

ISSN: 2392-5442 ESSN : 2602-540X		Sport system journal
V/12. N/01 Year 2025		International scientific journal published by: Ziane Achour –Djelfa- Algeria
P 217 - 237		Received: 2025-01-17 Accepted: 2025-02-27

The effect of a training program using the 'SST' method to increase strength and muscle mass among bodybuilding athletes

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Abstract:

Athletes in the field of bodybuilding resort to various training methods to increase muscle mass and strength in order to perform physical poses called "posing" during competitions, which enable them to win contests and earn more points. Among the most important methods used in preparing athletes is the one we discussed in this research, "Sarcoplasma Stimulating Training," which we applied with 6 bodybuilders aiming to increase muscle size and strength. After implementing the training program for 8 weeks using the "SST" method, we reached the following results: an increase in the averages of both weight and thigh and calf circumferences, as well as an increase in the averages of the 1RM tests for the chest muscles, triceps, biceps, shoulder muscles, back muscles, and both the front and rear thigh muscles, along with explosive strength tests for the lower limbs.

Keywords: Sarcoplasma Stimulating Training; Muscular strength; Muscular hypertrophy; training program; bodybuilding.

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1. INTRODUCTION

Bodybuilding is a sport that primarily aims to develop muscle mass for aesthetic and physical purposes. It is considered a popular and beloved activity among many people around the world, as it seeks to develop and strengthen muscles, improve strength and flexibility, and enhance overall body shape. In this way, it attracts all segments of society from all ages and genders, aiming to enhance their physical abilities, improve their appearance or overall mood, or develop their physical skills and prepare for various competitions in different sports. Athletes are not judged based solely on their athletic performance; rather, they are actually judged based on their muscles, which they showcase on the "stage" during competitions by executing specific body poses (called "posing"). To achieve their goals, athletes prepare for their competitions by committing to intensive bodybuilding training accompanied by strict dietary control that changes according to preparation phases. Their training plan features two main phases: the bulking phase, where they train intensively while consuming a large number of calories to develop overall body mass, and the cutting phase, where their diet becomes low in calories despite ongoing intensive training, aimed at losing excess body fat.

Héraclès (one of the most famous heroes of ancient Greece) is considered a symbol of masculinity and can be regarded as a pioneer of bodybuilding and the ideal man for developing male muscles in ancient Greece. In the nineteenth century, Eugène Sandow (an athlete of German origin) was born in 1867 and was the reason for the birth of bodybuilding in its current concept. Several years later, Joe Weider (a bodybuilder and Canadian businessman born in 1919 and died in 2013) documented many of the highest quality and intensity training techniques and established the International Federation of Bodybuilding (IFBB) along with the famous Mr. Olympia competition (whose first edition took place in 1965). Modern bodybuilding, as known by the general public, is particularly embodied by Arnold Schwarzenegger and Ronnie Coleman, and it gained widespread popularity with the proliferation of training halls and the emergence of the first sports competitions. Arnold Schwarzenegger revolutionized this sport by winning



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seven titles (for Mr. Olympia) and by entering the world of cinema. The Arnold Classic competition is today, in fact, the second most important competition after Mr. Olympia (Grandperrin, 2020, p. 70).

This sport has witnessed notable transformations and developments over the ages, thanks to scientific and technological advancements in the field of sports. Research and scientific studies have become an essential part of the bodybuilding world, aiming to achieve the highest levels of athletic performance and physical form. Trainees and coaches have benefited from new discoveries and techniques to improve and achieve desired results through research focused on the effects of exercise and healthy nutrition on muscle development, strength, and physical capacity. There is also advanced research studying genetic and hormonal factors involved in physiological adaptations and muscle responses to various training loads. Additionally, there has been a focus on nutrition within this field, along with a revolution in the world of dietary supplements aimed at building muscle and enhancing recovery after training. This includes monitoring athletes and their physical and morphological responses using modern means and computer and digital applications to analyze various body measurements, nutritional requirements, or performance determinants, employing the latest and most effective methods to achieve the desired results. Continuous updates in training methods are discussed, one of which is Sarcoplasm Stimulating Training (SST), a strength training approach designed to maximize muscle hypertrophy by specifically targeting the sarcoplasm, the fluid surrounding muscle fibers. Unlike traditional methods that primarily focus on increasing the strength and size of muscle fibers, SST emphasizes metabolic adaptation and increases the volume of sarcoplasmic fluid in the muscle cell.

