THE PUBLICATIONS OF
Prof. Yuri Verkhoshansky
SPORT
STRENGTH
TRAINING
METHODOLOGY

SUPERMETHODS OF SPECIAL PHYSICAL PREPARATION FOR HIGH CLASS ATHLETE

ORIGINALY PUBBLISHED IN:

ACTA ACADEMIAE OLYMPIQUAE ESTONIAE, VOL. 8 - 2000

N° 2 - MARCH 2007

WWW.VERKHOSHANSKY.COM

SUPERMETHODS OF SPECIAL PHYSICAL PREPARATION FOR HIGH CLASS ATHLETE

PROF. YURI VERKHOSHANSKY

Preface

Before we speak about special physical preparation (including weightlifting exercises), it is necessary to emphasize that the super - methods of special physical preparation covered in this paper are intended for the high – class athlete and should not be employed in the training of the lower qualified sportsman.

Special Physical Preparation (SPP) is an organic part of the general training system of sportsmen.

To get a picture of its role in the general training system, we studied the research of many years devoted to the process of attaining of sports mastery (PASM) (12,15).

An overview of the results of this research (16,18,20,22,25,26,27,31) is presented in Figures 1-3.

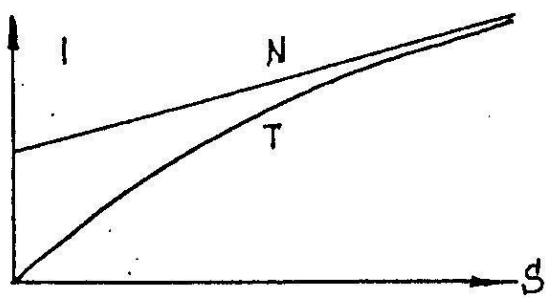


Figure 1. The tendencies in the rise of motor potential of the organism (N) and skill of the athlete to utilize its (T) over many years training; S - sport result (12,15).

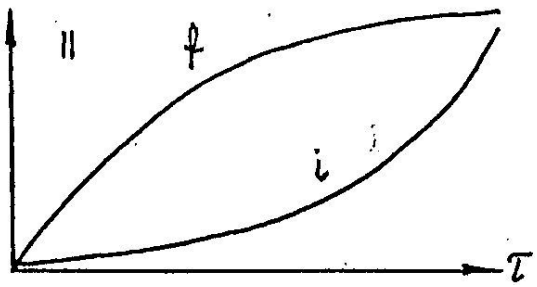


Figure 2. The tendencies in the rise of the leading motor function (F) and intensity of training influences on the organism of the athlete (J) over many years training; t - time spent on training (12,15).

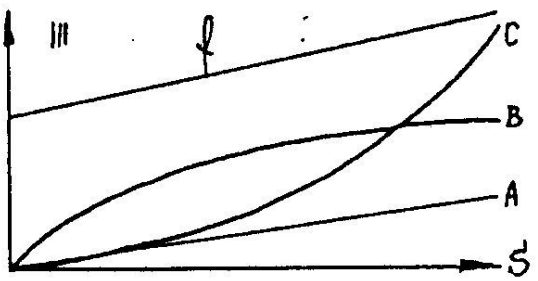


Figure 3. The tendencies in the improvement of the leading function (F) and development of functional systems of the organism (conditionally A, B and C) during many years training; S - sport result (12,15).

Our analysis of the literature permits the following conclusions:

1. There is a linear connection between the improvement of the athlete's competition results (S) and the improvement of the specific – motor - potential of the athlete's body (N) and also with the improvement of the athlete's skill to utilize this potential effectively (T); in training and in competitions (Figure 1). The greater the athlete can increase his specific motor potential (N) and make use of it effectively

(T), the more his performance will improve (S).

2. The improvement of the key motor ability (F) chiefly determines the improvement of the athlete's special - work - capacity (for example, strength, speed of movement, endurance specific to the particular work regime) over many-years of training (t) and coincides with slowing rate of improvement of sport results (Figure 2). The improvement of the key motor ability of the high class athlete requires the intensity of training influence on the body (J) be elevated; the energy expenditure of the body becomes more and more expensive.

3. The improvement of the key motor ability (F) is connected with the increase in sport results (S) over many years of training (Figure 3). It is specific to each kind of sport: a selective (individual) morphological specialization of the locomotor apparatus. One group of morpho - functional factors (A) progress uniformly and are distinguished, as a rule, by small functional improvement and a moderate correlation with performance (S) over its entire range. The functional improvement of other group (B) initially is fast and has a high correlation with performance; then the rate of improvement decelerates and the correlation with performance also diminishes. On the other hand, Physiological systems (C), initially progress slowly, then the rate of improvement accelerates and there is high correlation with performance at the higher level of performance for the high class athlete (12,15,18,20).

The aforementioned research permits a number of conclusions, important to the understanding of the role of SPP in training system:

1. The key mechanism underlying the development of the process of attaining sports mastery (PASM) during many years of training consist of the steady rise in the specific motor potential of the body and the improvement of a sportsman's skill to utilize it effectively in training and competitions. The rise of the specific motor potential is accomplished with the means and methods of SPP. Consequently, the latter should be considered as a primary factor behind the long term improvement of sport results, especially for the high class athlete (12,15,20,25,26,27).

2. The increase in the key motor function (F) in PASM slows (Figure 2) and its stagnation in the high class athlete requires that the intensity of the training be increased. This problem can be solved only with super specially-devised physical training. It has to correctly organized and become the main component of the training system (20,25); instead of an addition to it (as it often becomes in practice.

