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Completing Specific Techniques in Muscle Training by Using Electrostimulation in Combination with (TRX)

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Abstract: The idea of this work has been caused by restrictions imposed all over the world in recent years. The closing of the gym has brought new approaches to having a toned body, paying attention to health safety. Proposed training methods include (EMS) and (TRX) for an experiment group, compared to the control group, which worked only with the program (TRX). The combination of the two muscle-forming techniques is the subject of this study. The Muscle Training Program (TRX) took place over 6 weeks, 4 times a week, with 8 male subjects in each of the two groups. The age of the participants is between 23 and 31 years, the study being conducted over 6 weeks. Data collected from subjects and statistically analyzed were analyzed. Body mass index and BMI values were recorded using Jackson-Pollock. Hypothesis: We intend to verify through this study the effectiveness of a muscle training program that uses the Suspension Training (TRX) method in combination with Electrical Muscle Stimulation (EMS). Conclusion: The results of the study prove that the use of equipment (TRX) in combined training (EMS) brings significant benefits in weight control. Mean weight values showed a decrease from 98.2 kg to 93.7 kg, down by 4.4 kg and 4.48% respectively, as well as body mass index (BMI) from 27.8% BMI to 23.3% BMI with 4.5% BMI. The hypothesis of the work has been confirmed, a visible muscle toning is performed, thus forming a complex basis.

Keywords: *adaptation, consistency, concatenation.*

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1. Introduction

Nowadays, more than ever in the last decade, physical activities and sports occupy an important place in society, but the motivation for physical activity and types of training have evolved over time. The number of people who are aware of the benefits of physical activity is increasing, with the objective of obtaining a general state of health for a longer period of time, in order to integrate and be accepted in the groups of those who practice physical exercise, regardless of gender, age or level of education, but with the same purpose. Today we find enough variants in a fitness room with diversified training programs, to be able to practice physical exercise in an organized manner and under the guidance of a specialist, custom training, in-circuit training, dance or spinning classes. Among the new training methods are (EMS) Electrical Muscle Stimulation, which is based on a simple principle that reproduces the achievement of natural muscle contractions.

In sports medicine, electrical muscle stimulation has been used to strengthen muscles, maintain muscle mass and strength for long periods of immobilization or to selectively train muscles for recovery. Dr. David Lake studied in detail the use of electrical muscle stimulation to prevent muscle atrophy associated with prolonged immobilization of the knee following ligament reconstruction or lesions (Lake, 1992, p. 320). Several studies have shown that (EMS) is effective as training in preventing the decrease in muscle strength, muscle mass and atrophy of the muscles of the thigh after immobilizing the knee, the period longer than 10 days. In a study conducted in 2005 on 41 volunteers, it was found that the use of (EMS) significantly increased the isometric force and dynamic resistance of the abdominal muscles (Kemmler et al., 2021; Knecht, 2014; Porcari et al., 2005). This force increase of almost 58% is almost double compared to the studies of other researchers (Alon et al., 1987; Alon & Taylor, 1997; Ballantyne & Donne B., 1999). The most obvious explanations for this finding are that the duration of the 2005 study was 8 weeks, compared to 4 weeks in the Alon laboratory studies (1997). The duration of the study conducted by Ballantyne E. and Donne B. (1999) was 6 weeks, and their data suggested that the benefits of (EMS) tend to stagnate after 4 weeks, but in the study of Porcari et al. (2005), the stagnation period was not reached and muscle toning improved by an average of 34% after 4 weeks and by another 24% in the last 4 weeks.

Due to the characteristics of skeletal muscle fibers, different fibers can be activated in varying degrees of different types of (EMS), and the induced changes depend on how (EMS) is carried out. Variants of work are

called protocols or programs and will cause a varied response from the contraction of different types of fibers to variable periods and intensities. A number of programs will improve endurance, while others will increase strength. (EMS) can be used both for muscle training and as a therapeutic tool for recovery or prophylactic.

