant difference between muscle mass, skeletal muscle and segmental muscle mass before and after the exercise program with >0.05 p value. Our findings show that the training program is less effective in increasing Wushu athletes' muscle mass. Further research needs to be carried out to examine training programs and other supporting factors such as nutrition and recovery in increasing athletes' muscle mass.

Keywords: Body composition, Muscle mass, Training program, Wushu



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INTRODUCTION

Wushu (martial arts) as a major fitness sport is also growing rapidly. The state and government have officially included Wushu in the national fitness program and attach great importance to the development of Wushu in the field of fitness. Chinese Wushu as one of the national traditional sports is very loved by the wider community. Wushu has a high value in fitness and maintaining health, which contains a broad and profound traditional culture and philosophy (Xiaolei, 2018).

Wushu is a martial art requiring maximum muscle strength and endurance because the muscle structure is responsible for performing better. As a sport that has heavy weight considerations, body composition factors such as low body fat percentage and high fat-free mass can serve as sensitive indicators of an athlete's performance. Physical fitness factors that are important for performing strong and accurate movements include power, muscle strength and muscular endurance (Sarkar et al., 2018).

Body composition is one that is recognized as a determinant of the health and performance of an athlete. Body composition assessment is essential for

evaluating the efficiency of an athlete's diet or as it relates to the athlete's nutritional status. An athlete can change his body composition according to the needs of his sport to get an advantage. As a result, athletes will carefully adjust their training habits and nutrient intake according to the demands of their sport (Campa et al., 2021). So assessing body composition becomes very important to evaluate the results of an athlete's diet and exercise.

The benefits of nutrients on sports performance have long been known. There is no doubt that nutrition can affect health, weight and body composition, substrate availability during exercise, recovery after exercise, and ultimately sports performance ultimately leading to superior sports achievement. Dietary strategies to improve exercise performance include optimizing macronutrient, micronutrient, and fluid intake, including composition and spacing throughout the day. Carbohydrate intake has been shown to improve performance for events lasting about 1 hour. Protein consumption before and during endurance and endurance exercise has been shown to increase the rate of

Muscle Protein Synthesis (MPS) (Sarkar et al., 2018).

Muscle mass is essential for an athlete's performance, health and survival. The metabolic basis for changes in muscle mass is an increase in net muscle protein balance (called NBAL). NBAL is the difference between MPS (muscle protein synthesis) and MPB (muscle protein breakdown). Thus an increase in MPS and/or a decrease in MPB is required for NBAL to increase, leading to muscle protein accretion. NBAL responds to exercise, eating, and other factors. In healthy, stable adults, muscle mass remains constant because periods of positive balance after meals are offset by periods of negative balance during fasting. The combination of resistance exercise and nutrition is a powerful anabolic stimulus through stimulation of MPS from amino acids and attenuation of MPB by carbohydrates. Increased muscle mass results from the accumulation of small amounts of protein in response to each exercise combined with nutrient intake (Tipton & Ferrando, 2008).

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Physical activity and exercise are stimulators of MPS. Exercise stimulates the use of amino acids derived from dietary proteins used in muscles that are active during recovery from exercise. Maximal administration of protein provides stimulus to the MPS response by administering 20 g of whey protein in the recovery period after exercise. Exercise can increase not only maximal

postprandial MPS levels but also the duration of anabolic response. Exercise-induced increased anabolic sensitivity can support the full effects of muscle tone and allow for a longer MPS response to feeding. MPS levels are also sensitive to physical activity habits. Several studies have shown that unused muscle reduces postabsorptive and postprandial MPS levels after long bed rest or immobilization (Trommelen et al., 2019).

The exercises carried out by wushu athletes Pelatda DKI Jakarta certainly use many types of strength training that serve to increase muscle mass and strength. The exercise program carried out can change body composition related to increased muscle mass and decreased body fat mass. During training, it is necessary to evaluate the efficiency of exercises performed on muscle building that occurs due to exercise adaptation. Nutrient intake also needs to be evaluated considering the role of nutrients in providing a recovery effect and helping in muscle formation. Therefore, it is necessary to check before and after doing an exercise program to see the development of muscle mass in wushu athletes.

