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Combined Methods for Developing the Specific Strength of Women Long Jumpers U18

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Abstract: ***Background and Study Aim.*** *It is well known that neuromuscular electrostimulation and plyometric exercises positively influence the gain of explosive force in the lower limbs. The combination of plyometric method and electrostimulation begins to gain a positive trend, being included in the modern training of athletes due to the important gain of explosive force. The purpose of this study is to investigate the effects of combining plyometric and electrostimulation methods in specific training for the development of lower limb muscle strength in long jumpers.*
Material and Methods. *The study was conducted on 15 women's long jump athletes, age category 18 years ± 1,622, with an average weight of 50.80 kg ± 3,932, height of 165.87cm ±3,292 and foot plant of 39.00 ±1,254. The group carried out the experimental training program for a duration of 12 weeks, with means specific to the two methods, three times a week, lasting 60 minutes. It was assessed: horizontal speed on the last 10m of the run up, 1 RM (a maximum rep for a squat); vertical jump; flight time and performance achieved in the competition. The maximum repetition for a squat was tested with the GykoRePower system, the vertical jump was determined with the OptoJump Next system, and the performance in the test was recorded during the competition. The vertical jump, the average value of power used to develop the explosive force and the length of the jump were evaluated. The recorded data on the muscle profile of the subjects were analyzed with the SPSS statistical analysis program*
Results. *The statistical analysis performed with T-student obtained significant differences between the two tests of the experiment group ($p \leq 0.001$): 1RM registers a progress of 10.476 kg with a progress rate of 18.07%, optimal load registers a progress of 3.627 kg with a progress rate of 8.93%, vertical jump achieves a progress of 4.567 cm with a progress rate of 16.09% with a flight time progress of 0.03833 s with a progress rate of 7.39%, and the speed on the last 10 m of run up progresses by 0.5234 s with a progress rate of 6.79%. Subjects recorded a progress for competition performance of 36.467 cm compared to the initial test with a progress rate of 8.50%.*
Conclusions. *The research results are objective arguments that highlight that a specific training based on combining plyometric method with electrostimulation determines significant improvements in the development of explosive force of the lower limbs in long jumps with positive effects on sports performance for long jumpers.*

Keywords: *long jump, plyometrics, electrostimulation, performance, speed.*

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Introduction

A specific method of physical training of long jumpers is the plyometric method, which involves the development of explosive strength and effort resulting in increased performance in long jump trial. The use of plyometric exercises as means of improving the explosive force of the lower limbs, respectively of the takeoff leg, is a basic condition that must be observed in the physical training program of long jumpers, taking into account the fact that this event is dependent on the combination of speed-strength motor qualities.

It is well known that neuromuscular electrostimulation and plyometric exercises positively influence the gain of explosive force in the lower limbs. The combination of plyometric method and electrostimulation begins to gain a positive trend, being included in the modern training of athletes due to the important gain of explosive force.

The purpose of this study is to investigate the effects of combining plyometric and electrostimulation methods in specific training for the development of lower limb muscle strength in long jumpers. It was hypothesized that a combined training program of plyometrics and electrostimulation can improve sports performance obtained in training and competition of long jumping athletes.

Literature review

In the joints of the lower limbs, muscles generate forces to create movement that could perfect the long jump technique or at least provide optimal conditions for perfecting it (Dziewiecki et al., 2013). The literature treats plyometric training as a decisive factor in the development of explosive force of the takeoff leg, as it involves a cycle of shortening the stretch. Sharkey et al., (2013), concluded in his study that plyometric training induces rapid decelerations followed by rapid accelerations of muscle movement and contraction. In the eccentric phase of movement, the muscles involved in the effort stretch, so that in the concentric phase of movement all stored energy is released quickly and explosively. This muscle expansion during plyometric training favorizes the production of energy and greater strength in the targeted area.