3. The rise in the sportsman's motor potential over many years of training is based on a very concrete morpho-functional specialization of the organism which proceeds with a definite regularity. Such specialization can develop successfully (with respect to the PASM) only in the event that it is provided with adequate multi-year program of SPP. This is especially important to the functional systems of an organism which are chiefly responsible for providing a boost to its key function at the stage of higher mastery (Figure 3) (15,16,20,31).

One of the major methodical principles of sport training has been designed on the basis of the conclusions formulated above, the principle of the priority of the SPP in the programming of the training process. According to this principle, special strength

training should take precedence over extensive working on the sport technique, speed of competitive exercise and specific endurance. That principle also means that when a coach plans an annual training cycle, the role, tasks and place of the special strength training load in the training process should have priority. All other components of the training process should be planned around this priority (20,25,26,28).

Some Features of a Morpho-Functional Specialization of the Body Over ManyYears of Training Morpho-functional specialization means the perfecting of the functional abilities of the athlete's body which are paramount to success in the specific sports activity, and it includes the development of such morphological reconstruction, which becomes basis of a specialized hyper - functioning of the organism (15,16,18,20,22).

The qualitative characteristics and quantitative values of such morpho-functional acquisitions of the organism are the external results of the adaptive process which are the basis of the physical perfectioning of the sportsman. At the same time these acquisitions reflect the specificity of the adaptive process, conditioned by the sports activity, and become a feature of its development over time (12,16,18,31,32).

A long - term study of the tendencies in the development of this process has shown that in the beginning the organism adaptive reactions to the motor regime are intrinsic to the concrete sport activity, with all of its systems. This is sufficient for the initial successes in the sport arena.

However, subsequently, the adaptive alterations acquire an expressed selective - functional – trend, stipulated by the motor specificity of the competition exercise.

Under these conditions one of the systems of the organism receive the greatest possible development and others correspondingly smaller, depending on their role in the support of the required motor activity.

The functional specialization of the organism over the course of several years of training manifests itself in two forms:

- First, explicit adaptive - alterations are gained by those muscle groups and physiological systems which chiefly secure the athlete's special – work capacity;
- Second, the functional perfectioning of the body as a whole is expressed by the development of such specific motor abilities which are primarily necessary for the success of a concrete sports activity.

Thus, the key item is the specialization of the organism or organs, on the one hand, and in the motor ability on the other (16,20).

The specialization on an ability is expressed in the development of such functional qualities of the organism and, chiefly of working systems, which mainly determine the level of its specific work capacity. With the growth of the sports skill the selective character of the functional specialization of the organism becomes more manifest, and the specificity of the motor abilities increasingly more and more concrete (15, 20, 22).

The Function of Special Physical Preparation in the Training System

The function of SPP in the training system consists of the intensification of the work regime for the purpose of activating the process of its morpho - functional specialization and accommodating to the

specific conditions of sport activity. Within the framework of that process three main problems (20, 25) are solved:

- The increase in the level of special work capacity or, otherwise, the enhancement of the motor potential of the sportsman;
- The activation of the morphological reconstruction which amounts to the material basis of the long-term adaptation of the organism to the motor regime, mainly intrinsic to sport activity;
- The increase in the power and capacity of the energy-produsing systems of the organism necessary for progress in sport mastery.

The specific resources and methods of SPP are employed to solve these problems.

The Means of Special Physical Preparation Special physical preparation includes specialized means and methods which:

- First, correspond to the competition exercise in their motor structure and the work regime of the body;
- . Second, provide training - effect, capable of increasing level of the functional possibilities which are already present;
- . Third, provide a work - capacity for technical-tactical skill and to increase the power of the working organism.

Strength exercises (including exercises with weights) have an integral place in the system of SPP means.

However, these exercises will not be utilized exclusively for strength development. They should mainly serve to intensify training regimen to develop the necessary functional qualities and motor abilities of an athlete.

For example, these qualities would include speed of movement and locomotion, local muscle endurance, co-ordination of movement and efforts, quickness of a motor reaction, velocity and frequency of movements without weight, the ability of muscles to relax and so on.

It is necessary to be guided by so-called principle of dynamic correspondence when selecting the means of special strength preparation and the method with which they are employed. This principle states that the means and methods of strength training for specific sports should conform to the required motor qualities in terms of:

- the composition (structure) of the muscles involved in the work; the amplitude and direction of movement; the accentuated segment of the working amplitude of movement;
- the speed with which the working muscles develop maximum force 16,20,28).

Methods of Special Physical Preparation

The methods of SPP are the form with which the specialized training influences are organized such that the biomechanical, physiological and bio–energetic parameters of competition activity are closely approximated.

It is possible to refer to SPP methods with respect to any training means if it provides involves a work regime of adequate or close to competition conditions.

However, there are also the supermethods of SPP. These methods are capable of providing a regime of work which significantly exceeds that of competition conditions with respect to the most important parameters (20, 28). The traditional SPP

methods are utilized mainly for activating the morpho-functional specialization process within the framework of the body's gradual adaptation to the conditions of the sports activity. The supermethods of SPP should solve the problem of the stagnation of the high – class sportsman's functional possibilities by bolstering the adaptive morphological reconstruction reached at the previous stage of training.

The supermethods have been developed with my collaborators in the laboratory of "Training optimization" as an alternative to doping and anabolics.

The concept of the supermethods of training was based on the so-called *principle of forced (compulsory) intensification of the regime of working* (28,30).

The Principle of Forced Intensification of the Working Regime in Training Conditions.

All traditional methods of training are based on volitional actions, i.e. the ability of the sportsman to mobilize volitionally, as fully as possible, to carry - out the motor task.