The term "sarcoplasmic hypertrophy" has become a common term and a point of study. Sarcoplasmic hypertrophy refers to an increase in the volume of sarcoplasmic fluid in the muscle cell, where the fluid and its components serve as an energy source surrounding the muscle fibers. Scientific literature has indicated that resistance training facilitates fiber growth through a disproportionate increase in sarcoplasmic volume compared to the accumulation of myofibrillar protein. Until recent years, it was assumed and accepted by the scientific community that when a muscle significantly increases its cross-sectional area, the percentage of the area within cells occupied by myofibrils, myofibrillar protein, and muscle cytoplasm could be predicted.

What has become a prevailing thought is that by increasing the volume of muscle cytoplasmic fluid in muscle cells, one can work on amplifying muscle size, not necessarily actual muscle strength.

Currently, muscle cytoplasmic hypertrophy in skeletal muscles is still in its early stages, and most researchers' conclusions are from a theoretical and mechanical perspective. The SST method relies on scientific principles, including high-repetition schemes and low rest times, which promote a favorable environment for muscle growth. By incorporating diverse exercises for various muscle groups to stimulate the accumulation of energy substrates in the sarcoplasm, such as glycogen. Research has shown that the application of SST can lead to significant improvements in muscle performance and increases in lean muscle mass. This review aims to examine the physiological mechanisms underlying the SST method, as well as its effectiveness compared to other training strategies, with the goal of providing an in-depth understanding of its role in enhancing modern strength training programs.

2. The problem of study

Skeletal muscle fibers are multinucleated cells that primarily contain myofibrils suspended in a watery medium called sarcoplasm. Some evidence suggests that muscle hypertrophy, or the disproportionate expansion of sarcoplasm relative to the accumulation of myofibrillar protein, coincides with the growth of muscle fibers or tissue during resistance training. There is also evidence supporting the occurrence of other patterns of hypertrophy during periods of resistance training, including the relative accumulation of myofibrillar protein with the growth of fibers or tissue (i.e., traditional hypertrophy), or the accumulation of myofibrillar protein that precedes the growth of fibers or tissue (i.e., myofibrillar packing) (Roberts et al., 2020). The topic of muscle hypertrophy has led to numerous studies that have explored the role of resistance training in increasing muscle fiber cross-sectional area (Folland & Williams, 2007). However, little is known regarding the morphological adaptations that occur in muscle fibers following resistance training interventions. (Haun et al., 2019) add in their study concerning the increase in the Fiber Cross Sectional Area (FCSA) that sarcoplasmic hypertrophy in the muscle is largely responsible for the increase in FCSA in the short term, continuing for 8 days after cessation of resistance



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training, thereby refuting studies that suggest the increase in FCSA through resistance training is primarily due to increased contractile protein content.

Although research indicates that various morphological adaptations may occur with muscle fiber hypertrophy during resistance training periods, there are significant knowledge gaps that still exist in the realm of research and scientific literature regarding how different training modalities or training duration affect morphological adaptations. This leads us to pose the Following question:

Is there an effect on muscle size and strength after following the Sarcoplasm Stimulating Training method in the training of bodybuilders in the study sample?

3. Research Hypotheses

3.1. General Hypothesis.

The training program using the SST training method has an effect on muscle hypertrophy and maximum strength in bodybuilders.

3.2. Partial hypotheses.

There are statistically significant differences between the pre-test and post-test results of muscle hypertrophy among bodybuilders in favor of the post-test.

There are statistically significant differences between the pre-test and post-test results of maximum strength and explosive strength among bodybuilders in favor of the post-test.

4. Research Objectives

- To build a training program aimed at muscle hypertrophy and gaining muscle mass.
- To design and construct training units to develop maximum strength in bodybuilders.
- To determine the effectiveness of using the SST training method in gaining muscle hypertrophy and maximum strength in bodybuilders.

5. Importance of Study

- To use and follow scientific and systematic methods to help bodybuilders achieve the desired muscle mass and hypertrophy by adopting the latest methods that are scientifically supported based on theories proven effective in numerous studies.
- To identify the impact ratio between pre- and post-tests and the significance of statistical differences among research variables, as well as to monitor various morphological changes in the research sample.

