



Influence of the method of postactivation stimulation on the performance of ski jumping from springboards of various capacities by highly qualified athletes

UDC 796.015.134



PhD **A.S. Kryuchkov**^{1, 2}

Postgraduate student **I.A. Avvakumova**³

PhD, Associate Professor **T.V. Fendel**³

PhD, Associate Professor **D.A. Zubkov**³

¹The Federal Training Sports Center of the representative teams of Russia, Moscow

²Federal Science Center of Physical Culture and Sport (VNIIFK), Moscow

³Tchaikovsky State Physical Education and Sport Academy, Tchaikovsky

Corresponding author: fendel82@mail.ru

Received by the editorial office on 20.10.2023

Abstract

Objective of the study was to evaluate the impact of exercises performed by highly qualified female athletes within the framework of the post-activation stimulation method on the performance of ski jumping from springboards of various powers.

Methods and structure of the study. The pedagogical experiment was conducted with the participation of six representatives of the Russian national ski jumping team (4 masters of sports, 1 international master of sports and 1 honored master of sports). The experiment was carried out in the 2023–2024 season (preparatory period). The effectiveness of performing jumps from springboards of various power was assessed by the method of control tests (ski jump from a springboard). The final score included a range score and a technique score.

The influence of three sets of exercises performed within the framework of the post-activation stimulation method on the performance of jumping from springboards of various power was assessed using the Spearman pair correlation method.

Results and conclusions. In the process of preparing to perform low-power springboard jumps (K-60), it is advisable to use exercises performed using the post-activation stimulation method, aimed at increasing the power of muscle contraction (in this case, the jump distance increases) and aimed at improving the biodynamics of movement (technique scores increase).

In the process of preparing for performing medium-power springboard jumps (K-90), it is advisable to use any variants of the post-activation stimulation method (they have a positive effect on both the jump distance and marks for technique), and for performing high-power springboard jumps (K-120) it is advisable to use exercises performed by the method of post-activation stimulation, aimed at improving technique (in this case, the jump distance increases) and aimed at improving the biodynamics of movement (scores for technique increase).

Exercises performed by the post-activation stimulation method have different effects on the performance of highly qualified female athletes ski jumping from springboards of varying power.

Keywords: *ski jumping, post-activation stimulation method, ski jumping technique, jump distance.*

Introduction. Technical training using springboards of various powers has its own periodization within the preparatory period: from June to October, athletes successively move from training on the K-60 springboard to training on the K-90 springboard, after which it is time to train on the K-120 springboard. Taking into account the fact that strength training in this period is often accompanied by a temporary decrease in the functional capabilities of the athlete's neuromuscular system in the phase of acute and delayed

adaptation lasting from 24 to 72 hours [3, 4, 6], and training on springboards within the microcycles of the preparatory period are carried out almost daily, a contradiction arises between the need, on the one hand, to expand the working capabilities of the jumper's neuromuscular system through strength exercises, and on the other hand, the increasing risks of reducing the effectiveness of performing a jump and consolidating in the memory erroneous variants of the technique of performing it, caused by reduced functionality skeletal



muscles. To resolve this contradiction, it is advisable to include in the training microcycle such exercises and methods of their implementation that would level out the negative functional “background” of delayed recovery after strength exercises and ensure the operational readiness of the neuromuscular system for the demands of the springboard. Experts call one of these methods the method of post-activation stimulation, which, depending on the form of movements and the mode of muscle work, provides for the updating of motor images (muscle-joint sensations along the leading variables of movement) in the athlete’s memory, accelerates the formation of a motor program for muscle activation and forms advanced readiness neuromuscular system to the manifestation of high power of working efforts. In addition, strength exercises performed using the post-activation stimulation method can enhance the positive effects of “traditional” strength exercises in the delayed recovery phase on ski jumping technique and motor performance [2, 5]. The use of this method in sports practice is limited by the lack of scientific information about its differentiated effect on the technique and distance of jumps performed from springboards of various powers by highly qualified athletes, which makes this research relevant.

Objective of the study was to evaluate the impact of exercises performed by highly qualified female athletes within the framework of the post-activation stimulation method on the performance of ski jumping from springboards of various powers.

Methods and structure of the study. The pedagogical experiment was conducted with the participation of six representatives of the Russian national ski jumping team (4 masters of sports, 1 international master of sports and 1 honored master of sports). The experiment was carried out in the 2023-2024 season (preparatory period).

At three educational and training events within the framework of the general preparatory and special preparatory stages, the method of post-activation stimulation was used using three options for specially de-

signed sets of strength exercises, differing in the form of movements and the mode of muscle work:

1. as a method aimed at correcting errors in technique - in this case, they imitated the working poses of a jumper with an explosive isometric type of muscle contraction, after which they moved on to performing jumps from springboards of varying power;

2. as a method aimed at increasing the power of muscle contraction - in this case, a combination of strength exercises with significant external resistance (80% of 1 RM) and a non-specific jumping exercise was used, and training on the springboard began after 4 - 5 hours;

3. as a method aimed at improving the biodynamics of movement, in this case one of two options was used:

- performed a combination of two jumps, the first of which was performed with a rubber shock absorber pulling the athlete upward (with an artificial increase in vertical speed), and the second from an isometric “start” position without an artificial “accelerator”;

- performed a combination of two speed-strength exercises (a squat with a barbell on the shoulders (weight 20 - 30% of 1 RM), performed in the reactive mode of muscle work, and a jump simulating the repulsion phase from the table on a springboard from an isometric “start” position). The time interval between two exercises in combinations was minimal, and springboard jumping was started 5–10 minutes later, after using the post-activation stimulation method [1, 2].

