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STUDY ON IMPROVING MUSCLE MASS AND ENDURANCE IN ADULTS

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Abstract: Improving muscle mass is essential for maintaining health and functional capacity in adults. Strength and endurance training are recognized methods for improving these aspects, having significant benefits on general health and quality of life. The purpose of this study is to evaluate the effects of a structured physical training program on muscle mass and physical endurance in adult women aged between 48 and 51 years, who have not previously practiced physical training. Hypothesis of the paper: it is assumed that a structured physical training program will lead to a significant improvement in muscle mass and physical endurance in adult women. Objectives of the work: 1. To investigate the effects of different types of training on muscle mass and physical endurance in adults, by evaluating changes in physical parameters such as weight, cardiovascular performance measured by the Ruffier test (resting pulse, pulse in effort and recovery pulse), and muscle strength measured by Prone trunk lifts, Supine trunk lifts și Squats 2. To investigate the impact of the experimental training program on the general health of the participants before and after. The results indicate that the combined training program led to a significant increase in muscle mass and physical endurance in adults.

Introduction: In an era where sedentary lifestyles and health problems associated with lack of exercise are increasingly common, it is important to identify and implement effective strategies to promote optimal physical fitness. Our study aims to investigate the impact of different types of training on the development of muscle mass and physical endurance in adults [1]. Physical inactivity is currently recognized as one of the main causes of morbidity and mortality, highlighting the seriousness of this problem [5]. Therefore, it is essential for practitioners and researchers to identify strategies for implementing physical activities that not only bring health benefits, but also favor the maintenance of an active behavior in the long

term. "'Long-term training is considered a typical intervention method and is effective for improvement of both muscle quantity and physical function' [2]. Antrenamentul este una dintre tendințele recente care prezintă promisiuni semnificative în acest contex [9]. Fitness is essential for everyone, from athletes and students to the general public. However, fitness requirements vary depending on each person's daily activities. For example, adults, who are often engaged in varied and demanding activities throughout the day, may need excellent physical fitness to cope with work-related stress and fatigue. In this context, the objective of this study was to improve the physical capacity of adults by using circuit training methods. Regular exercise has shown beneficial effects on health, reducing the risk of developing or worsening cardiovascular disease, obesity, diabetes and cancer. Constant exercise not only prevents the development of these conditions, but also contributes to increasing muscle mass, lowering body fat levels and strengthening the bone system [7]. Regular physical training is known as an essential factor for improving work capacity, endothelial function and cardiovascular risk profile in the context of obesity. However, there are no clear certainties about which type of exercise is most effective: high-intensity aerobic exercise, moderate-intensity aerobic exercise, or strength training. Each approach offers distinct benefits, and determining the most optimal form of exercise requires detailed analysis to identify the most appropriate method based on individual goals and conditions [6]. The authors concluded in their study that muscle strength, balance, and endurance can be improved through physical activity in people between the ages of 40 and 65. There were greater effects on muscle strength from programs using resistance exercises, indicating the need to include a resistance training component if the goal is to improve strength [8].

Material-method: The purpose of this study is to evaluate the effects of a structured physical training program on muscle mass and physical endurance in adult women aged 48 to 51 years, who have not previously practiced physical training. Hypothesis of the paper: it is assumed that a structured physical training program will lead to a significant improvement in muscle mass and physical endurance in adult women in the study group. Objectives of the work: 1. To investigate the effects of different training regimens on muscle mass and physical endurance in adults, by evaluating changes in physical parameters such as: weight, cardiovascular performance measured by the Ruffier test (resting pulse, exercise pulse and recovery pulse), and muscle strength measured by Prone trunk lifts, Supine trunk lifts and Squats. 2. To investigate the impact of the experimental training program on the general health of the participants before and after it. Organization and conduct of the experiment: The experiment was carried out on a group of 12 adult women aged between 48 and 51 years, who had not previously practiced physical training. The

participants gave their informed consent to participate in the research. The experimental program lasted 4 weeks (May-2024), including three sessions per week of training, each session lasting between 50 and 90 minutes. The trainings were organized and held in the Wondergym hall, under the guidance of coach Scheuleac Adelina.