METHOD

The method used in this study is a descriptive comparative method with the aim of comparing two variables to get an answer or fact whether there is a comparison or not from the object under study. Comparative research methods are ex post facto, meaning that data is collected after all collected events have taken place.

Population and Sample

The population of this study was Jakarta wushu athletes who underwent Pelatda a total of 22 people. Sampling technique by means of Total sampling. Total sampling technique is a sampling technique by including all sample populations. Population is a whole of something whose characteristics may be investigated or researched (Rachmat, 2021). The sampling criteria are as follows; (1) Wushu athletes PELATDA KONI DKI Jakarta, (2) Aged between 16 - 30 years, (3) Do not have a history of disease, and proven by a health certificate from a sports specialist, (4) Willing to participate in research. Research samples that drop out if they suffer from illness in the research process or fail to continue the research. Data collection techniques in this study

used body composition measurement tests with Bioelectrical Impedance Analysis (BIA) tools to respondents who were subjects in the study.

Preparation of Research Instruments

The type of data used in this study is primary data which includes individual characteristics and anthropometric data. The individual characteristic data collected are age and gender. Anthropometric measurements in the form of measurements of athletes' height and weight.

Table 1. The type of data

Individual characteristics	Data	Data collection methods
Anthropometric Measurements	<ul style="list-style-type: none"> • Age • sex 	Interview
	<ul style="list-style-type: none"> • High • Weight • Otoriy Dough • Skeletal muscl • Muscle mass segments 	<ul style="list-style-type: none"> • Hight using stature meter • Measurement of body weight and body composition using BIA (Bioelectrical Impedance Analysis) Mediana i30

Athletes take anthropometric measurements before and after running regional training programs. Preliminary data was taken in June 2023 and data collection after the exercise program was conducted in September 2023. Anthropometric measurements are carried out to obtain data on weight,

height and body composition (muscle mass). Measurement of body weight and body composition using BIA (Bioelectrical Impedance Analysis) Mediana i30. Height measurement is carried out using a stature meter with an accuracy of 0.1 cm. Data Analysis Techniques The data obtained was recapitulated and processed with Microsoft Office Excel 2019 and SPSS version 27 for windows. Data processing begins with several stages, namely coding, entry, cleaning, and data analysis. Coding is done by providing certain codes as guidelines for the next stage. Then the data will be entered into Microsoft Office Excel and presented in the form of a table. Re-checking is done after all the data is entered and the next stage is data analysis.

The individual characteristic data used are age and sex. Anthropometric data is data measuring height, weight, body composition consisting of muscle mass, skeletal muscle, and segmental muscle. The data was analyzed with several tests. The first test is carried out to see whether the distribution of data in the sample is normally distributed or not.

The comparative test performed is the paired sample T test. Paired sample T test is widely used for experimental

research. Both data are dependent, if both groups of data being compared have the same subject. The requirement for this test is normally distributed quantitative data (intervals or ratios). if the data is not normally distributed, then testing is performed using the Wilcoxon test.

H0: There is no difference between muscle mass before and after regional training in Jakarta Wushu athletes

H1: There is a difference between muscle mass before and after regional training in Jakarta Wushu athletes

The significance value used in this study was 0.05. This explains that H0 is rejected and H1 is accepted when the p value is <0.05 which means there is a difference between muscle mass before and after regional training in DKI Jakarta Wushu athletes.

RESULTS AND DISCUSSION

Characteristics of Wushu Athletes

The subjects in this study were DKI Jakarta Wushu Pelatda athletes. The DKI Jakarta Pelatda (Regional Training Center) is intended to prepare athletes for PON XXI in Aceh and North Sumatra. Wushu athletes who were the subjects in

this study were 20 people consisting of 13 people (65%) men and 7 people (35%) women. The age of the Wushu athlete who was the subject was 16-29 years old. The average age of athletes was 21.45 ± 4.21 years. Data on the characteristics of Wushu athletes are shown in the following table.