For example, the greater the volitional effort, the more force is produced in an isometric muscle contraction. The more forceful the athlete concentrates on lifting a barbell, the greater its speed of movement. However, as the weight of barbell is increased gradually, a point will be reached where an athlete will be unable to move it.

Thus, the effect of any traditional training method is determined by the limit of the athlete's strength of will, for which the sportsman is capable of at the given moment.

It is known that under the influence of hypnosis and in extreme situations man can exhibit fantastic physical possibilities. We demonstrated in my laboratory* that if the excitability of the central nervous system is increased beforehand a sportsman can lift a barbell with a weight he was unable to lift without this excitation. A sportsman instantaneously produces of effort of such power he could not exhibit under ordinary training conditions in a take – off after a depth jump (10,13,14,16,17,34).

So, when an athlete lifts a barbell or executes an ordinary vertical jump, the effort is entirely volitional. Everything depends on his concentrated effort and the mobilization of motor potential. If the sportsman conducts a vertical take-off after a depth jump with the aim of flying up as high as possible or runs down a slight incline at maximum speed, these conditions force his central nervous and physiological systems to exceed the ordinary boundaries. The creation of such conditions in training process is the forced intensification of the work regime which becomes a potent training stimulus (10,16,20).

Apparently, under these conditions the body mobilizes any innate mechanisms designed by nature to be available for these and even more complex, extreme situations.

W. Hollman and T. Hettinger (5) have determined the common to all, innate potential of the human organism (inclusive of the nervous system and muscles). They divided them into four parts:

- reserves employed in reactive movements (15%);
- "physiological" reserves employed under conditions of elevated motor activity (20%);
- "special" reserves mobilized only under conditions of muscle performance of great intensity or long duration (35%);

- "innately defended" reserves mobilized only in extreme, life-threatening situations (30%).

The third and fourth segments of the reserve potential are distinguished by their mobilization barrier, inhibited by the central nervous system. Overcoming this barrier under normal living conditions is precluded by a protective inhibition, which forces the body to reduce the intensity of the work, or cease it[1].

To overcome of this barrier with doping can cause irreparable harm to health and can even be lethal.

Experiments conducted in my laboratory demonstrated that the aforementioned Experiments conducted in my laboratory demonstrated that the aforementioned "protected" functional reserves of the body are inaccessible regardless of the intensity of the volitional effort without special long–term training.

In Figure 4, the F(t) curve of a electro – stimulated triceps surae through the tibial nerve, (gastrocnemius and soleus, Ed.) muscle of gymnasts of various age and qualification are represented. The F(t) curves of voluntary, explosive contraction of muscles by the same gymnasts (B) are also shown.

Here it is necessary to turn our attention to the fact that the electro - stimulation the parameters of F(t) curve of the gymnasts of various age (graphic A) show no essential differences.[2]

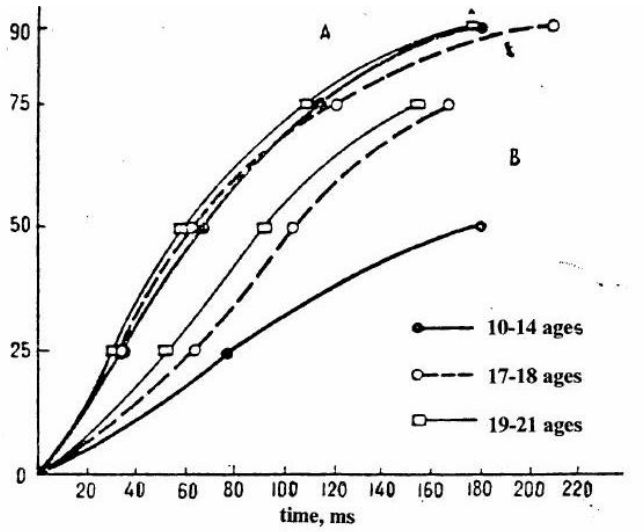


Figure 4. Changes of F(t) «force-time» curves of tetanic muscles contraction caused by electrical irritation (A) and their voluntary contraction (B) of the gymnasts of various age (29,30).

If we assume that the quantitative parameters of graph F(t) of tetanic contraction of muscles caused by electro - stimulation (A) designate the upper limit of the "special" reserves, and that the "automatically defended" reserves lie above that graph, it is apparent, that:

- the greatest difference between the parameters of curve F(t) of a volitional effort (B) and the parameters of F(t) curve of a realizable part of "special" reserves (A) is characteristic of young gymnasts of low qualification;
- with age and the rise in qualification the gymnasts realized a greater portion of

[1] Based on the W. Hollman and T. Hettinger scheme, it is possible that systematic sport training draws upon the "physiological" reserves of the body; and that high class sportsman utilize "special" reserves (20,29).

[2] From this fact it does not follow to conclude expediency of usage an electrical stimulation for development of explosive strength of muscle. The usage of electrical stimulation for the development of explosive abilities of the neuromuscular apparatus of the sportsmen is an unnatural and ineffective training method which has already compromised itself.

their functional potential with respect to a volitional effort.

Thus, it is possible to conclude that the central-nervous system mechanism controlling the mobilization of the contractile function of muscles of the gymnasts gradually is perfected during many years of training; making it possible to realize the motor potential fully (including the "special" reserves) in a volitional effort.

So, the skill of the high – class sportsmen involves the application of "special" reserves of functional motor possibilities. The more fully the sportsman can utilize these reserves, the higher the sport results he can achieve. However, in accordance with the rise in the functional capacity of the body, the value of their contribution decreases (Figure 2, graph F).