Although this training method is theoretically consolidated, several studies conducted by researchers have not obtained results confirming that plyometric training brings significant improvements in performance. A possible reason for this is the erroneous selection of plyometric means and exercises used in training and their wrong introduction in the planning of the

training program, but it is very important to mention that the experience and level of physical training of each athlete can decrease the efficiency of plyometric training. Vassil et al., (2012) reported no significant improvements following plyometric training, which included double-legged jumping and deep jumping, arguing that a technique that is not well developed or new in the execution of movement leads to a late adaptation to this type of muscular effort.

As a general consideration on plyometric training that includes deep jumping is considered to be a more effective method of developing explosive force than plyometric training based only on countermovement jumping (Muraki et al., 2008), due to increased muscle effort on the lower limbs. It should be noted that most studies on plyometric method have not taken into account biomechanical parameters of movement, focusing only on the effects of plyometric training on performance.

An effective method of developing explosive force is electrical stimulation of muscles, which, unlike voluntary muscle contraction activity, induces an electrical signal in muscle fibers identical to that of voluntary contractions. (Wahl et al., 2014). The natural nerve route in voluntary activity is from the brain, which gives the command for muscle effort, instead, electrostimulation directly generates involuntary contractions by exciting nervously with the help of electrical impulse the nerve endings of the targeted muscles, thus producing a mechanical response of contraction or muscle spasms. The muscle response with EMS stimulation is identical to that of brain-controlled muscle effort (Wirtz et al., 2016).

At the muscular level, muscle contractile are made practical without being able to distinguish where the command comes from (brain or EMS). The electrostimulation method has a variety of programs designed to develop certain muscle groups, certain types of muscle fibers (fast or slow) depending on the purpose and objectives pursued in training (Micke et al., 2018). The benefit of this method is that, depending on the type of muscle fibers we want to develop, we can develop specific and individualized training programs that focus on the precise development of muscle strength necessary to achieve high performance in the sport practiced (Sharkey et al., 2013, Wirtz et al., 2016).

Training programs in the long jump event should include, in addition to improving the technical aspects of the jumping phases (runup, takeoff, flying and landing) and the phase of approach and takeoff from the board (phases contributing to an efficient flight), also the improvement of the physical factors determining the achievement of performance in the long jump event (Tan et al., 2005, Muraki et al., 2008), in particular the

development of the explosive force of the lower limbs with immediate effects on the runup speed and speed before takeoff, as well as the explosive force of takeoff from the threshold. The development and improvement of the explosive force of the lower limbs also brings changes to the structure of the length of the steps on the runup, respectively to the specificity of the last three steps of runup (Singh et al., 2012).

The use in training of the plyometric method and muscle electrostimulation in combination, brings improvements in the performance obtained in vertical jumping (heigh jump and pole vault) and horizontal jumping (triple jump and long jump) events (Dervisevic et al., 2002, Malatesta et al., 2003, Maffiuletti et al., 2009). There have also been improvements in sports performance in other sports disciplines, such as football on ball execution and kicking speed (Billot et al., 2010) horizontal speed (Dauty et al., 2002, Herrero et al., 2006) and anaerobic force (Herrero et al., 2010a, Herrero et al., 2010b). The researches on this combined method have been conducted encompassing both high-performance sports and amatory (Pichon et al., 1995, Benito et al., 2012). Filipovic et al., (2011) state that for the development of physical abilities of strength and speed it is more effective if the training program includes the combination of the two methods than a program based only on plyometrics or electrostimulation alone.

Although the combination of the two methods has led to significant improvements in performance, there are discussions about the intensity values used in applying the electrical excitation pulse. For the development of explosive force in both vertical and horizontal jumping events, several studies have investigated the effects of a specific intensity of electrostimulation (Babault et al., 2007, Maffiuletti et al., 2009, Benito et al., 2010) and the effects of the duration of the stimulus applied (Maffiuletti et al., 2002, Gondin et al., 2005).