Training-experiment program

Table 1. Training-Week 1.
Objectives: 1. Pain relief. 2. Maintaining and preserving muscle tone. 3. Growth of muscle endurance.

Day	Type of training	Heating	Content	Cardio
Monday	Upper body	5 minutes - general and specific heating	Exercises for the deltoid muscles Chest exercises Exercises for the abdomen	20--minutes Elliptical Bike work program routines/total body level 6
Wednesday	Lower body	5 minutes - general and specific heating	Exercises for the gluteal muscles Exercises for the calf Quadriceps exercises	20--minutes Elliptical Bike work program routines/total body level 6
Friday	Whole body	5 minutes - general and specific heating	Exercises for the upper limbs Exercises for the trunk Exercises for the abdomen Exercises for the lower limbs	20--minutes Elliptical Bike work program routines/total body level 6

Week 1 of the training program focused on relieving pain, maintaining and maintaining muscle tone, as well as increasing muscle endurance.The workouts were structured to address these goals through a combination of strength training and cardio. Exercises for the deltoid, chest and abdominal muscles have been selected to activate and strengthen the muscles of the upper body, thus reducing tension and discomfort. Exercises for the glutes, calves and quadriceps muscles have been chosen to tone the muscles of the lower body, thus maintaining a balanced muscle tone and preventing muscle atrophy. The full-body workout, which included exercises for the upper limbs, trunk, abdomen, and lower limbs, was designed to improve overall muscle endurance. Cardio sessions have been integrated to support this goal while maintaining a consistent level of intensity and cardiovascular activity. Cardio sessions on the elliptical bike, of 20 minutes each, were essential for improving cardiovascular endurance and supporting a complete training regimen. Level 6 of the program provided a moderate intensity, appropriate for the beginning of the program.

Table 2. Training - Week 2
Objectives: 1. Strengthening the joints; 2. Correcting posture and body alignment. 3. Improving flexibility and mobility

Day	Type of training	Heating	Content	Cardio
Monday	Upper body	5 minutes - general and specific heating	Exercises for the triceps Exercises for the trunk Trapezius exercises Exercises for the abdomen	20--minutes Elliptical Bike work program routines/total body level 7
Wednesday	Lower body	5 minutes - general and specific heating	Exercises for the adductor muscles Exercises for the abductor muscles Exercises for the biceps femoris	20--minutes Elliptical Bike work program routines/total body level 7
Friday	Whole body	5 minutes - general and specific heating	Exercises for the upper limbs Exercises for the trunk Exercises for the abdomen Exercises for the lower limbs	20-minutes -minutes Elliptical Bike work program routines/total body level 7

Exercises for the triceps, trunk, trapezius and abdomen have been selected to strengthen the joints and prevent injuries by increasing muscle resistance in the upper body area. Specific exercises and general warm-up helped prepare the joints for physical exertion. The exercises for the adductors, abductors and biceps femoris were oriented towards improving the stability and alignment of the body. These exercises were chosen to strengthen the stabilizing muscles of the pelvis and thighs, thus helping to correct posture. The exercise program for the upper limbs, trunk, abdomen and lower limbs has been designed to stimulate flexibility and mobility. Stretching and strength exercises have been integrated in a way that promotes flexibility and joint movement. All training sessions included cardio sessions on the elliptical bike at level 7, lasting 20 minutes. This ensured that the experiment group benefits from effective cardio training, which improves cardiovascular endurance and contributes to calorie burning.

Table 3. Training- Week 3
Objectives:1. Toning muscles through exercise. 2. Improvement of physical and mental state

Day	Type of training	Heating	Content	Cardio
Monday	Upper body	5 minutes - general and specific heating	Exercises for the forearm Back exercises Exercises for the abdomen Chest exercises	20--minutes Elliptical Bike work program routines/total body level 8

Wednesday	Lower body	5 minutes - general and specific heating	Exercises for the buttocks Exercises for the abductor muscles Exercises for the biceps femoris Quadriceps exercises	20--minutes Elliptical Bike work program routines/total body level 8
Friday	Whole body	5 minutes - general and specific heating	Exercises for the upper limbs Exercises for the trunk Exercises for the abdomen Exercises for the lower limbs	20--minutes Elliptical Bike work program routines/routine body level 8