The application of "special" reserves with the traditional methods of SPP, through strength - of - will - impulse, becomes increasingly difficult and involves major expenditure of time and energy by the sportsman. The subsequent increase of the special – work - capacity level requires essential increases in the force (intensity) of the training (Figure 2, graph J).

Consequently, it is necessary to create the training conditions that will force the body to mobilize the hidden (concealed) functional reserves and to form central-nervous system mechanisms for their application, i.e. to make them accessible for mobilization from a strength-of - will impulse.

This problem should be solved by the supermethods of SPP, the essence of which involves the principle of forced intensification of the regime of work in training (28,30).

Now we shall consider two related methods:

- the Shock Method;
- the Stimulation Method.

The Shock Method

The shock method was developed at the end of the 1950s (22,24). This method was then researched in detail and successfully utilized by my friend C. Bosco in Italy and by many pupils and followers in America, Germany and other countries.

The shock method is intended for the development of explosive strength of muscles and the reactive - ability of the neuro - muscular apparatus[3].

The essence of the method consists of a stimulatory muscle stretch created by the kinetic energy accumulated from the sportsman's falling body from a specific, strictly proscribed, height. The resistance of the falling body (the shell) is stopped over a short movement path. This produces a sharp muscle - tension which creates instantaneously, a resilient potential of muscle - tension and stimulates a high-intensity central neuro - impulse on motoneurons. This in turn promotes a faster switching of the muscles from eccentric to concentric work and a more powerful contraction (14,17).

This is a non - conventional method of stimulating the work of muscles. Its peculiarity consists in the capacity of external

[3] The explosive strength characterizes of t he athlete's ability to show a maximum of effort in minimum time. The reactive ability is a specific property of a neuromuscular apparatus to develop power explosive effort immediately after an intensive mechanical tension of muscle, i.e. at the moment of their fast switch over from eccentric to concentric contraction (10,11,14,17,20,30).

stimulus coming not of a weight, but the kinetic energy accumulated by a free falling the body (or a shell) (10,11,14,27).

When free weights are employed, the magnitude of the muscles' working tension is a function primarily of volitional effort. However, in the shock method, the activation of the working muscles is "forced." The external factor of the weight example only assists the force produced by the muscles; on the other hand, with the shock regime the external factor (kinetic energy) forces the body to mobilize the innate motor resources.

This circumstance makes the shock regime of the working muscles a very potent training means for the development of explosive strength and reactive ability of the neuromuscular apparatus of the sportsman (14,29,30).

The simplest and most appropriate use of the shock method of developing explosive strength and the reactive ability of the extensor muscles of legs is the depth jump (Figure 5); from a strictly proscribed height (10,13).

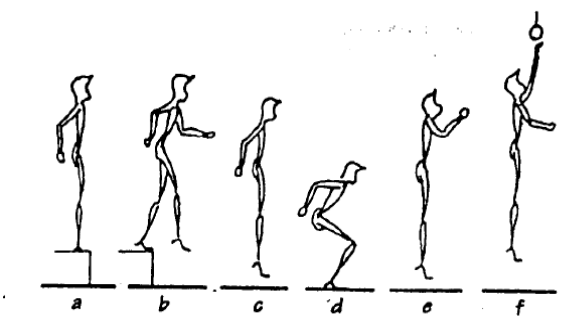


Fig. 5

Figure 5. Technique of the depth jump execution (10,13,14).

The specific features of the training - effect of the shock method was demonstrated by the results of an experiment with highly – qualified - weightlifters who employed depth jumps in a pre - competition stage (20).

Two groups of sportsmen took part in experiment. The control group utilized the traditional training program.

The experimental group utilized depth jumps (for 3 – weeks; three time per week, 40 jumps in each training session). The back squat and traditional jumping exercises were eliminated from the training program. The changes in the level of explosive force and reactive ability of the neuromuscular apparatus were measured weekly on a special device (16,17).

The F(t) curve of the explosive extension of legs and the characteristics of F(t) curve corresponding to three sections of the leg's movement were recorded (16,17,21).

The weekly changes of the speed of leg extension with standard resistance (load) of both groups of weightlifters are depicted in Figure 6.

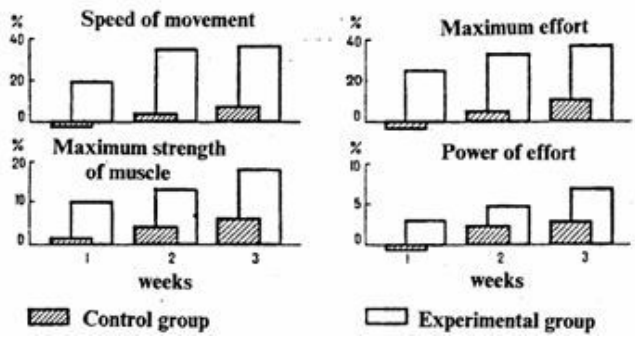


Figure 6. Changes in the speed-strength characteristics of the control movement of weightlifters of experimental and control groups (16,20,29).

The improvement of all recorded characteristics of the sportsmen in the experimental group exceeded significantly the same parameters of the sportsmen of the control group. The biggest increase in the speed of the loaded movement (V) and power

of work (N) was found to be in beginning segment of the working amplitude of the control movement (Figure 7).