The intensity of the stimulus applied in physical training with electrostimulation is considered an important factor in the gain of explosive force and in the effectiveness of the applied training program (Maffiuletti et al., 2000). The duration of electro stimulus intensity appears to be directly proportional to the gain in maximum muscle strength (Benito et al., 2010). Depending on the muscle group targeted to improve the specific explosive force, the intensity of electrostimulation can vary between frequencies 70-150 Hz (Meaños et al., 2002) with significant improvement in explosive force and specific power. Several authors believe that the frequency of EMS stimulation is directly proportional to the accumulation of muscle fatigue in the targeted muscles (Gorgey et al., 2009).

What is important in applying this combined method is that this method is addressed to athletes with very good and experienced sports training and less to beginner athletes (Aceña et al., 2007).

Therefore, training programs to develop explosive force of the lower limbs are applied to improve performance in the long jump. Based on these previous facts, this research aims to investigate the effects of combining plyometric and electrostimulation methods in specific training for lower limb muscle strength development in women long jumpers aged 16-18 years.

Methodology

Participants

The present experimental study was conducted on a number of 15 athletes U18 (Under 18) participants in the women's long jump event at the County and National competitions of Romania. The initial testing took place in February 2023 at the indoor championship and the final testing took place in July 2023 at the outdoor event.

According to anthropometric indicators, the experimental group is a homogeneous group with values grouped around the average, and the values of anthropometric indicators fit the group into the standards of the long jump event respecting the requirements of the trial.

Instruments

In order to carry out the research, we identified three devices, installations for evaluating the control of motor actions: Compex SP 8 neuromuscular electrostimulation device, optical system for performance and motion analysis Opto Jump Next, GykoRePower motion analysis system.

Research Design

To test our hypothesis, we analyzed the effects of 12 weeks of plyometric training combined with electrostimulation in an experimental group. Therefore, the study used a controlled experimental design using initial and final tests of the physical and performance parameters of the long jumpers.

The initial and final tests were implemented at the same stage of preparation of the long jumpers, analyzing the differences recorded at the end. The parameters investigated for this experiment were the speed on the last 10 meters of the run up recorded during the competition, vertical jump and flight time tested with the OptoJump Next sports performance rating

system, a maximum repetition (1RM) measured with the GykoRePower system, and the optimal load for the development of explosive force determined by creating the muscle profile with the GykoRePower system. The data was collected two weeks before the goal competition.

The experimental program took place over a period of 12 weeks, 3 times a week Monday, Tuesday and Friday. The subjects were instructed to perform the proposed exercises at a high level, as required throughout the experiment. The proposed training program has been inserted into the annual long jump training plan in the preparatory period II, leading up to the 2023 outdoor season. The proposed plyometric and electrostimulation exercises were:

- Semi-squats with power threshold set by the GykoRePower system.
- Detachments from the 30 cm crate on the takeoff leg with wireless electrostimulation Compex SP8.
- Deep jumps with counter movement from the 40 cm crate with electrostimulation of the thighs with Compex SP 8.

The optimal load for takeoff semi-squats for the development of explosive force was determined by the GykoRePower system by performing the muscle profile, and the optimal threshold for the development of explosive force expressed in Watts was also determined.

The average values of the percentage of 1RM, semi squats, maximum power and the power threshold for developing explosive force used in training are presented in Table 1.

Table 1. Training program with GykoRePower experiment group

Assessed indicators	No.	Min.	Max.	Mean	Std. Deviation
Percentage of 1RM used in training (1)	15	26	37	32.13	3.482
Kg used in training (1)	15	14.0	35.9	20.833	6.8458
Percentage of maximum strength used in training (1)	15	50	98	75.27	13.885
Watt power threshold values (1)	15	90.4	342.8	194.240	56.5702

Values are expressed as means ± standard deviations. 1RM- a maximum repetition

The intensity threshold for thigh electrostimulation was determined by muscle scanning of the subjects with the Compex SP8 device, calculating the average intensities recorded. For the takeoff semi-squats, the electric

stimulation used was 30mA and for the deep jumping with counter movement the electric stimulation was 45 mA. The intensities of muscular effort were established unitarily for all subjects, representing the value of the acceptance averages of the electrical stimulus of the subjects.