This innovative training mode is used internationally by a number of performance athletes with greater efficiency than some classical methods. This type of workout is aimed at all those who want to improve their muscle tone, (EMS) provides an intense and effective workout of the muscles throughout the body, without creating pressure on the joints, with full freedom of movement, in a simple and durable way. A 2015 study entitled "Effects of high-frequency pulse therapy on abdominal obesity in young women" (Kim & Duck-Won, 2015), provides a different example of the effectiveness of (EMS). This study examines whether (EMS) can help to lose body fat. In another study conducted by (Wolfgang, K 2021) and which provided additional evidence for significant effects, large size, of WB-(EMS) on the parameters of muscle mass and strength, but in which the WB-(EMS) intervention on body fat mass is not confirmed.

2. Hypothesis

We intend to check if using a muscle-with training program (TRX) in combination with electrical muscle stimulation (EMS), we can achieve a toning of the muscle groups of the whole body in six weeks time. At the same time, we want to check the hypothesis that the use (EMS) twice a week for six weeks results in a significant decrease in the body mass index BMI.

3. Materials and methods

Proposed training methods include Electrical Muscle Stimulation (EMS), a technique used for a group of experiments that had a program supplemented with exercises in the category of total resistance exercise (TRX). The training program for the control group was designed only with exercises in the category of total resistance (TRX). The combination of the two muscular training techniques used only for the experiment group represents the subject of this study.

The intervention method used in this experiment was the use of a method of stimulating muscle contraction using electrical impulse, this technique is known as electrical muscle stimulation (EMS), or neuromuscular electrical stimulation (NMES). The impulses are generated by an electronic device and are transmitted to the muscular tissue to be

stimulated. This shrinkage is carried out by means of electrodes that circulate electrical impulses and adhere to the skin, in close proximity to the muscles. These electrical impulses mimic the action potential that is generated in the central nervous system, causing effects similar to those of voluntary contraction. Another method of intervention was an exercise program, held for four days a week, in the following days (Monday, Wednesday, Thursday and Friday), lasting six weeks. The workout program was designed with a day of rest between sessions, to allow rest and recovery of the muscle-training capacity before the workout and two days on the weekend. Total Strength Exercise (TRX) is a suspension-based exercise system that works to strengthen the body's strength, agility, endurance and muscles toning by using a rope system that keeps the body suspended, which uses the gravity and body weight of the athlete to perform the exercises.

In addition to toning and the proposed training program, we intervened with the introduction of a nutrition plan in correlation with the weekly workouts and the particularities of the subjects participating in the study. We completed the muscle training programs by using an efficient food intake in correlation with weekly training, forming three categories of weekly caloric rate, correlated with the average daily caloric consumption of the study participants. The workout program for muscle training (TRX) took place over 6 weeks, 4 times a week, with 8 male subjects in each of the two groups. The group of subjects includes in the research program was formed of eight subjects, men. The data collected from the subjects were analyzed, the identity of the participants remaining to be presented only with the explicit consent of the participants. The ages of those who participated are between 23 and 31 years, the study was conducted over 6 weeks. For the study groups, totaling 16 subjects, the training took place four times a week, results being presented in the tables included in this. All subjects having as objective to participate at least three times in the training sessions based on use (TRX). Subjects of the experiment group participated in meetings (EMS) twice a week, but with a minimum of 2 days of break between meetings (EMS). Preparation through use (EMS) was made six days, starting Monday to Saturday, during which the subjects of the experiment group conducted two weekly workouts for six weeks. Besides the muscle training programs in which I intervened, I used diet sheep in correlation with workouts. Given the goals, the consumption of saturated fat-rich foods was reduced and we introduced, in addition to the three main meals, two other small snacks. We focused on the main foods that offer protein: eggs, tuna, cottage cheese, beef, chicken, yogurt, nuts. Consumption of red meat was present twice a week. Chicken or turkey and fish were consumed for the rest of the week.