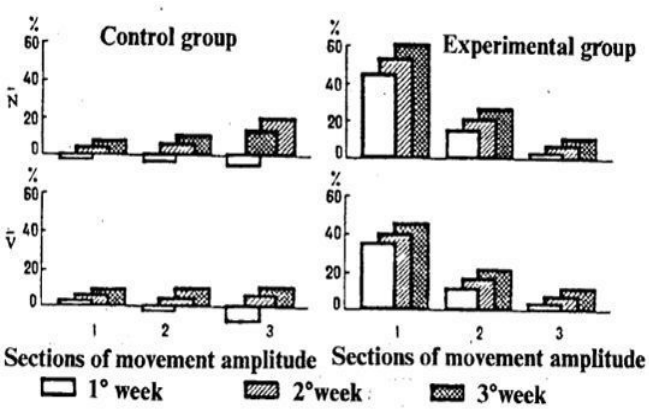


Figure 7. Changes in the power of effort (N) and speed of control movement (V) of the separate fields of its working amplitude in weightlifters of experimental and control groups (16,20,29).

This reaffirms the high level of the effectiveness of the shock method for the development of the muscles' starting strength[4] and increase in the power of muscles working in ballistic movements.

EMG research shows that the shock method enhances the effectiveness of the central regulation of the production of power; especially, through the mobilization of a greater number of motor units, a higher frequency impulses and an enhanced synchronization of the motor - neurons (7,8,18,23,24). It has been also established, that the shock method increases the stiffness of muscles (stiffness of the sequential resilient component). This plays an important role for a fast onset of muscle contractions when they are called upon to switch rapidly from eccentric to concentric work; especially when overcoming a large external resistance, for example, in weightlifting exercises and athletic jumps (7,23,24).

Considerable research has confirmed the high training effect of the shock method (1,3, atc). (See also reviews 2,6,34). The research of the training - effect of the shock method under laboratory and natural training conditions permits the following conclusions (16,29,30):

1. The kinetic energy of the falling body which creates the intense stimulation of the muscles in an amortization phase, does not slow the speed of their subsequent contraction (which happens with weights). In fact, quite the contrary, this kinetic energy augments the speed of the resulting contraction.

2. The mobilization of muscles stimulated in the shock regime is "forced". In weightlifting exercises the magnitude of the mobilization of the muscles' motor potential is dependent chiefly on volitional effort. However, in the shock method the central nervous system and motor apparatus are forced to react to the extreme conditions created in the amortization phase of the impact such that the subsequent magnitude of muscular contraction is simply outside the realm of volitional effort.

3. The shock regime has a profound training - effect, which is significantly greater than any other methods of "natural" stimulation of muscles. Therefore, it is imperative not to exceed the optimum dosage and duration of use in training.

4. Because of its profound effect on the central nervous system, the muscles, and ligaments, the shock regime should be utilized in the training of highly skilled sportsman following a period preliminary speed-strength training.

[4] Starting strength is an ability of muscles fast to educe working effort in the beginning of their contracting (11, 16, 17)

5. One should not execute depth jumps with a barbell on the shoulders, as has been recommended by T. Bompa (see: "Power Training for Sport: Plyometrics for Maximum Power Development"). First and foremost this distorts idea of the shock method and, secondly, there is a significant risk of injury to the loco – motor apparatus and spinal column of the sportsmen. A functional lack of knowledge of biomechanics, muscle physiology, as well as an inadequate grasp of the concept of the shock method could condone such an exercise protocol.

It is important to emphasize that the potential of the shock method cannot be overstated. It is only one way of intensification of the working regime and cannot replace the other ones. It should occupy a special place in the system of special – physical - training and be utilized at a specific time of the year.

It is also necessary to emphasize that the shock method, developed by this author, should not be included in the training of children and the low - level - sportsmen. It poses danger to the ankle and patella ligaments and tendons. There are safe and effective means of training for juvenile sportsmen, which should be utilized reasonably.

The Stimulation Method.

The idea behind this method is to employ the hyper - excitability of the central nervous system created by brief powerful muscular tension, to enhance the subsequent specific work, in order to develop explosive strength and the reactive ability of the neuro - muscular apparatus (16,47).

It is common knowledge in physiology that any irritant which stimulates muscle activity, however short-term, leaves traces in the nervous system. The trace phenomenon remains for some time after the stimulation has ceased. These traces can have a significant effect on the subsequent muscular activity; in particular, enhance the magnitude of this activity (4,8,16,20). For example, the preliminary isometric tension has a positive effect on the subsequent dynamic work. This effectiveness of this preliminary tension is up to 20% higher in comparison with the work conducted without preliminary isometric tension (in detail see 16,29).

The results of a laboratory experiment demonstrate (Figure 8) the effect on explosiveness as measured by the height to which a weight is thrown on the special device (16,20).

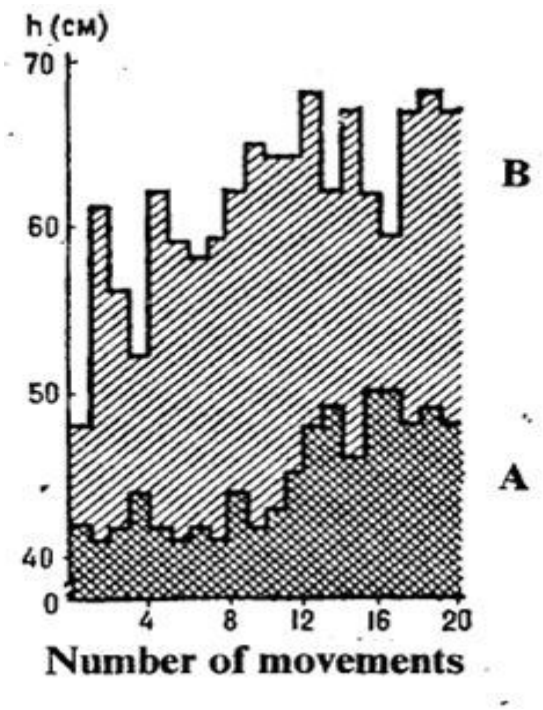


Figure 8. Influence of the after-effect of the preceding tonic work on the height of take-off of the weight (h), thrown by hand on the special experimental device (16,17).