The electrostimulation of the thigh muscles was performed with wireless electrodes placed on the insertion ends of the quadriceps muscles, the working time was set to 4 seconds with a break of 20 seconds between repetitions for the takeoff leg. For deep jumps with counter movement the electrical excitation was only during the exercise with a break of 3 min between repetitions.

The training program (Table 2) was implemented for 12 weeks and included plyometric training and electrostimulation training The means of action were introduced in the preparatory stage with a rhythmicity of 3 times a week, and the specific training was planned in the weeks of the experiment individualized on each subject, taking into account the somato-functional characteristics of each, as well as the muscular profile with the effort thresholds developed by the Gyko system and the response and adaptability capabilities to electrical stimuli E.M.S. Compex SP 8. The exercises of electrostimulation of the muscles of the lower limbs combined with the plyometric method were performed during the preparatory period introduced in the weekly training cycle on Tuesdays and Fridays to allow muscle recovery of the subjects and prevent possible injuries, and the dosage of specific exercises was in accordance with the requirements of the plyometric method. Also in the weekly training cycle, on Monday, specific exercises for the development of explosive force of the lower limbs by plyometric method were introduced.

In order to develop the explosive force of the lower limb muscles, we took into account the fact that the training program must contain both its development at the entire kinematic chain involved in the run-up phase and takeoff phase, respectively the muscle groups and joints of the takeoff leg.

Table 2. 12-week experimental training plan

During the day	Date	No. of Workouts: 10		
		AM	**PM**	**In the evening**
M.	02.Apr.2023	Plyometrics Semi squats with detachment Gyko threshold 6x8rep	Warm up 8 x 300 (55.6" - 60.3") [5'] Recover	P
T.	03.Apr.2023	Specific force Detachments on the takeoff leg with electrostimulation 6x12rep	Warm up 6 x 40 (5.0" – 6.0") [5'] Recover	P
W.	04.Apr.2023	-	Warm up 6x50m 100% [5'] Recover	P
Th.	05.Apr.2023	Development of long jump technique – short run up jumps 3,5,7 stepsx6rep	Warm up 3 x400, 4x300 (51" - 58") [4'] Recover	P
Fry.	06.Apr.2023	Plyometrics Deep jump 40cm with counter movement with electric stimulation 12x	Warm up 3 x 40 (5.2" - 5.5") [3'] 3 x 120 (17.4" - 18.4") [5' Revert]	P
Sat.	07.Apr.2023	-	Warm up 10 x triple, penta, deca jumps (7.5m – 12m-35m) [3'] 8x80m/75% Recover	P
Sun.	08.Apr.2023	P	P	P

P- recovery

Statistical Analysis

Statistical analyses were realised with SPSS software, with which the T Student test was performed. The use of the statistical-mathematical method in our research aimed at analyzing and interpreting quantitative data for measuring parameters determined with the help of identified recording and measuring devices and equipment, respectively the OPTOJUMP NEXT system and the GykoRePower sports performance measurement system.

The arithmetic mean (mean), variability coefficient, progress rate and standard deviation (SD) were calculated for all variables.

Results

In Table 3 are presented the results of the initial and final tests of the parameters investigated for the experimental group as means, results recorded in the competition in the indoor and outdoor season. The conditions were similar in both tests, the wind, the running surface and test protocols had no influence on the results obtained by the athletes.