The third week of the experimental program was designed to continue toning the muscles and improve the physical and mental state of the participants. The program included varied exercises, which targeted all muscle groups, and maintained a continuous focus on cardiovascular endurance and general body toning. The exercises for the forearm, back, abdomen and chest were chosen to work the main muscle groups of the trunk and arms. These exercises were integrated into a routine that boosted both strength and endurance, contributing to the overall toning of the body's upper muscles. Exercises for the glutes, abductor muscles, biceps femoris and quadriceps have been selected to strengthen and tone the lower body. These exercises have been designed to improve stability and mobility, thus contributing to a state of physical and mental well-being. The program included exercises for the upper limbs, trunk, abdomen and lower limbs. These exercises were intended to work all muscle groups in a balanced way, promoting the complete toning of the body. Medium-intensity exercises and cardio on the elliptical bike were maintained to boost cardiovascular endurance as well. Cardio sessions on the elliptical bike continued at level 8, lasting 20 minutes a day. This level was chosen to ensure an effective workout that supports both muscle toning and improving cardiovascular endurance.

Table 4 Training - Week 4

Objectives:1. Decrease in body weight. 2. Increasing the body's exercise capacity

Day	Type of training	Heating	Content	Cardio
Monday	Upper body	5 minutes - general and specific heating	Exercises for the upper limbs Back exercises Exercises for the peiept Exercises for the abdomen	20-minutes Elliptical Bike work program routines/routine body level 9
Wednesday	Lower body	5 minutes - general and specific heating	Exercises for the buttocks Exercises for the abductor muscles Adductor exercises	20--minutes Elliptical Bike work program routines/routine body level 9

			Exercises for the biceps femoris Quadriceps exercises	
Friday	Whole body	5 minutes - general and specific heating	Exercises for the upper limbs Exercises for the trunk Exercises for the abdomen Exercises for the lower limbs	20--minutes Elliptical Bike work program routines/total body level 9

Week 4 workouts continue to focus on intensifying exercise to boost calorie burn. Strength and high-intensity cardio exercises are essential for boosting metabolism and reducing body weight. The increased intensity of workouts and exercises on the elliptical trainer at level 9 is designed to improve overall physical endurance. Integrated workouts for all muscle groups contribute to the development of greater effort capacity. Upper body exercises are varied and target all relevant muscle groups. The cardio session on the elliptical trainer at level 9 ensures a constant intake of intensity for efficient calorie burning. Focusing on the lower body helps strengthen muscles and improve flexibility. Intensified cardio on the elliptical trainer supports weight loss and endurance growth goals. Integrative full-body training supports overall toning and the development of greater effort capacity. High-intensity cardio sessions continue to contribute to weight loss goals and improved fitness.

Results: The analysis and interpretation of the recorded data focuses on changes in statistical indicators for various physical variables between two data sets, TI and TF. These variables include height, age, weight, Ruffier test (Resting pulse, pulse in effort and recovery pulse), Prone trunk lifts, Supine trunk lifts and Squats. By examining the mean (X), standard deviation (S), and coefficient of variability (Cv%), this analysis provides a comprehensive understanding of trends and variations in the physical performance of the subjects studied, highlighting both the significant improvements and the variability observed between the two assessment points.