We observed a decrease in fatty acid free deposits, in parallel with muscle toning exercises. The consumption of saturated fats, such as those most present in fatty pastries that have been replaced by healthy fats, olives, consumption of oilseeds, avocados, sesame seeds or sunflowers. In terms of carbohydrate intake, those obtained from sweet potatoes, fresh fruits and vegetables, consumed raw or cooked mechanically were accepted. Measurements of the following body parts were made: Chest - I measured around the largest part of the chest/bust without too tightening the tape measured. Waist- I measured the waist at the lower circumference of the natural waist, usually just above the navel button. Hip diameter to most of the lower hip, opposite the femoral head. Upper arm - I measured around the widest section of the arm above the elbow. Thigh - I measure around the thigh, above the knee. The weight and BMI body mass index values were recorded. Jackson-Pollock 3-spot body fat test provides an estimate of the percentage of body fat and lean body mass based on age, weight, gender and thickness of three skinfold measurements. Jackson-Pollock's 3-spot formula uses the chest, abdomen, and thigh to calculate body fat. The selection of exercises and how they were combined was done according to muscle groups, in methodical correlation with training (EMS). Caloric intake and food quality were similar in the three categories in each group. EMS programs with toning exercises have been developed for: lower limbs, upper limbs, pectoral muscles, abdominal wall muscles, back muscles and lumbar muscles, deltoid and trapezoid muscles.

4. Results

The results of this study provide a clear insight regarding the efficiency of using the two techniques of muscle training, presented previously. The number of studies in the literature is reduced and for this reason we are convinced that this paper brings a scientific contribution proved by significant statistical results that specialists can introduce in practice. The evolution of the recorded values in the case of both groups of the experiment is similar. We consider that the small difference between the mean weight of the control group 94.1 kg and that of the experimental group 93.7 in the final testing, in value of 0.4kg (Figure 1), is not a consequence of the intervention (EMS). The value of 3.4 kg is the difference with which the average final weight within group control is lower than the initial values recorded.

For experimental group the difference between the average values of the weight at initial testing and final testing is 4.5 kg, which is 24.4% higher than the difference between the average values from initial testing and final

testing measured at group control. With all the experimental group values we can believe that the introduction in the method preparation program (EMS), the BMI analysis proves that the reduction of fatty acid deposits is not statistically significant.

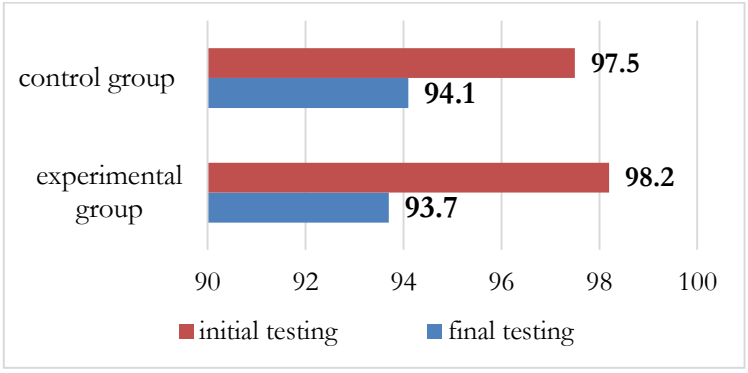


Figure 1. Graphical representation for weight evolution
Source: Author own conception

By analyzing the evolution of weight and BMI, we can say that (EMS) has a more important influence in obtaining an increased muscle tone, than in decreasing fat deposits. We note that the evolution of BMI values recorded in both groups of the experiment is very similar.

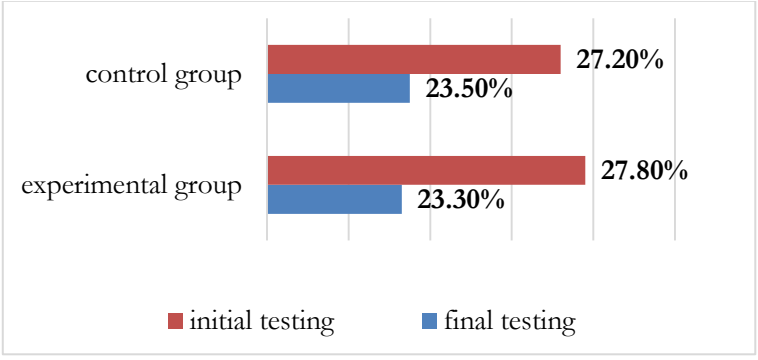


Figure 2. Graphical representation for the evolution of the Body Mass Index
Source: Author own conception