Table 2. Anthropometric data of athletes before and after the training program

Variable	Before Exercise Program (Mean \pm SD)	After Exercise Program (Mean \pm SD)	Weight Difference (CI 95%)	p-Value
Age (Tahun)	21,45 \pm 4,21			
Hight (cm)	163,31 \pm 7,47			
Weight (Kg)	61,58 \pm 8,98	61,27 \pm 8,69	,31 (-0,39 - 0,99)	0,369 ^a
BMI (kg/m ²)				
Median	22,50	22,15		
(Min-Max)	(19,90 - 27,90)	(20,50 - 26,70)		0,552 ^b

The data in the table shows changes in body weight and body mass index decreased but not significantly. Body weight changed from 61.58 ± 8.98 kg to 61.27 ± 8.69 kg with a p-value > 0.05. Body Mass Index value reduced from median value of 22.50 (19.90 - 27.90) kg/m² to 22.15 (20.50 - 26.70) kg/m² with p-value > 0.05.

Muscle Mass

Body composition describes and measures various elements in the human

body. Body composition assessment can be divided into various groups according to their level. Starting from atomic levels such as the amount of hydrogen, carbon, oxygen, and other atoms, molecular levels such as fat mass and fat-free mass, cellular levels such as adipose cells, intracellular and extracellular water, and body cell mass, tissue levels such as adipose cells and lean soft tissue and skeletal muscle mass, and whole body levels that summarize the mass of different body segments such as the head, body, and other limbs (Campa et al., 2021). The following is comparative data of muscle mass of athletes before and after the exercise program tested using the paired *t-test difference test*.

Table 3. Muscle mass data of athletes before and after training programs

Variabel	Before The Exercise Program (Mean ± SD)	After Exercise Program (Mean ± SD)	Weight Difference CI 95%)	p-Value
Muscle Mass (kg)	44,68 ± 8,15	44,84 ± 8,29	-1.60 (-0,85-0,53)	0,634
Skeletal Muscle (kg)	25,35 ± 7,67	26,73 ± 5,66	-1.38 (-4,04 -1,27)	0,291
Segmental Muscle Mass				
Right Arm(kg)	2,41 ± 0,64	2,43 ± 0,65	-0,02 (-0,08-0,05)	0,613

Left Arm (kg)	2,38 ± 0,65	2,38 ± 0,66	0,00 (-0,07-0,79)	0,912
Trunk				
	21,02 ± 4,03	21,02 ± 4,04	-0,00 (-0,28-0,27)	0,979
Right Leg (kg)	7,66 ± 1,47	7,67 ± 1,49	-0,02 (-0,14-0,10)	0,755
Left Leg (kg)	7,60 ± 1,44	7,59 ± 1,47	0,01 (-0,10-0,13)	0,838

Muscle mass is an important part of body composition for athlete performance. Strength and power are closely related to muscle performance. Greater strength and power benefit athletes by affecting speed in changing direction, high jumps, potential linear acceleration and reduced risk of injury (Hetherington-Rauth et al., 2021). Table3 shows changes in muscle mass, skeletal muscle, and segmental muscle mass in wushu athletes before and after an exercise program.

The average muscle mass in wushu athletes after doing an exercise program increased by 1.6 kg and in skeletal muscle by 1.38 kg. However, this increase in statistical testing is not significant with a p-value > 0.05. The same thing also happened to segmental muscle mass which experienced an increase in muscle mass by 0.02 kg on the right arm and right leg. Statistically

this increase is also not significant. While in other muscle mass segments such as left arm, trunk and left leg there is no change.