Table 3. Results of initial and final tests

Variables	Nr.	Min.	Max.	Mean	Std. Deviation
V 10 M-I T (m/s)	15	6.76	8.28	7.7107	.44295
V 10 M-F T (m/s)	15	7.49	8.76	8.2340	.36223
T Z-I T (s)	15	.425	.529	.48040	.026497
T Z-F T (s)	15	.49	.54	.5187	.01790
V J-I T (cm)	15	22.10	34.30	28.3733	3.11619
V J-F T (cm)	15	28.90	36.20	32.9400	2.34393
1RM I T (kg)	15	19.00	106.00	57.9333	25.83593
1RM F T (kg)	15	40	110	68.40	19.816
O L-I T (kg)	15	15.20	74.40	40.6133	18.49393
O L-F T (kg)	15	25.20	74.30	44.2400	14.12959
P-I T (cm)	15	368	515	429.20	46.847
P-F T (cm)	15	409	525	465.67	33.391

V 10 m- speed on the last 10 m of the run up, V.J.- vertical jump, T.Z. - flight time, 1 RM- a maximum rehearsal, O.L. - optimal load, P - performance in the test, I. T. - initial test, F. T. - final test

The comparative analysis of the results obtained at the initial and final testing of the experimental group (Figure 1) highlights a progress for all tested parameters so that the performance in the event registered a progress of 36.467 cm compared to the initial test, 1RM registers a progress of 10.476 kg, the optimal load registers a progress of 3.627 kg, the vertical jump achieves a progress of 4.567 cm with a flight time progress of 0.03833 s, and the speed on the last 10 m of the run-up progresses by 0.5234 s. The group is more homogeneous, with the best results recorded for the performance obtained in the competition, 1RM and optimal load.

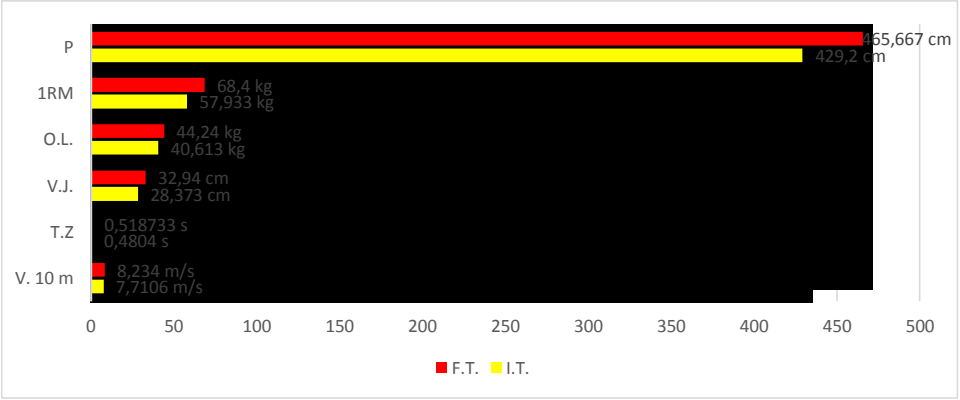


Figure 1. Comparative analysis of progress between tests

Table 4 shows the progress rate and the results obtained by statistically processing between initial and final testing of the subjects.

Table.4 Progress rate, Pair T-test, experiment group, initial – final testing

Experiment evaluated	Group/Metrics	R*,(%)	t	Df	Significance	
					TI p	TF p
Pair 1	P (cm)	8,50	-4.911	14	<,001	<,001
Pair 2	V (m/s)	6,79	-12.905	14	<,001	<,001
Pair 3	T Z (sec)	7,39	-10.324	14	<,001	<,001
Pair 4	V J (cm)	16,09	-10.756	14	<,001	<,001
Pair 5	1RM (kg)	18,07	-4.501	14	<,001	<,001
Pair 6	O L (kg)	8,93	-10.952	14	<,001	<,001

V 10 m- speed on the last 10 m of the run up, VJ- vertical jump, TZ - flight time, 1 RM - maximum repetition, OL - optimal load, P - performance in the sample, p - level of significance of differences between groups in the system of variables ($p \leq 0{,}001$).