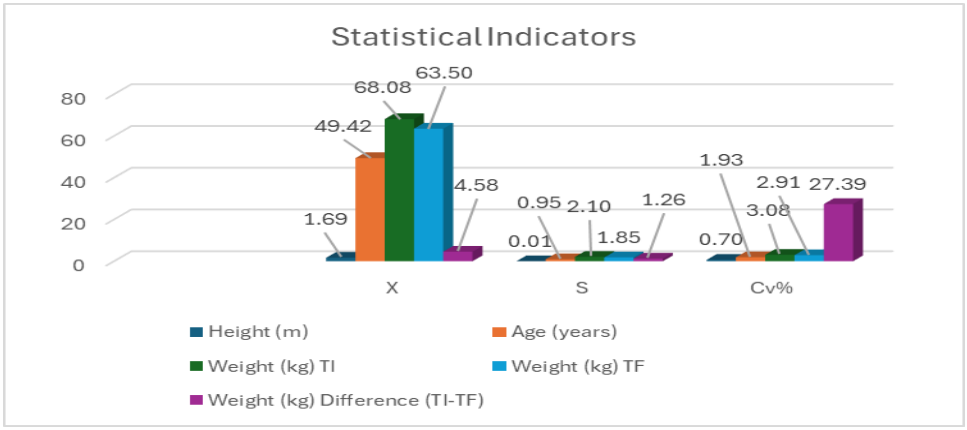

Fig.1 Statistical representation - height, age, weight

For height, statistical indicators reveal a mean of 1.69 m, a standard deviation of 0.01 m and a coefficient of variation of 0.70%, indicating extremely low variability and high uniformity in the measured height of the sample. For age, statistical indicators indicate a mean of 49.42 years, a standard deviation of 0.95 years, and a coefficient of variability of 1.93%, suggesting a relatively small variation around the mean and a fairly uniform age distribution in the sample. For weight, the statistical indicators show an average of 68.08 kg in the initial test and 63.50 kg in the final test, with a difference of 4.58 kg between the two tests; the standard deviation was 2.10 in TI and 1.85 in TF, reflecting a decrease of 1.26, and the coefficient of variability decreased from 3.08% in TI to 2.91% in TF, indicating a significant decrease in relative weight variation.

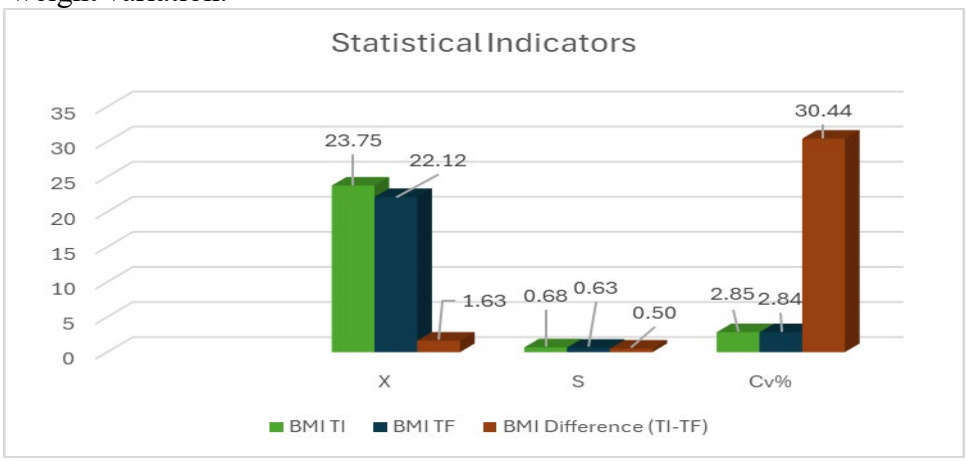

Fig.2 Statistical representation-BMI

The differences observed between the statistical indicators of the Body Mass Index (BMI) indicate a decrease in the mean BMI from 23.75 in the TI to 22.12 in the TF,

a reduction in the standard deviation from 0.68 to 0.63 and a relatively constant variation in the coefficient of variability (2.85% in the TI compared to 2.84% in the TF), thus suggesting a significant decrease in the mean values and a slight decrease in the variability in the TF.