The effect increases on the average by 38-40% after preliminary stimulating work (pressing a barbell with 80% of maximum, three sets of three repetitions, followed by rest between the first and second bout of work for 5-6 minutes).

Here, the movement time is reduced (6.0%), its amplitude is greater (4.8%), the speed of movement has increased significantly (11.7%) and the power of work has increased significantly (47.3%).

The traces phenomena in the nervous system and their effect on the subsequent work are the end result of many factors: the force of the tonic influence, the degree of fatigue and the time separating the preceding and subsequent work.

For example, after a back squat (tonic work) the alteration in the parameters of a F(t) curve of explosive isometric effort by extension of the leg is observed (Figure 9).

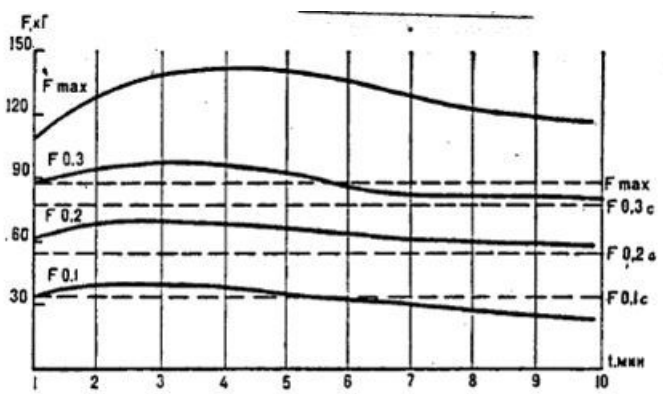


Figure 9. The tendency in the change of the parameters of a F(t) curve of the explosive isometric effort after squat with the bar on shoulders (individual example). The dotted line shows the initial level of the F(t) curve parameters (F1=0.1 sec, F2=0.2 sec, F3=0.3 sec) (16).

The maximum effort increases by 26% from the initial level after the first minute and then by the 4th -5th minute it reaches 65%. The beginning of the F(t) curve does not change much (F1, F2 and F3) the forces which exceed the initial level and duration with which they are maintained are the smaller the closer to the beginning of effort F(t) is to the ordinate.

The amount of time required for the maximum increase in effect (Figure 10) falls 2.6% immediately after tonic work. Then this time drops to 3-4 minutes up to 4.6%; and the subsequent increase exceeds the initial level considerably.

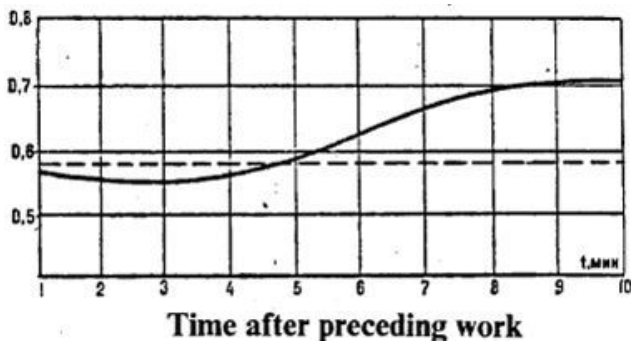


Figure 10. The tendency in the change of the time of maximum and explosive isometric effort achievement after preceding tonic work (16).

The effect of the stimulation determines the amount of time to reach a maximum of force and duration of the after-effect of the tonic work. Therefore, it is important at which moment the subsequent work starts.

For example, maximum height of the vertical standing jump is reached after the 3rd-4th minute. The difference is a 6.8% increase over the initial level. After the back squat an increase of 8.0% from the initial level is realized in the 8th – 10th minute after depth jumps (Figure 11).

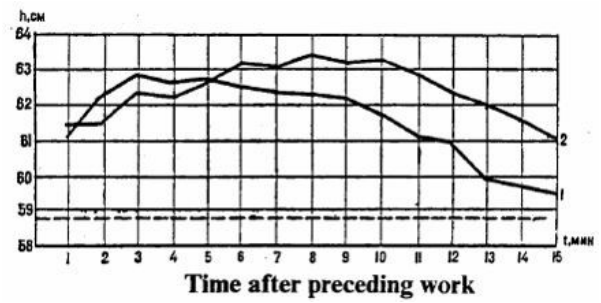


Figure 11. An example of the change in the height of standing vertical jump after tonic work of various character. 1 - squat with the bar on shoulders, 2 - take-off after depth jump (16).

The stimulation method consists of two successive muscle activities. The first (tonic) is carried - out slowly with major resistance and a limited number of repetitions. The second activity (developing) is conducted with an extremely concentrated explosive effort with smaller weights (30-40% from the maximum) and significantly more (optimum) repetitions. The preliminary (tonic) activity essentially increases the power output of the subsequent, because of its tonic effect on the central nervous system, which is in effect the main training effect of the stimulation method.

The high effectiveness of the stimulation method has been proven effective for the development of explosive strength and the reactive ability of the neuromuscular apparatus. The value of this method is that it provides a fast and steady increase in these parameters within a short period of time and with a relatively small expenditure and energy (16,20,27,30).

Variants of the stimulation method for the development of explosive strength and reactive ability of muscle-extensors of legs are presented in Figure 12.