- To enrich specialized knowledge in this field for researchers, specialists, and coaches regarding the impact of training methods on athletes' muscle hypertrophy and maximum strength.

6.Study Terminology

6.1 Bodybuilding

Bodybuilding is defined as a physical activity based on exercises designed to increase muscle strength, size, and endurance. This activity forms the foundation for many sports, including competitive bodybuilding, strength sports, and weightlifting, in addition to its important role in physical preparation for many other sports such as gymnastics. It can be considered a healthy lifestyle, whether for the purpose of sports competition or to achieve physical balance and maintain fitness (Meeus & Mompo, 2021, p. 33).

6.2 “SST” Sarcoplasm Stimulating Training

The SST method has gained popularity among bodybuilders as it involves various types of muscle movements, with very short rest periods between sets to increase time under tension and working within 60% to 80% of the maximum load that can be achieved (60-80% 1RM). SST was originally developed by Swiss coach Patrick Tour to intensify resistance and strength training sessions for highly trained athletes (Meeus & Mompo, 2021), as it primarily relies on stimulating the muscular system where the duration of training varies significantly due to metabolic stress (short rest periods), while the main idea is to keep the muscles under tension as much as possible, even with reduced training duration (de Almeida et al., 2019).

6.3 Muscle Strength

Developing muscle strength does not necessarily require gaining muscle mass, as it represents the maximum recruitment of muscle fibers through the stimulation of the central nervous system, which will allow for lifting weights. The total strength developed by a muscle is the sum of the individual forces of each muscle fiber involved in the contraction. The more motor units that are activated, the greater the strength developed by the muscles; thus, increasing strength is not linked to weight gain. This is what strength sports target in weight categories, such as weightlifting or bodybuilding. However, it is possible to undergo training cycles to increase mass if the muscle base is insufficient, relying on a well-planned diet



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to achieve the desired goals. (Meeus & Mompo, 2021, p. 157).

6.4 Strength Training

The selection of a strength training program begins with defining goals, which is the most important and challenging step. Training goals are diverse and varied, ranging from maximum and explosive strength to strength endurance, muscle mass increase, and improving neuromuscular coordination. This goal precisely determines the quality of training, in terms of defining the training load and selecting appropriate tools and equipment, while considering the type of muscle contraction (static or dynamic); as the physiological response differs for each type, it may require the use of different types of contractions for different muscle groups during a single training session. Therefore, the coach is keen to accurately select the type of contraction to ensure achieving the maximum targeted physiological effect, in line with the principle of specificity of physiological effect (Abu Alaa & Nasr Al-Din, 2003, p. 101).

6.5 Maximum Load 1RM:

In fact, it is simply about one maximum repetition for a specific exercise, in other words, the maximum weight that can be moved in one repetition. We can thus determine the 1RM for all possible exercises in bodybuilding. Once established, the 1RM allows us to calibrate training sessions for those who practice bodybuilding. It is agreed that there are different work densities that enable the coach or athlete to pursue their various goals; for example, working at 30% of 1RM allows for the development of endurance, working at 70-80% allows for muscle hypertrophy, while working at 90-100% allows for maximum strength training (THOLLET, 2020).

6.6 Muscle Hypertrophy

How does muscle size increase? There are two types of hypertrophy: transient hypertrophy and chronic hypertrophy.

Transient hypertrophy: This is the increase in muscle size that develops during and after performing exercise or several exercises directly, primarily resulting from fluid accumulation (edema) in the spaces between cells and within the cells in the muscle that comes from blood plasma. Transient hypertrophy, as its name suggests, lasts only for a short period, as the fluids return to the blood within hours after exercise.

Chronic hypertrophy: This refers to the increase in muscle size that occurs as a result of long-term resistance training. It reflects actual structural changes in the

muscle that can result from an increase in the size of existing individual muscle fibers (fiber hypertrophy), or in the number of muscle fibers (fiber hyperplasia), or in both (Larry et al., 2015, p. 631).

6.6.1 Myofibrillar Hypertrophy

This method of training plays a role in muscle structure by increasing the number and size of muscle fibers within the muscle fibers. This hypertrophy results from overload stimulation (weight during training), which creates micro-injuries at the level of muscle fibers. The body interprets this as an injury and will generate compensation during muscle recovery by increasing the number and density of muscle fibers. This phase consists of performing sets of 6 to 8 repetitions with rest periods of 3 minutes (full recovery) (Meeus & Mompo, 2021, p. 154).