Comparative analysis of the results obtained and progress rates at initial and final testing (Table 4) the experiment group registers progress for all tested parameters so that the performance in the event registered a progress of 36,467 cm compared to the initial test with a progress rate of 8.50%, 1RM registers a progress of 10,476 kg with a progress rate of 18.07%, Optimum load achieves a progress of 3.627 kg with a progress rate of 8.93%, the vertical jump achieves a progress of 4.567 cm with a progress rate of 16.09% with a flight time progress of 0.03833 s with a progress rate of 7.39%, and the speed on the last 10 m of the runup progresses by 0.5234 s with a progress rate of 6.79%. Analysis performed with the t-Student test between initial and final testing in the experiment group shows statistically significant differences for $p < 0001$.

Limits and discussions

Following the research approach and the statistical-mathematical analysis of the individual values, all subjects of the experimental group registered obvious progress between the two tests for all investigated parameters.

The long jump requires explosive efforts, both for the phase of takeoff from the threshold and for the speed developed on the run up and near the takeoff zone (Herrero et al., 2006). Training the specific muscles of long jumpers generates positive changes in competition performance, and it has been reported that a voluntary isometric training program of 12 weeks (4 days per week) induced a significant increase in explosive force of the lower limbs (Kubo et al., 2006). Among the various training methods, the electrostimulation method (EMS) could improve muscle strength capabilities (Duchateau et al., 1988, Enoka 1988, Lake 1992, Bax et al., 2005). Indeed, the increase in strength production was evident in the main muscle groups after EMS training, ranging from 10 to 41% for the quadriceps muscles (Maffiuletti et al., 2000, Malatesta et al., 2003, Brocherie et al., 2005, Gondin et al., 2006). On the other hand, Babault et al., (2007) measured an increase in performance for 1RM after 6 and 12 weeks of EMS training, similar to our study that describes a progress of 18,07%.

The optimal load for the development of explosive force used in the training program proposed for this study, achieved a progress of 8.93%, the intensity of the electrostimulation level being 30-45 mA, and the combination with plyometric exercises with stable power threshold significantly improved explosive force, specific explosive force and lower limb strength. The method of electrostimulation used as a method of developing explosive force specific to long jumpers brings performance improvements for long jump when combined with the plyometric method. Due to the multitude of variants of exercises both plyometric and EMS, as well as the possibilities to engage certain muscle fibers in effort, make this combined method an effective method to develop explosive force, as demonstrated by the study conducted by Ward et al., (2002).

The results of this study highlighted the fact that a specially designed training program combining plyometric methods with EMS produces significant gains of specific strength, improving the height of the vertical jump and the afferent flight time. All investigated parameters register an improvement from a statistical point of view, results that are similar or better compared to other studies in the same field. Similar results on vertical jump were recorded in volleyball where the EMS intensity used was 115Hz and combined with plyometric exercises resulted in a progress of 21.4%

vertical jump and 7.39% flight time (Maffiuletti et al., 2002), in the rugby game EMS intensity 100Hz with a progress of 10% (Babault et al., 2007), in the tennis game EMS intensity 120Hz with a progress of 19.10% (Maffiuletti et al., 2009), Herrero et al., 2010b) Muscle elasticity seems to be negatively influenced when the training program is built solely on the method of electrostimulation (Paillard 2008, Paillard et al., 2010) and although specific muscle strength makes significant progress following the use of strictly plyometric training (Cometti, 2002), we can say that the development of the specific strength of long jumpers can only be achieved by combining the two methods with maximum efficiency.

Recent studies have identified that electrostimulation is much more effective than plyometric or classic weight lifting training (Bax et al., 2005), and a combination of these two methods produces a performance gain in vertical jumping (Malatesta et al., 2003, Brocherie et al., 2005, Herrero et al., 2006, Maffiuletti et al., 2009, Billot et al., 2010, Benito et al., 2010) and at the same time reduce the time to achieve these advances by 33% in terms of specific explosive force (Cometti, 2002).

Regarding the speed possibilities generated on the runup, in this study the muscle electrostimulation method combined with the plyometric method brought an improvement in the times recorded on the last part of the runup of 6.79%, progress similar to the study conducted by Herrero et al., (2006). The benefits of using this combined method on speed parameters, have also been studied in other sports disciplines such as volleyball (Voelzke et al., 2012), tennis (Maffiuletti et al., 2009), gymnastics (Deley et al., 2011) and football (Filipovic et al., 2016).