The small difference between the mean value of 23.5% of the control group compared to that of the experimental group which was 23.3% at the final testing, in value of 0.2% (Figure 2), we can say that the difference between the two training programs that is made by using techniques (EMS)

in the experimental group, does not produce consequences by its intervention on free fatty acid deposits. The value of 3.4 kg representing the difference with which the average final weight within group control is lower than the initial values recorded, is not found in case of BMI evolution. For experimental group the difference between the average values of BMI at initial testing 27.8% and final testing 23.30% is 4.5%, which is 21% more than the difference between the average values from initial testing 27.20% and final testing 23.50%, in group control and which was 3.7%. By comparing the evolution of weight and BMI, we find that the different evolution of weight between the two groups participating in the experiment is not preserved in the case of BMI values.

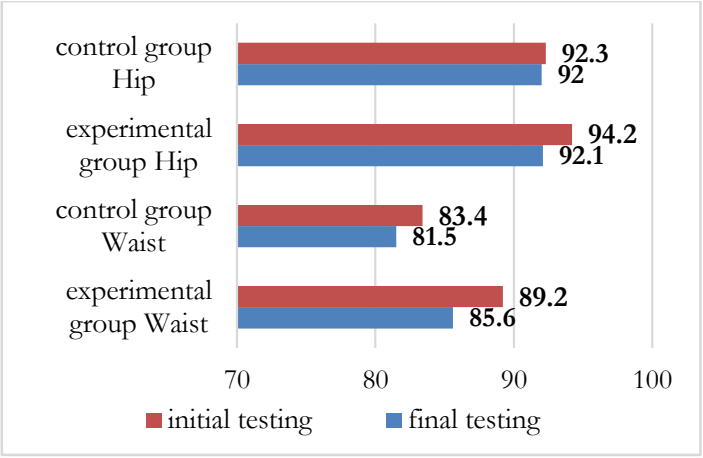


Figure 3. Graphical representation for the evolution of diameters at hip and waist
Source: Author own conception

Figure 3 presents the values recorded in the case of both groups of the experiment, hip and waist diameters. In the mean hip value box, the small difference between the mean recorded in the control group 92.3 cm and that of the experimental group 94.2 cm at initial testing, in value of 2 cm, shows that there were no significant differences in the beginning of the experiment. The values recorded in the final testing for the two groups show a difference of 2.8 cm more for the experiment group. We consider the higher values at hip me level show that the (EMS) sessions are not a way for the subjects to reduce the adipose tissue layer, but which produces an increase in the quality of the muscle mass. For experimental group, the difference between the average values of the diameter at initial testing and final testing is 1.2 cm, as the value recorded in experimental group is

positive. The difference between the average values from initial testing and final testing within group control, recording a very small decrease at final testing. By analyzing the evolution of weight, BMI and hip diameters, we can say that (EMS) has a more important influence in obtaining a high muscle tone in case of large muscle groups. The involvement of the muscle groups in the thighs and the pelvis in the various exercises dedicated to this group, but also their involvement in maintaining the positions and preserving the stability during the execution of other exercises was highlighted by this measure.

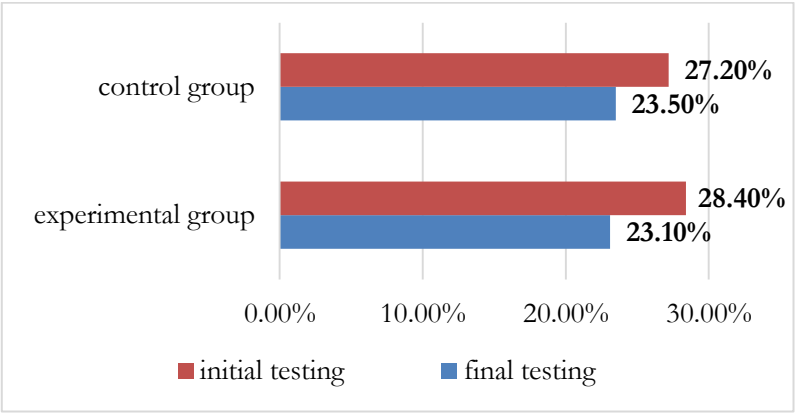


Figure 4. Graphical representation for the evolution of thigh diameters
Source: Author own conception