6.6.2 Sarcoplasmic Hypertrophy

This form of training also encourages an increase in mass and has a greater impact on metabolism, especially carbohydrates. The volume of fluid inside the cells (sarcoplasm) increases, among other things, through overcompensation for muscle glycogen (the form of glucose stored in muscles). The goal of the training is to deplete muscle glycogen stores. Then, during the recovery period, the body will increase its reserves through the phenomenon of overcompensation. This phase consists of performing sets of 10 to 15 repetitions with rest periods ranging from one minute to one and a half minutes (incomplete recovery). For more information and the best supervision, please refer to a qualified sports coach specialized in bodybuilding. (Meeus & Mompo, 2021, p. 154).

7. Previous and Similar Studies

7.1 Study (de Almeida et al., 2019)

Acute Effects of the New Method Sarcoplasma Stimulating Training Versus Traditional Resistance Training on Total Training Volume, Lactate and Muscle Thickness

The purpose of this study was to compare the acute effects of Traditional Resistance Training (TRT) versus two types of Sarcoplasma Stimulating Training (SST) methods on Total Training Volume (TTV), lactate, and Muscle Thickness (MT).

This research used an experimental method where twelve trained male participants aged (20.75 ± 2.3 years), with heights (1.76 ± 0.14 meters) and body



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mass (79.41 ± 4.6 kg), and training experience (4.1 ± 1.8 years) completed three training protocols in a random order: TRT, or SST contraction type (SST-CT), or SST rest interval variable (SST-RIV) with 7 days between trials in the arm curl (elbow flexors) and triceps pulley extension (elbow extensors) exercises conducted on the same day. Results showed that both SST-RIV (SST) groups experienced an increase in the biceps and triceps brachii during the TRT session, with no difference in lactate levels between them. The biceps and triceps brachii exercises resulted in an increase in the biceps and triceps brachii compared to the triceps exercise session, and the Total Training Volume (TTV) was greater in the session.

7.2 Study (Penzer et al., 2016).

Comparison of muscle activity and tissue oxygenation during strength training protocols that differ by their organization, rest interval between sets, and volume

This study investigates the effectiveness of different strength training protocols on muscle activity and tissue oxygenation, particularly focusing on a new training method called the 3/7 protocol. This method involves performing five sets of varying repetitions (from 3 to 7) with a 15-second rest interval, in contrast to more traditional methods such as the 8×6 protocol, which has longer rest periods and uniform load intensity. The study aimed to determine how the organization of exercise sets and rest intervals affect muscle hypertrophy and strength gains, with a focus on the role of metabolic stress and muscle tension. The main findings indicate that the 3/7 protocol may lead to increased metabolic stress and effectively stimulate muscle hypertrophy, even with a lower total training volume compared to classical protocols. Muscle activity was measured using electromyography (EMG), and tissue oxygenation was assessed using near-infrared spectroscopy (NIRS) during elbow flexion exercises. The results reveal insights into the underlying mechanisms of muscle adaptation, highlighting the potential of the 3/7 protocol as an effective training strategy for gaining muscle mass and hypertrophy.

7.3 Study (Schoenfeld et al., 2015).

Effects of Low- vs. High-Load Resistance Training on Muscle Strength and Hypertrophy in Well-Trained Men

The document explores the effects of low-load versus high-load resistance training on muscle strength and hypertrophy in well-trained young men. The study

included 18 participants with experience in resistance training, who were divided based on the results showing improvements in muscle thickness and strength, particularly in the back squat and bench press exercises. The results also indicated that both training styles significantly increased muscle hypertrophy, but heavy weight training was superior in enhancing muscle strength, especially in squat performance. In contrast, low-load training improved the endurance capacity of the upper body muscles. These findings suggest that while both training intensities can lead to noticeable muscular changes, heavy weight training may be more effective in achieving strength gains, highlighting the importance of weight selection in resistance training programs for experienced trainees.

8. Methodology

The experimental method is considered the optimal and most suitable approach for such studies due to its nature of studying the causal relationships between the independent variable and the dependent variable in search of the cause and how it occurs by making a deliberate change and controlling some related variables. (Haider, 2015, p. 82).