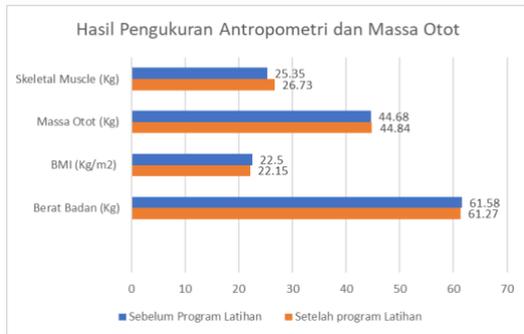


Figure 1 Comparison of anthropometric measurement results and muscle mass

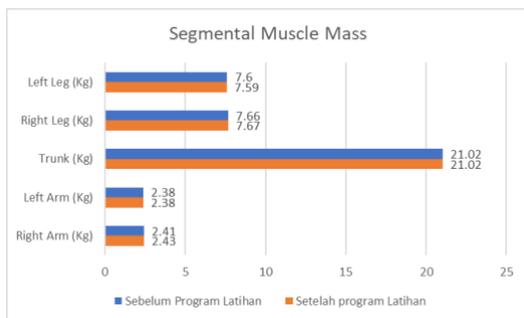


Figure 2 Comparison of Segmental Muscle Mass measurement results

Anthropometric measurements (body weight, Body Mass Index, muscle mass, and muscle skeletal) and muscle mass segmentally were carried out to see the difference in muscle mass increase in Wushu athletes during the training program. The results in the chart above show that after a training program was carried out on Wushu athletes from June

to September 2023, it showed a decrease in weight and BMI as well as an increase in muscle mass and skeletal muscle in DKI Jakarta Wushu athletes. Figure 2 shows a picture of weight loss and body mass index but followed by an increase in muscle mass and skeletal muscle. Muscle mass increased from 44.68 kg to 44.84 kg while skeletal muscle increased from 25.35 kg to 26.73 kg. Figure 2 shows a picture of segmental changes in muscle mass before and after the training program. Only a slight increase occurred in the right arm from 2.41 kg to 2.43 kg and the right leg from 7.66 kg to 7.67 kg.

Discussion

A total of 20 Wushu athletes have taken anthropometric measurements before and after they run the regional training program. Wushu is a martial art requiring maximum muscle strength and endurance because the muscle structure is responsible for performing better. As a sport that has heavyweight considerations, body composition factors such as low body fat percentage and high fat-free mass can serve as sensitive indicators of athlete performance (Sarkar et al., 2018).

Wushu athletes who have participated in regional training programs and carried out anthropometric measurements and body composition are

DKI Jakarta regional athletes. Wushu athletes who were the subjects of the study consisted of 13 people (65%) men and 7 people (35%) women. The age of Wushu athletes who were subjects was 16-29 years with an average age of athletes 21.45 ± 4.21 years.

Anthropometric measurements consist of height, weight, and body mass index. The results of height measurements of wushu athletes have an average height of 163.31 ± 7.47 cm. The weight of wushu athletes has decreased from before participating in the training program, which is 61.58 ± 8.98 kg to 61.27 ± 8.69 kg. The average weight loss is 0.31 kg. However, the results of statistical tests show that this weight loss is not significant with a p-value of > 0.05 . A decrease also occurred in the body mass index of wushu athletes. BMI (Body Mass Index) is a measure to indicate nutritional status in adults. BMI is defined as a person's weight in kilograms divided by the square of the person's height in meters (kg/m^2). BMI is widely used to measure the level of overweight and obesity in a population (Jameel et al., 2019). The BMI change in wushu athletes is from 22.50 (19.90 - 27.90) kg/m^2 to 22.15 (20.50 - 26.70) kg/m^2 . Similar to body weight, statistical

tests showed no difference in changes in body mass index with a p-value of > 0.05 . The results of this measurement show that the BMI of wushu athletes is still within the normal range. According to WHO (1998) the normal range of BMI is between 18.5-25 kg/m^2 . BMI in athletes is also important because it can affect athlete performance, nutritional regulation and risk of injury in athletes. BMI in athletes can be influenced by many things such as exercise and nutritional intake. This weight loss and body mass index may occur as a result of increased exercise intensity during the exercise program (Jameel et al., 2019).

Physical exercise involves planned and structured body movements designed to improve physical fitness. Research by Dewi et al., (2021) shows that the higher the level of physical activity, the higher a person's physical fitness level. A high fitness level has a correlation with a lower BMI. When determining the success rate of exercise, body composition measurement becomes a more effective parameter compared to BMI parameters.

Body composition and nutritional status are important and proven in determining athletic health and performance. Many sports are influenced

and benefited by changes in body composition in athletes. For example, sports related to aesthetics and gravity such as gymnastics, rock climbing, long jump and so on whose success is influenced by anthropometric characteristics and body composition. Other sports are classified by weight so athletes need to maintain body mass, and body composition is within a certain range. Therefore, it is important for athletes to adjust training to their nutritional intake depending on the characteristics of their sport (Campa et al., 2021).