All three sets of strength exercises were used 3 times at each of the three training events.

In addition to the post-activation stimulation method, other (“traditional”) methods of strength training were used according to the training plan: at the first training events, strength exercises were performed in the hypertrophy and maximum strength mode; on the second training events - in the explosive force mode, on the third training events - in the mode of maximum and explosive force.

During the study, 24 training sessions on the diving board were analyzed and 180 human examinations were performed.

The influence of modifications of the post-activation stimulation method on the performance of ski jumping from springboards of various powers in highly qualified athletes

Springboard power	Direction of the post-activation stimulation method					
	To correct errors in technology		To increase the power of muscle contraction		To improve the biodynamics of movement	
	Distance	Technique	Distance	Technique	Distance	Technique
K-60	0,61	0,65	0,82*	0,74*	0,56	0,72*
K-90	0,78*	0,72*	0,82*	0,68	0,89*	0,86*
K-120	0,7*	0,64	0,62	0,55	0,68	0,74*
Direction of “traditional” power loads	For hypertrophy and development of maximum strength		To develop explosive strength		To develop maximum and explosive strength	

Note: * statistically significant Spearman rank correlation coefficients at $\alpha=0.05$.



The effectiveness of performing jumps from springboards of various power was assessed by the method of control tests (ski jump from a springboard). The final score included a range score and a technique score.

The influence of three sets of exercises performed within the framework of the post-activation stimulation method on the performance of jumping from springboards of various power was assessed using the Spearman pair correlation method.

Results of the study and discussion. It was revealed that the use of the post-activation stimulation method has a different effect on the performance of highly qualified athletes performing ski jumps from springboards of various powers (see table).

It was found that exercises performed by the method of post-activation stimulation, aimed at correcting errors in technique, help to increase the distance of jumps performed on springboards of medium and high power (K-90 and K-120, respectively), and have a positive effect on the technique of jumps performed from a springboard K-90 and do not affect the performance of a low-power ski jump (K-60).

It was found that exercises performed by the method of post-activation stimulation, aimed at increasing the power of muscle contraction, help increase the distance of jumps performed on springboards of low and medium power (K-60 and K-90, respectively), and have a positive effect on the technique of jumping performed from a springboard K-60 and do not affect the performance of a high-power ski jump (K-120).

It was determined that exercises performed by the method of post-activation stimulation, aimed at improving the biodynamics of movement, contribute to an increase in marks for the technique of jumps performed on springboards of any power (K-60, K-90 and K-120) and have a positive effect on the distance of the jump performed with springboard K-90.

Conclusions.

Exercises performed using the post-activation stimulation method have different effects on the performance of highly qualified female athletes performing ski jumps from springboards of varying power.

In the process of preparing to perform low-power springboard jumps (K-60), it is advisable to use exercises performed using the post-activation stimulation method, aimed at increasing the power of muscle contraction (in this case, the jump distance increases) and aimed at improving the biodynamics of movement (scores for technique increase).

In the process of preparing to perform medium-power springboard jumps (K-90), it is advisable to use any variants of the post-activation stimulation method (they have a positive effect on both the jump distance and marks for technique). The maximum correlation values were recorded in the case when the post-acti-

vation stimulation method was aimed at improving the biodynamics of movement.

In the process of preparing to perform high-power springboard jumps (K-120), it is advisable to use exercises performed using the post-activation stimulation method, aimed at improving technique (in this case, the jump distance increases) and aimed at improving the biodynamics of movement (scores for technique increase).

The maximum response (positive changes in both technique and jump distance) to the use of various modifications of the post-activation stimulation method is observed in medium-power springboard jumps (K-90); minimal – in high power ski jumping (K-120).

To improve the technique of ski jumping from springboards of various powers, the maximum effect is achieved by using a modification of the post-activation stimulation method aimed at improving the biodynamics of movement; to increase the range of jumps - a modification aimed at increasing the power of muscle contraction.

References

1. Avvakumova I.A., Fendel T.V., Kryuchkov A.S., Barinov M.V. Metod postaktivatsionnogo stimulirovaniya v sportivnoy podgotovke vysokokvalifitsirovannykh prygunov na lyzhakh s trampolina. *Nauka i sport: sovremennyye tendentsii*. 2023. Vol. 11. No. 2. pp. 45-53.
2. Avvakumova I.A., Fendel T.V., Kryuchkov A.S., Barinov M.V. Primneneniye metoda postaktivatsionnogo stimulirovaniya v silovoy podgotovke vysokokvalifitsirovannykh prygunov na lyzhakh s trampolina. *Nauka i sport: sovremennyye tendentsii*. 2023. Vol. 11. No. 2 pp. 54-62.
3. Armstrong R.B. Initial events in exercise-induced muscular injury. *Medicine and science in sports and exercise*. 1990. Vol. 22. No. 4. pp. 429-435.
4. Lieber R.L., Fridén J. Morphologic and mechanical basis of delayed-onset muscle soreness. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*. 2002. Vol. 10. No. 1. pp. 67-73.
5. Golas A., Wilk M., Stastny P. et al. Optimizing half squat postactivation potential load in squat jump training for eliciting relative maximal power in ski jumpers. *The Journal of Strength & Conditioning Research*. 2017. Vol. 31. No. 11. pp. 3010-3017.
6. Pyne D.B. Exercise-induced muscle damage and inflammation: a review. *Australian journal of science and medicine in sport*. 1994. Vol. 26. p. 49.