8.1 Study Sample

In our research, we relied on a deliberately chosen sample consisting of 6 bodybuilders in the state of Setif, who underwent the training program for 8 weeks.

8.2. Research Variables

8.2.1 Independent Variable: This is the experimental variable or factor, and in our study, it is the training program using the SST (Sarcoplasmic Stimulating Training) method.

8.2.2 Dependent Variable

The dependent variable is considered the result of the influence of the independent variable on the phenomenon under study; in our study, the maximum strength, muscular strength, and hypertrophy are the dependent variables.

8.3 Research Tools

8.3.1 Measurements

Measurement of:

height and weight, neck circumference, shoulder length, chest circumference, waist circumference, arm circumference, forearm circumference, thigh

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circumference, calf circumference, body fat percentage

8.3.2 Physical Tests

Explosive strength test for the lower body

Explosive strength test for the upper body

1RM tests for muscle groups (chest, thigh, shoulder, back, leg)

9. Study Limits

9.1 Spatial Domain:

The study was conducted in one of the fitness gyms in Setif, and both pre-tests and post-tests were conducted on the study sample.

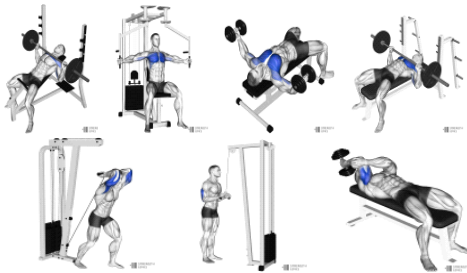
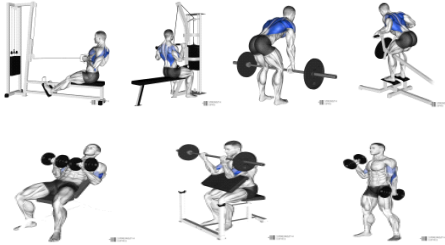
9.2 Temporal Domain:

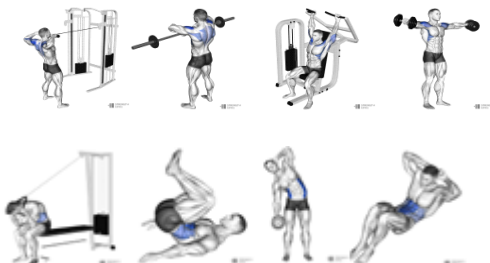
The study was conducted from January to March 2024. The pre-test of the study sample was conducted on January 6-7, 2024, before the start of the planned training program. The post-test was conducted on March 9-10, 2024, after the completion of the 8-week planned training program.

9.3 Training Program

Number of training days per week: 4

Distributed as follows: Training, Training, Rest, Training, Training

	Chest muscles (bench press exercise + dumbbell fly exercise + chest fly exercise + incline bench press exercise) with the triceps muscle (lying dumbbell tricep extension exercise + tricep pushdown exercise + cable (overhead tricep extension exercise
	Back muscles (T Bar Row exercise Bent Over Row exercise + Lat + Pulldown exercise) and biceps Hammer Curl exercise + preacher) .(curl exercise + exercise Dumbbell Curl(

	Shoulder muscles (Dumbbell Lateral Raise exercise + Machine Shoulder Press exercise + Upright Row exercise + Face Pull exercise) and abdominal muscles (Crunches exercise + Dumbbell Side Bend exercise + Reverse Crunches exercise + High Pulley Crunch exercise)
	Front thigh muscles (Squat exercise + Sled Leg Press exercise + Horizontal Leg Press exercise + Leg Extension exercise) and back thigh muscles (Lying Leg Curl exercise) with leg muscles .(Barbell Calf Raise exercise)

Week 1 Program: Intensity: 60% 1RM, three sets for each exercise with repetitions from 8 to 15, rest period of (1 min 30 sec to 2 min) between sets and (1 to 2 min) between each exercise.

Week 2 Program: Intensity: 65% 1RM, three sets for each exercise with repetitions from 8 to 15, rest period of (1 min 30 sec to 2 min) between sets and (1 to 2 min) between each exercise.

Week 3 Program: Intensity: 70% 1RM, three sets for each exercise with repetitions from 8 to 15, rest period of (1 min 30 sec to 2 min) between sets and (1 to 2 min) between each exercise.