In Figure 4 are presented the values of the diameters in the thigh, registered in the case of both groups of the experiment. The small difference between the mean recorded between the initial test and the mean of the final testing values in the 0.8 cm value at the control group and that of the difference between the final testing and the initial testing at the experimental group of 1.7 cm, shows that the toning program of the large muscle groups was more effective in the experimental group.

The value of the average diameter increase, almost double in the case of the experiment group, brings obviously and significantly in attention (EMS) contribution in the proposed muscle training program. For both groups participating in the study, the average values recorded at the final testing are higher compared to the initial testing. The growth is due to obtaining a better muscle quality, but against the background of losing a quantity of adipose tissue. The initial value of the measurements also included the size of the fat layer in the thighs area. However, the final

measurements showed that changes in eating habits sustained by physical exercise can bring desired results within six, eight weeks.

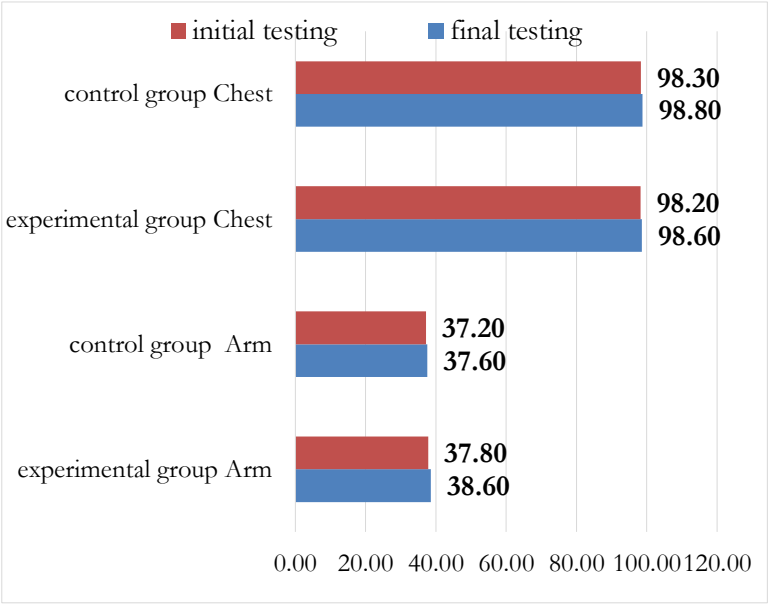


Figure 5. Graphical representation for the evolution of diameters in upper arm and chest
Source: Author own conception

The latest data presented in the graphical representation are the values recorded in the case of both groups of the experiment, arm and chest diameters.For the mean arm value, the small difference between the mean recorded in the 37.2 cm control group and that of the 37.8 cm experimental group at the initial test, 0.6 cm (Figure 5), indicates that there were no significant differences at the start of the experiment. The values recorded in the final test for the two groups show a 0.8 cm greater difference for the experimental group between the initial test and the final test. The correlation of the results obtained from the measurements of the muscle groups at the level of the thighs and hip, shows that the performance of different exercises dedicated to this group, but also in maintaining positions, or synergistic action performed in the programs (TRX), leads to the achievement of muscle tone amid the loss of adipose tissue. We believe that the measured arm values show that sessions (EMS) are not a way for the subjects to reduce the superficial layer of adipose tissue, but produce a reduced increase in the quality of muscle

mass in the arms. For the experimental group, the difference between the mean diameter values at the initial and final test is 0.8 cm.