For example, the vertical squat jump with a weight held between the legs (16, 24 or 32 kg is selected individually) used in the first variant for tonic work. Two sets of 6-8 jumps with the rest of 3-4 minutes are conducted. Then after a rest of 3-4 minutes, the second (developing) exercise is executed for 6 or 8 multiple jumps from one leg to the other with the maximum effort. The work consists of two sets of 5-6 repetitions of exercise with the rest between the sets of 3-4 minutes. This series is repeated for 2-3 times with the rest of 6-8 minutes.

Other variants of a stimulation method are carried out in a similar manner. The back squat is employed as a tonic exercise. Now the main (developing) exercises are the jumps with the weight held between the legs, jumps with the bar on the shoulders, or depth jumps.

All the variants are rank - ordered from the top to bottom by the power of work and the training effect on the neuromuscular apparatus. The most potent variants are the fourth and especially the fifth, which should be utilized only in the training of the high level sportsman.

The potential to develop new variants of the stimulation method are limitless and are confined to the realm of developing explosive strength and reactive ability.(review see 16,29).

For example, sprinters have experienced an increase in the speed of the initial acceleration and the running speed after intense jumping exercises. It has also been established that three hops from one leg to the other at sub - maximum effort over a distance of 60-80 meters with resting pauses of 1.5 - 2 minutes between bouts, increases the speed by 2-3% in the main part of the training session of middle distance runners.

The velocity of short distance runs increases and in this is maintained at a high level during the majority of a series of runs.

The after-effect of tonic work (swimming with the resistance of a rubber cord, swimming with towing a resistance, swimming with a harness on the shoulders) will increase swimming speed over short distances by 4-7% (review see 20).

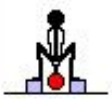
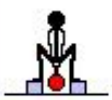
First exercise	Rest between exercises	Second exercise	Number of reps of complex	Rest between reps of complex
16-24 kg 2x6-8 rec. 3-4 min. 	3-4 min.	6x8 balzi 2x5-6 rec. 3-4 min. 	2 - 3	6-8 min.
70-80% 2x5-6 rec. 2-4 min. 	4-6 min.	3 balzi 2-3x6-8 rec. 4-6 min. 	2 - 3	6-8 min.
80-85% 2x2-3 rec.3-4 min. 	3-5 min.	16-24-32-kg 2-3x4-6 rec. 3-4 min. 	2 - 3	6-8 min.
90% 2x2-3 rec. 3-4 min. 	4-6 min.	30% 3x6-8 rec. 3-4 min. 	2 - 3	8-10 min.
90-95% 2x2 rec. 2-4 min. 	4-6 min.	h = 0,75 m. 2x6-8 rec. 4-6 min. 	2 - 3	8-10 min.

Figure 12. Variants of the stimulation methods for the development explosive strength and reactive ability of the legs muscles (16,20). Explanation in the text.

The stimulation method is defined by the following:

1. The form or the first (tonic) exercise movement has no principal value. However, it is important, that the key muscle groups the athlete employs in the sport activity are activated and that they work hard. As to the second (developing) exercise, its motor structure should approximate the competition exercise as much as possible and be conducted with extreme explosive effort.

2. The effectiveness of the stimulation method depends on following closely the work regimen, the number of repetitions, the rest intervals, the amount of weight, etc. For example, to develop explosive strength and reactive ability it is necessary to follow the guidelines presented in Figure 12; while at the same time, seeking the optimum individual variant of the regimen in each concrete case.

3. Between the sets it is necessary to work on flexibility and relaxation of muscles.

Between series work at moderate intensity with the same muscles groups (for example, light jumping exercises, acceleration, jogging on short distances etc.) in combination with exercises for relaxation and flexibility. The first (tonic) and especially second (developing) exercises should be fulfilled with maximal effort.

4. During training it is necessary to increase the intensity of the tonic work, not by increasing the volume, but the amount of weight. As to the second (developmental) exercise, it is not necessary to change the total amount of work (number of repetitions, sets, series), the weight of load or intervals of rest between the sets and series.

5. The stimulation method should not be utilized at the end of the training session or in a fatigued state. The stimulation method should not be used in addition to any other training activity. This method is effective only when the athlete is "fresh".

6. The stimulation method can be a separate training session with a duration of from 40 minutes to one hour and it should be the first one of the day (in case there are two training sessions per day). The interval for the training session to follow should be no less than four hours.

7. The stimulation method is mainly intended for the purpose of stimulating the ability of the central nervous system to generate a stream of impulses to the motor periphery.

It has a strong training effect and should not be applied frequently. During the training stage where there is a concentration on special strength training it should be utilized no more than one-two times per one week.

Conclusion

The main means of increasing the motor potential of the athlete and stimulating the improvement of sports achievements of the highly skilled athlete is special physical training.

Super methods of special physical training can effectively enhance the motor potential of the high class athlete. The basic idea of super methods consist of employing the principle of forced intensification of the work regime in training.

These methods affect the body profoundly, forcing it to mobilize its functional reserves and to form central nervous mechanisms for the implementation of these reserves, when the necessity arises.

Nature has provided man with the possibility to enhance his abilities in extreme situations, and we need to utilize it in the training of the high class athlete.