Week 4 Program: Intensity: 75% 1RM, three sets for each exercise with repetitions from 8 to 15, rest period of (1 min 30 sec to 2 min) between sets and (1 to 2 min) between each exercise.

Week 5 Program: Intensity: 80% 1RM, three sets for each exercise with repetitions from 8 to 12, rest period of (1 min 30 sec to 2 min) between sets and (1



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to 2 min) between each exercise.

Week 6 Program: Intensity: 82% 1RM, three sets for each exercise with repetitions from 8 to 12, rest period of (1 min 30 sec to 2 min) between sets and 1 to 2 minutes between each exercise.

Week 7 Program: Intensity: 84% 1RM, three sets for each exercise with repetitions from 8 to 10, rest period of (1 min 30 sec to 2 min) between sets and 1 to 2 minutes between each exercise.

Week 8 Program: Intensity: 84% 1RM, three sets for each exercise with repetitions from 8 to 10, rest period of (1 min 30 sec to 2 min) between sets and 1 to 2 minutes between each exercise.

Note: The tempo of the exercises is as follows (0-1-0-2).

Training Program								
	1 WEEK	2 WEEK	3 WEEK	4 WEEK	5 WEEK	6 WEEK	7 WEEK	8 WEEK
INTENSITY	60% 1RM	65% 1RM	70% 1RM	75% 1RM	80% 1RM	82% 1RM	84% 1RM	84% 1RM
REPETITIONS	8 - 15	8 - 15	8 - 15	8 - 15	8 - 12	8 - 12	8 - 10	8 - 10
REST / SET	1m 30s /2min	1m 30s /2min	1m 30s /2min	1m 30s /2min	2min /3min	2min /3min	2min /3min	2min /3min
REST / EXERCISES	1min/2min	1min/2min	1min/2min	1min/2min	1min/2min	1min/2min	1min/2min	1min/2min
TEMPO	2-0-1-0	2-0-1-0	2-0-1-0	2-0-1-0	2-0-1-0	2-0-1-0	2-0-1-0	2-0-1-0

A table showing the program implemented in the research.

9.4 Statistical Methods

- The results were analyzed using the SPSS statistical processing program.
- Calculation of means and standard deviations.
- T test for paired samples to determine the differences between pre-test and post-test measurements.

10. Presentation and Analysis of Results

10.1 Presentation and Discussion of the First Hypothesis

The first hypothesis stated that there are statistically significant differences between the results of muscle hypertrophy for pre-test and post-test measurements among bodybuilders in favor of the post-test measurement. To verify the hypothesis, we relied on paired sample tests, and the results were as follows:

table (1)

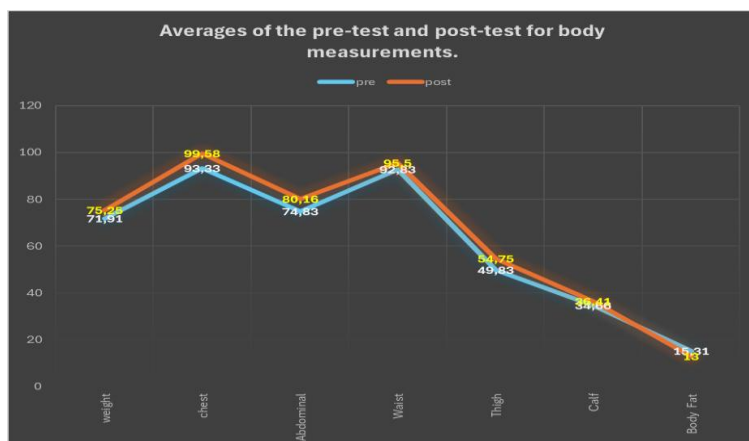
Variables	Measurement	Mean	Standard Deviation	(T) value	Degree of Freedom	(Sig)	Statistical Decision
Weight	Pre	71,91	12,45	3.071	5	0.02	significant
	post	75,25	13,7				
Chest	Pre	93.33	4.718	2.101	5	0.09	not significant
	post	99.58	7.767				
Abdominal	Pre	74.83	4.53	1.022	5	0.35	not significant
	post	80.16	12.62				
Waist	Pre	92.83	7.60	1.294	5	0.25	not significant
	post	95.50	7.28				
Thigh	Pre	49.83	3.25	4.073	5	0.01	significant
	post	54.75	3.72				
Calf	Pre	34.66	1.96	2.573	5	0.05	significant
	post	36.41	1.96				
Body fat	Pre	15.31	3.29	0.844	5	0.43	not significant
	Post	13.73	5.94				