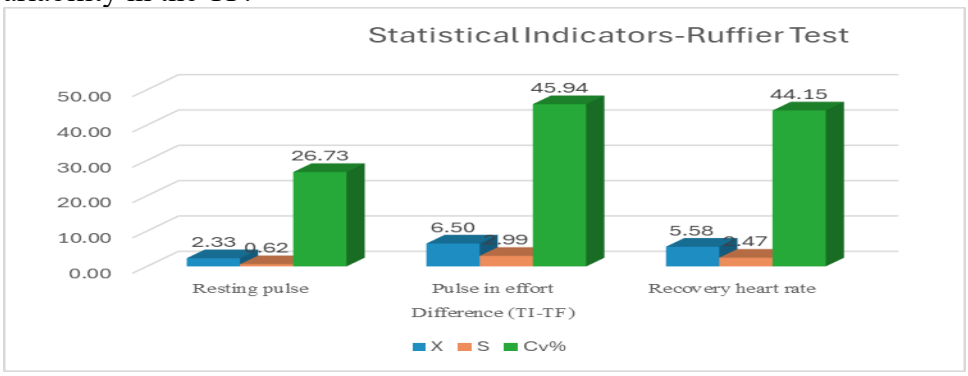

Fig.3 Statistical representation-Ruffier Test

Analysis of statistical indicators for the Ruffier test shows that the mean resting heart rate decreased from 71.58 to 69.25 beats per minute (a difference of 2.33), the mean exertional heart rate decreased from 143.83 to 137.33 beats per minute (a difference of 6.50), and the mean recovery heart rate decreased from 114.33 to 108.75 beats per minute (a difference of 5.58); the standard deviation for resting heart rate decreased from 0.76 to 0.92, for exercise heart rate from 11.40 to 8.96, and for recovery heart rate from 11.25 to 10.04, while the coefficient of variation increased for all three measurements, indicating a relatively greater variability in the final test: 26.73% for resting heart rate, 45.94% for exercise heart rate and 44.15% for recovery heart rate

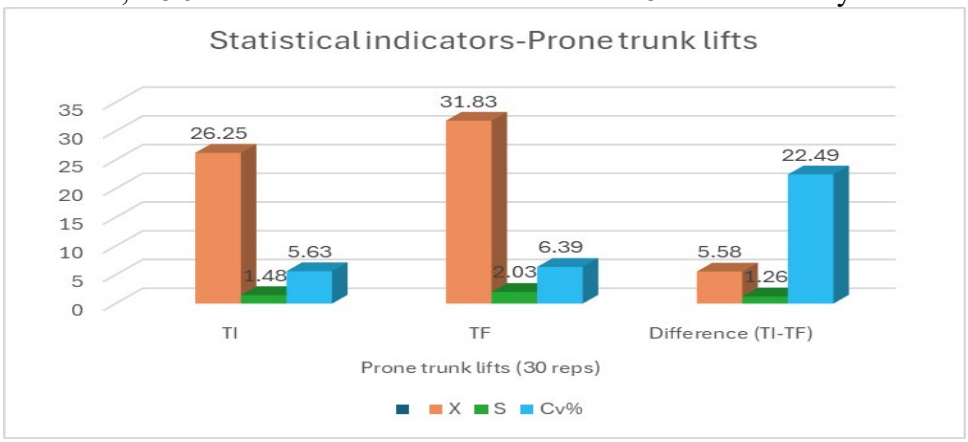

Fig.4 Statistical representation-Prone trunk lifts

For Prone trunk lifts (30 reps), the average performance increased from 26.25 to 31.83 reps, with a difference of 5.58; The standard deviation increased from 1.48 to

2.03, and the coefficient of variability increased from 5.63% to 6.39%, indicating an increase in relative variation in the final test, with a significant difference of 22.49% in the coefficient of variability.

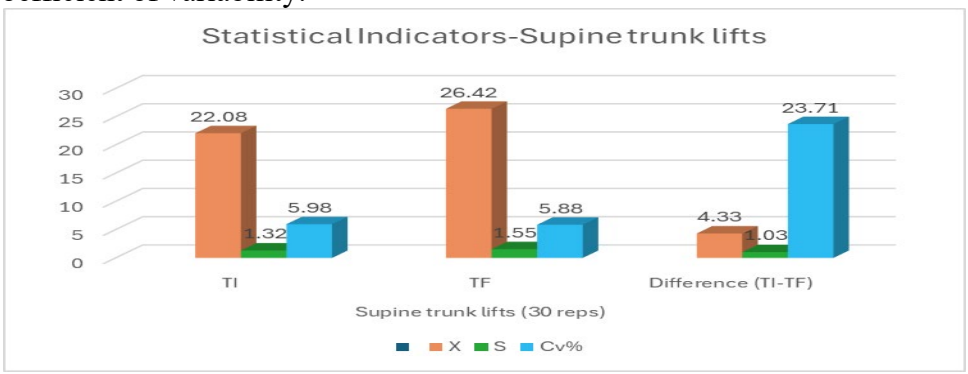

Fig.5 Statistical representation-Susig trunk lifts

For Supine trunk lifts (30 reps), the average performance increased from 22.08 in the initial test to 26.42 in the final test, with a difference of 4.33 reps; The standard deviation increased from 1.32 to 1.55, and the coefficient of variability decreased slightly from 5.98% to 5.88%, with a percentage difference of 23.71%, indicating an increase in average performance and a relatively constant variation in final testing.