The results of the research suggest that the combined method of electrostimulation and plyometrics introduced in the training of long jumpers brings, in addition to the gain of explosive force in the lower limbs, brought benefits in more specific attributes such as speed on the last 10m of the runup and performance achieved in the event.

Electrostimulation training combined with plyometric exercises induced adaptations on explosive movements on all investigated parameters. The means used to benefit from a wide range of options such as multiple jumps from one or two legs without weight or with weight, multiple jumps on and off crates, jumping sequences and combinations thereof with jumped or jumped steps, squats or semi-squats with weightlifting with or without takeoff, strength circuits. Understanding the importance of strength training of long jumping athletes, strength should not be approached as a whole. The training process must focus on the neural and muscular factors that compose it, and to improve neuro-muscular coordination, the most appropriate is the maximal

effort method, and effort methods with repetitions and submaximal effort are indicated to stimulate inter-muscular hypertrophy.

The typology of programming these methods in training lessons or micro cycles is the application of the maximal effort method and then the submaximal one. A complex of exercises like a typical programming pattern needs to be changed once or every two cycles. The training load varies, in particular, according to the empirical rule, 60%. The training of long jumpers is given by the maximum force converted into power (Manno, 1992; Neyroud et al., 2019,), that is, by the horizontal speed transformed into vertical speed at the moment of detachment by overcoming one's own body weight.

In the transformation of strength gain, speed, a particularly important role is played by two basic conditions of training specific to long jumpers – the choice of means of strength training and the periodization of sports training (Zatsiorsky et al., 2002, Wirtz et al., 2016). The use of plyometric training combined with EMS training of long jumpers results in precise and very fast execution of the jump, aiming at an optimal dosage of strength effort intensity and execution speed for power to be at an optimal level. To achieve this goal, the characteristic of strength training of long jumpers is the use of means for the development of mixed-isotonic and plyometric force.

The combination of plyometric deep jumps with counter movement and squat jumps with electrostimulation is necessary for long jumps, training the specific force of long jumpers being more effective than conventional specific force training.

Evaluating the benefits of using the combined method of electrostimulation and plyometrics on physical components in training may be of limited value. One of the limitations of this study is the relatively small number of subjects and another limitation is the absence of a control group. Future studies should focus on highlighting the effectiveness provided by this combined method of explosive force development, as well as the impact on health and physical integrity.

The study was carried out in accordance with the guidelines contained in the declaration of Helsinki, and informed written consent was obtained from all subjects and their legal guardians. The study was aimed only at students from the High School with Sports Program Brasov, Romania and has the approval of the high school management for conducting this research and is part of the research for the PhD thesis entitled "OPTIMIZING PERFORMANCE IN THE LONG JUMP BY INDIVIDUALIZING THE PATTERN OF SPECIFIC STRENGTH TRAINING" in the Doctoral School of Sport Science and Physical

Education in Pitesti, Romania. The research has the approval of ethic committee I.O.S.U.D., Pitesti, Romania.

Conclusions

The results of this study showed that combining the plyometric method with neuromotor electrostimulation, operationalizing the training program on the design model developed according to the principle of individualization, improves performance, which confirms our working hypothesis.

The progress achieved at the end of the experiment on the performance obtained in the long jump event, as well as the improvements in force speed parameters, demonstrate that a specific and specialized training of long jumpers must be addressed in their basic training. The research results are objective arguments that highlight that a specific training based on combining plyometric method with electrostimulation determines significant improvements in the development of explosive force of the lower limbs in long jumps with positive effects on sports performance for long jumpers.

We believe that this methodical alternative, which has proven effective, introduced over a longer period of time in the training of athletes of the same age or older, can represent a methodical lever favoring the increase of the performance level in this event.

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