It is clear from the data in Table (1) that the averages of the variables (weight, thigh circumference, calf circumference) were in the pre-test and post-

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test as follows in order (71.99, 75.25), (49.83, 54.75), (34.66, 36.66) with standard deviations of (12.45, 13.50), (3.25, 3.72), (1.96, 1.96). The T-test for weight showed a value of (3.071) at a significance level of (0.005), and the T-test for thigh circumference showed a value of (4.073) with a significance level of (0.01), which is less than the significance level (0.05). The T-test for calf circumference showed a value of (2.573) at a significance level of (0.05), which is less than or equal to the significance level (0.05). Therefore, we conclude that there are statistically significant differences at the significance level (0.05) between the averages of the pre-test and post-test for weight, thigh circumference, and calf circumference. This explains the muscular hypertrophy in these areas of the body among athletes in both the pre-test and post-test, favoring the post-test for weight, thigh circumference, and calf circumference. We also recorded an increase in the circumferences of the chest, waist, and arm, which explains a slight increase in muscle size in these areas; however, it is not statistically significant compared to the thigh and calf muscles, as well as weight in general, to indicate that athletes gained muscle mass during the proposed training program, as illustrated in the following figure:

Figure 01: Averages of the pre-test and post-test for body measurements.



Source: Researcher

10.2 Presentation and Discussion of the Results of the Second Hypothesis
The second hypothesis stated that there are statistically significant differences

between the results of maximum strength and explosive strength in the pre-test and post-test measurements among bodybuilders in favor of the post-test measurement. To verify the validity of the hypothesis, we relied on paired sample t-tests.

Variables	Measurement	Mean	Standard Deviation	(T) value	Degree of Freedom	(Sig)	Statistical Decision
Chest muscles	pre	62.00	21.419	4.889	5	0.005	significant
	post	66.66	23.593				
Triceps muscle	pre	51.50	17.626	5.217	5	0.003	significant
	post	55.00	17.888				
Back muscle	pre	54.33	17.682	5.270	5	0.003	significant
	post	57.50	18.641				
Biceps muscle	pre	29.66	4.760	9.00	5	0.000	significant
	post	34.16	3.763				
Shoulder muscle	pre	43.16	10.628	5.855	5	0.002	significant
	post	47.16	11.321				
Anterior thigh muscle	pre	61.33	10.628	6.425	5	0.001	significant
	post	67.00	12.165				
Posterior thigh muscle	pre	48.83	10.943	7.746	5	0.001	significant
	Post	52.83	11.839				
The	pre	37.17	3.251	2.117	5	0.088	not



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explosive strength of the lower limbs 1	post	45	11.153				significant	
The explosive strength of the lower limbs 2	pre	223.33	6.055	3.051	5	0.028	significant	
	post	232.50	6.124					
The explosive strength of the upper limbs.	pre	428.67	61.455	2.360	5	0.065	not significant	
	Post	451.67	76.004					