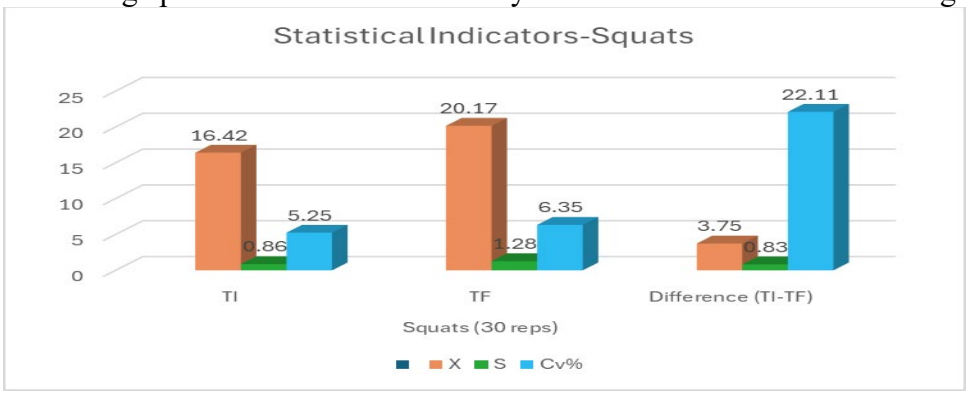

Fig.6 Statistical representation-Squats

For the squat test (30 repetitions), the average performance increased from 16.42 repetitions in the initial test to 20.17 repetitions in the final test, with a difference of 3.75 repetitions; The standard deviation increased from 0.86 to 1.28, and the coefficient of variability increased from 5.25% to 6.35%, indicating an increase in relative variation by 22.11% and a significant improvement in average performance in final testing.

Discussions: One study demonstrated that aging is associated with loss of muscle mass and metabolic quality of skeletal muscle, but these effects can be counteracted by endurance training (ET) and resistance training (RT). After 6 months, RT

increased maximum resistance by 15% in foot pressing, 25% in bench pressing, and 30% in bench pull, while ET improved workload by 31% and reduced body fat by 5.3%, with no significant effects on aerobic power [3], And another study points out that multi-component exercise is the latest evidence for improving muscle strength, endurance, and balance in frail older adults, and long-duration exercise regimens (over 12 weeks) are more effective for increasing muscle endurance[10]. The purpose of another study was to evaluate the effects of 21 weeks of strength and/or endurance training on health-related quality of life (HRQoL) in healthy subjects aged 39-77 years., concluding according to the results, both endurance and especially combined training may have the potential to promote or maintain certain dimensions of HRQoL even in middle-aged and older adults [4].

Conclusions: A significant improvement in physical performance is indicated in strength and endurance tests, including in Prone trunk lifts, Supine trunk lifts and squats. The average result in Prone trunk lifts increased by 5.58 repetitions, and in squats by 3.75 repetitions. The results suggest that the exercises in the workouts had a positive impact on the development of strength and physical endurance of the participants. A significant decrease in average weight, from 68.08 kg to 63.50 kg, and a corresponding decrease in mean BMI, from 23.75 to 22.12, reflect significant improvements in weight and body composition, which are essential for improving participants' physical performance and overall health. The analysis of the Ruffier test shows a decrease in the mean resting heart rate, exercise heart rate and recovery heart rate, with values that decreased from 71.58 to 69.25 beats per minute, respectively from 143.83 to 137.33 beats per minute, and from 114.33 to 108.75 beats per minute. However, the coefficient of variability increased for all assessments, indicating greater variability for the cardiovascular system of exercise and recovery participants. These changes suggest an improvement in cardiovascular efficiency, but also the need to analyze individual variations in more detail. It is necessary to adopt personalized training approaches to meet the specific needs of each participant and maximize the benefits of training for the whole group.

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