References

1. *Asmussen E.,Bonde-Petersen* F. Storage of elastic energy in skeletal muscles in man. Acta Physiologica Scandinavica 1974, 92, 385-392.
2. *Bobbert M.*, Drop Jumping as a Training Method for Jumping Ability. Sports Medicine, 1990, 9, 1: 7-22.
3. *Bosco C. Komi P*. Potentiation of the mechanical behavior of human skeletal muscle through prestretching. Acta Physiologica Scandinavica, 106: 1979, 467-472.
4. *Gurfinkel V., Levik Y.* A skeletal muscle: structure and function (Russ). Moscow, 1985.
5. *Hollman W., Hettinger Th.* Sportmedizin. Arbeits und Training. Grundlagen, Stuttgard, New York, Schattaner, 1976.
6. *Lundin Ph., Berg W.* A review of plyometric training. NSCA Journal, 1991, 13, 6: 22-30.
7. *Masalgin N., Verkhoshansky Yu et al.* Influence of the shock method of the training on the myographics parameters of the explosive efforts. The theory and practice of physical culture (Russ). 1987, 1: 45-46.
8. *Person R.* Spinal mechanisms of a muscular contraction control (Russ), Moscow, 1985.
9. *Steben R., Steben A.* The validity of the strength shortening cycle in selected jumping events. Journ. Sports Med. 1981,21: 28-37.
10. *Verkhoshanski Yu.* A new method of the strength preparation of the jumpers. In: Scientific Works of the Research Institute of Physical Culture (Russ). Moscow, 1959, 23-38
11. *Verkhoshanski Yu.* Perspective in the improvement of speed-strength preparation of jumpers. Track and Field, 1966, 9: 11- 12,
12. *Verkhoshanski Yu.* Regularities of the process of attaining of sport mastery. The Theory and Practice of Physical Culture (Russ) 1966, 9:18-21.
13. *Verkhoshanski Yu.* Are depth jumps useful? In: Yessis Review of Soviet Physical Education and sport. 1968, 3, 75-78.
14. *Verkhoshanski Yu.* Shock method of the explosive strength of muscles development. The Theory and Practice of Physical Culture (Russ) 1968, 8: 21-24.
15. *Verkhoshansky Yu*. The regularities of the morpho-functional specialization of the organism in the process of attaining sport mastery. The Theory and Practice of Physical Culture (Russ) 1970, 6: 4-9.
16. *Verkhoshansky Yu*. Basis of special strength preparation in sport. Moscow, 1970, 214 pp.
17. *Verkhoshanski Yu*. Some features of the working movements of man. The Theory and Practice of Physical Culture (Russ) 1970, 12:6-10.
18. *Verkhoshanski Yu*. Regularities of the process of attaining sport mastery as the premises to the many years training control. In: Control of sport training process (Russ). Leningrad, 1974, 124-132.
19. *Verkhoshanski Yu*. Programming and Organization of Training Process (Russ), Moscow, 1985, 176 p.
20. *Verkhoshansky Yu*. Basis of special physical preparation of the sportsman (Russ), Moscow, 1988, 331 p.
21. *Verkhoshansky Yu.*, Masalgin N. Electromyografical criteria of evaluation of the central-nervous factors, determining explosive strength of muscles. In: Paths of perfecting the methods of sport training (Russ). Tashkent, 1988, 99-105.
22. *Verkhoshanski Yu.* The regularities of organism adaptation to increase muscle performance. In: Scientific basis of the modern theory and methods of sports training (Russ). Leningrad, 1989, 30-33.
23. *Verkhoshansky Yu.*, Gorshenin A. Adaptation of the neuromuscular apparatus of weightlifters to a specialized speed-strength load. In: Complex diagnostic and evaluation of functionality of the organism and the mechanism of adaptation in high class sportsmen to intensive performance (Russ). Moscow, 1990, 25-30.
24. *Verkhoshansky Yu.*, Novikov G. Adaptive changes of the neuro-muscular apparatus of weightlifters on a special speedstrength load. In: Means, methods and mechanisms the adaptation of man to muscle performance (Russ). Khabarovsk, 1990, 2: 29-34.

25. *Verkhoshanski Yu*. Principles of training of the high class sportsmen. Theory and Practice of Physical Culture (Russ). 1991< 2: 24-31.
26. *Verkhoshanski Yu*. Ein neues Traininggssystem fur ziklische Sportarten. Philppka-Verlag, Munster, 1992, 135p.
27. *Verkhoshansky Yu*. Ein neues Trainingssystem fur azikliscge sportarten, Philippka-Verlag, Munster, 1995, 136 pp.
28. *Verkhoshansky Yu*. Sei principi della preparazione fisica speciale. SdS/Rivista di cultura sportiva, Anno XV, #.35, 1996.
29. *Verhoshansky Y*. Mezzi e metodi per l'allenamento della forza esplosiva. Tutto sul metodo d'urto. Societa Stampa Sportiva, Roma, 1997, 160 pp.
30. *Verkhoshansky Yu*. Todo sobre el metodo pliometrico (Medios y metodos para el entrenamento y la mejora de la fuerza explosiva). Editorial Paidotribo, Barcelona, 2000, 191 pp.
31. *Verkhoshanski Yu*., Viru A. Some regularities of the long tine adaptation of the organism of the sportsman to physical loads. Physiology of the Man (Russ), Moscow 1987, 5: 811-818.
32. *Viru A.* Hormonal mechanisms of adaptation and training (Russ). Leningrad: Nauka, 1981.
33. *Yachtshaninas J., Verkhoshansky Yu.*, Scurvidas et al. Influence of various levels of a preliminary muscle strain on explosive effort in the isometric regime. Theory and Practice of Physical Culture (Russ). 1988, 4:41-43.
34. *Yessis M.* Secrets of Soviet Sport Fitness and Training. Arbor House, New York, 1987.

Journal of Sport Strength Training Methodology

March 2007 - N° 2

Electronic publishing www.verkhoshansky.com

Edited by Natalia Verkhoshansky