Source: Researcher

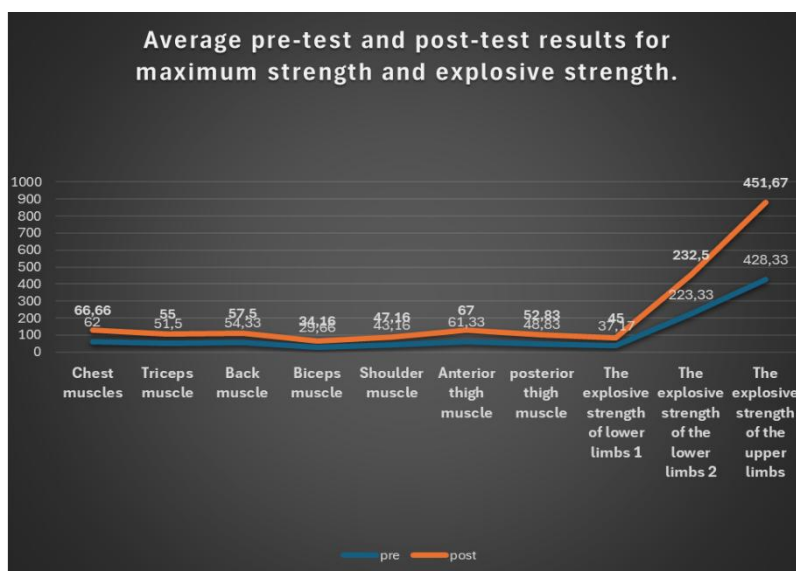
It is evident from the data in Table (2) that the averages of the 1RM tests for the muscles (chest, triceps, back, biceps, shoulder, quadriceps, and hamstrings) in the pre-test and post-test were as follows in order: (62.00, 66.66), (51.55, 55.00), (54.33, 57.50), (29.66, 34.16), (43.16, 47.16), (61.33, 67.00), (48.83, 52.83) with standard deviations in order of (21.419, 23.593), (17.626, 17.888), (17.682, 18.641), (4.760, 3.763), (10.628, 11.321), (10.628, 12.165), (10.943, 11.839). The results of the (T) test showed (4.889) with a probability value of (0.005) for the chest muscles, a value of (5.217) with a probability value of (0.003) for the triceps, a value of (5.270) with a probability value of (0.003) for the back muscle, a value of (9.00) with a probability value of (0.000) for the biceps, a value of (5.855) with a probability value of (0.002) for the shoulder muscles, a value of (6.425) with a probability value of (0.001) for the quadriceps, and a value of (7.746) with a probability value of (0.001) for the hamstrings.

The results of the average explosive strength for the lower limbs from the tests were as follows: (37.17, 45), (223.33, 232.50), (428.33, 451.67) with standard deviations of (3.251, 11.153), (6.055, 6.124), (61.455, 76.004) respectively. The results of the (t) test were as follows: (2.117) for the first test in explosive strength of the lower limbs at a significance level of (0.088) and a (t)

test value of (3.051) for the second test of explosive strength of the lower limbs at a significance level of (0.028), and a (t) test value of (2.360) for the explosive strength test of the upper limbs at a significance level of (0.065).

Therefore, we conclude that there are statistically significant differences at the significance level (0.05) between the means of the pre-test and post-test for maximum strength 1RM for the chest muscles, triceps, back muscles, biceps, shoulder muscles, anterior thigh muscles, posterior thigh muscles, and explosive strength tests of the lower limbs after applying the training program for muscle hypertrophy and maximum strength, and explosive strength for 8 weeks using the SST training method.

Figure 02: Average pre-test and post-test results for maximum strength and explosive strength





The effect of a training program using the 'SST' method to increase strength and muscle mass among bodybuilding athletes

11. Conclusion

In conclusion, we can deduce and extract many important results regarding the SST (sarcoplasmic stimulating training) method among bodybuilders and its effectiveness in developing athlete levels and improving their appearance and performance concerning strength and muscle size, considering the results achieved during the trial period, which lasted 8 weeks for the experimental sample. The results were compared with post-tests that showed an increase in the measurements of the chest, thigh, and calf, as well as an increase in maximum strength for the chest, back, biceps, triceps, and both front and rear thigh muscles, in addition to the explosive strength of the lower limbs after applying the training program aimed at increasing maximum strength and muscle size. This was evident in the research sample through the experimental results, thus suggesting that training using the SST method contributes to increasing muscle mass by enhancing the muscle fibers and their ability to store glycogen. It can have very positive outcomes for bodybuilders if the goal is muscle hypertrophy, maximum strength, and explosive strength, by following a correct methodology in training load and tailoring it to each athlete while considering their level and capacity limits in establishing, determining, and planning their requirements and training doses. We emphasize the necessity of adhering to the limits of the intensity percentage applied in exercises according to the set goal.

In light of these results, we recommend using the SST training method in programming training sessions aimed at hypertrophy and muscle strength, and pairing it with other variables such as exercise frequencies, maximum intensity, resistance training, and conducting more studies on several variables related to muscle strength development, hypertrophy, and performance improvement in the field of bodybuilding, and comparing it with other methods or pairing it within the same research, with the aim of exploring the different aspects of this method within training programs and its effects on all levels of athletes, which opens new horizons for research in improving athletic performance and easier, lower-cost ways to reach higher levels.

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