The comparative increase obtained after the six weeks of muscle training at group control is 0.4 cm, compared to the average value of the experimental group which is 0.8 cm. Measurements of the mean chest value in case of measurements made at the control group show a small difference between the mean recorded at initial testing 98,3 compared to 98,8 at final testing. In the case of the experiment group 98.2 cm is the initial testing value compared to 98.8 in the final testing. Comparing the differences obtained in measurements of chest diameters between the initial and final tests in the two groups, 0.6 cm and 0.8 cm in the experiment group, we find that both values are larger than those obtained in the initial tests, the difference of 0.2 cm is not significant. We consider the measured values at the chest shows that (EMS) sessions are not a way to achieve but a significant increase in the quality of muscle mass evident by measuring the circumference at the chest. Average values of BMI and chest diameters show that (EMS) has no significant influence in obtaining different results between the two groups and implicitly between the two programs used. The involvement of the muscle groups in the thighs and the pelvis in the various exercises dedicated to this group, but also their involvement in maintaining the positions and preserving the stability during the execution of other exercises was highlighted by this measure.

5. Discussions

Our permanent concern throughout this study was to avoid exposure to increased electrical loads that can cause muscle damage. While neurophysiologists at the DGKN advise against (EMS) training, they do suggest sticking to a regular fitness program.

Following the presented study we came to the conclusion that the use of equipment (TRX) in combined training with (EMS), brings significant benefits in obtaining a muscle tone of large muscle groups and insignificant effects in weight control, the average weight values recorded a decrease in the experimental group from 98.9 kg to 93.3 kg, a decrease of 5.2 kg, respectively 5.25% and BMI body mass index, from 27.2% BMI to 23.5% BMI with 3.7% BMI less, compared to the first test.

Decreases of the recorded values at the measurement of the subjects from the control group showed weight decreases similar to those obtained by the subjects from the experiment group. Finally, we can conclude that the work hypothesis has been confirmed and a visible muscle toning is achieved,

thus forming a complex basis for various other training programs, which subjects can follow in the next period in reopened fitness studios. The comparative evolution of the two values represented by weight and BMI shows that physical effort required the production of energy not only from the mobilization and burning of adipose tissue. The weight loss within the expert group was also caused by the loss of active mass, this being confirmed the less significant losses in terms of fat percentage, both in the experimental group and in group control. Increasing the measured diameters in the final tests for small muscle groups was reduced. The most significant qualitative gains and accumulated, both in the experiment group and in the control group, were recorded when measuring the diameters of large muscle groups, the muscles of the thigh and hip. Equally, I continued throughout the study promoting a healthy lifestyle, avoiding the confusion between physical activities under the intrusion of a specialist and various other complementary inclusive approaches (EMS). Simultaneously, we focused the attention of all the participants in the study on keeping a properly conceived and customized diet depending on the period and personal activities. "In moderation and under medical supervision, (EMS) training is acceptable. Before starting, you should definitely have your liver function checked and make sure that you are not suffering from a muscle disorder," informs Knecht, J. While neurophysiologists at DGKN advise against (EMS) training, they suggest that we stick to a regular fitness program.

6. Confirmations

The management of the effortless intensity correlated with the heart rate values, but also with the quality and quantity of the food intake, the way of supporting the energy producing systems through the administration of supplements, can bring different evolutions of the comparative values between weight and BMI.

The changes found in experimental group the difference where the average values of BMI at initial testing 27.8% and final testing 23.30%, is 4.5%, value 21% higher than the difference between the average values from initial testing 27.20% and final testing 23.50%, in group control and which was 3.7%, does not confirm the significant influence of the program composed of TRX and EMS techniques, in the decrease of BMI. By comparing the evolution of weight and BMI, we find that the different evolution of weight between the two groups participating in the experiment is not preserved in the case of BMI values. Different from the evolution of BMI is the result obtained by measuring the circumferences in thigh and hips. The program composed of the techniques of muscle training confirm

the hypothesis of the present study, the large muscle groups register a higher quality increase compared to the muscle groups in the arms or chest. The importance of muscle recovery periods after effort has a contribution in achieving the proposed objectives. We consider that the dosage of exposure to electrical stimuli and distribution of training sessions during a week, concatenated with the use of a food plan in which caloric intake and food quality are correlated with the subject's peculiarities, can bring an improvement of muscle tone.

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