Muscle mass is a part of body composition that is closely related to athletic performance. The results of muscle mass measurements carried out on wushu athletes showed changes in muscle mass before and after participating in the training program. Muscle mass increased from 44.68 ± 8.15 kg to 44.84 ± 8.29 . The average increase in muscle mass is about 1.6 kg after the athlete follows the training program. Increased skeletal muscle also occurs in wushu athletes from before to after undergoing an exercise program. Increase from 25.35 ± 7.67 kg to 26.73 ± 5.66 kg with an average increase of 1.38 kg. However, this increase in muscle

mass and skeletal muscle did not differ markedly statistically with a $p\text{-value} > 0.05$. This showed no difference in muscle mass before and after the training program.

Resistance training for muscle mass development (hypertrophy) is the goal of strength and conditioning. The increase in muscle mass is the result of synthesized contractile tissue containing actin and myosin proteins responsible for contractile strength. Since hypertrophy involves morphological changes and an increase in tissue, an increase in muscle mass can be associated with an increase in overall body mass, if no other tissues such as fat are catabolized (broken down) proportionally (Young et al., 2019).

When viewed segmentally muscle mass per body part, there is a slight increase in muscle mass that occurs from before to after the exercise program. The increase only occurred in the right arm from 2.41 ± 0.64 kg to 2.43 ± 0.65 kg and leg arm from 7.66 ± 1.47 kg to 7.67 ± 1.49 kg. The increase only increased by 0.02 kg on the right arm and right leg. In other segments such as the left arm and trunk there is no increase or fixed, while in the left leg there is a decrease of 0.01 kg. Statistical tests

conducted with paired sample T tests did not show significant results with a p -value > 0.05 . This showed no difference between segmental muscle mass before and after the exercise program.

Muscle protein synthesis (MPS) is a metabolic process that describes the incorporation of amino acids into skeletal muscle proteins. The difference in MPS and protein breakdown levels will cause muscle protein to be obtained (MPS exceeds muscle protein breakdown) or muscle protein to be lost (muscle protein breakdown exceeds MPS). Based on these two metabolic forms, MPS is more responsive to exercise and nutritional stimuli in healthy individuals and in sportsmen as an exercise adaptation (Witard et al., 2022).

Sports with weight classes are sports that focus on building muscle mass. Almost all forms of resistance training and strength training are carried out by sports with weight classes, including wushu. The main focus of the exercise is to make the muscles hypertrophy periodically (Penggali & Solichah, 2018).

Resistance-type exercises are an effective strategy for increasing skeletal muscle mass and strength. Resistance-

type exercise stimulates muscle protein synthesis and the rate of muscle breakdown. Thus, resistance-type exercise increases net muscle protein balance, but the balance remains negative in the absence of protein consumption. Protein consumption after exercise adds to the increased rate of muscle protein synthesis and inhibits the rate of muscle protein breakdown, resulting in a positive net muscle protein balance during the acute stage of post-workout recovery. Therefore, post-workout protein consumption is widely applied by athletes as a strategy to increase the rate of post-workout muscle protein synthesis and, to facilitate skeletal muscle conditioning. Current guidelines for protein intake after exercise lower body resistance types recommend consumption of 20 g (or 0.3 g/kg body weight) high-quality protein sources after exercise in healthy young men (Fuchs et al., 2020).

Conclusion

Our research showed that there was no significant difference in muscle mass of wushu athletes before and after the exercise program. The increase in muscle mass during the three months

following the exercise program did not correspond to the expected increase in muscle mass. The exercise program carried out is still less effective for increasing muscle mass of wushu athletes. Further research is needed to examine the exercise program and other supporting factors in increasing muscle mass in athletes.

Recommendations

The recommendation for future research is to increase the number of samples studied and conduct research on samples of other sports. Given that respondents are not in training centers, additional supporting data should be monitored such as training patterns, resting patterns and athletes' nutritional intake before, during, and after training to minimize bias. In addition, it is necessary to conduct further research related to other components of body composition.

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