Development of hypertrophy in ski jumpers

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Abstract

Objective of the study was to theoretically substantiate the feasibility of developing hypertrophy in ski jumpers.

Methods and structure of the study. The main research method was the method of analysis and generalization of scientific and methodological literature data.

Results and conclusions. During the study, the following conclusions were made: exercises with a hypertrophic effect are an effective tool for increasing the strength potential of skeletal muscles; hypertrophic "response" of the athlete's skeletal muscles, as a response to power loads, depends on two groups of factors: congenital and acquired; strength exercises used for the purpose of myofibrillar hypertrophy must meet two requirements: to ensure the involvement of the maximum number of muscle fibers in the composition of the working (loaded) muscles and to ensure the maximum tension of each muscle fiber; an increase in myofibrillar hypertrophy requires special training to transform the strength effect into the power of motor efforts; skeletal muscle hypertrophy threatens to reduce the speed of the competitive exercise in ski jumpers.

Keywords: *strength abilities, hypertrophy, ski jumping.*

Introduction. The logic of strength training in ski jumping is in many ways similar to the logic of strength training in the absolute majority of speed-strength sports: first, muscle hypertrophy is developed, then the emphasis is shifted to the development of maximum strength, and, finally, a transition is made to the development of speed-strength abilities (power) [6]. This logic solves the problem of transforming the maximum strength, developed, among other things, with the help of exercises with a hypertrophic effect, into an impulse of strength, manifested in ski jumping.

The force impulse (I) is determined by the product of muscle force and the time of its manifestation (I=F•t) and is the most important factor in the mechanical efficiency of ski jumping [4].

The morphological basis of the force impulse is determined by the ratio of fast (FMF) and slow (SMF) muscle fibers in the composition of the working muscles, as well as the cross-sectional area of the muscles (that is, their hypertrophy) [5].

Regarding the expediency of hypertrophy among specialists who train ski jumpers, there is no consensus today. There are concerns that myofibrillar hypertrophy may reduce the rate of muscle shortening and adversely affect the aerodynamics of the jump [1, 2].

Thus, it can be stated that the use of exercises with a hypertrophic effect in the strength training of ski jumpers needs scientific justification and additional and comprehensive research.

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Results of the study and their discussion. Hypertrophy is one of the factors in increasing the power potential of a ski jumper, so we consider it appropriate to clarify the following:

– the presence of a hypertrophied muscle does not guarantee the manifestation of a high power of its work in a competitive motor mode [3], which necessitates a specialized stage of "transformation" of the accumulated muscle power potential into the performance of a competitive movement,

– for ski jumpers, it is advisable to develop, first of all, the hypertrophy of fast muscle fibers (FMF), which have the ability to develop significant efforts at high speed movements in the phase of repulsion from the take-off table.

The analysis of the scientific and methodological literature made it possible to identify two groups of factors that affect the hypertrophic response of skeletal muscles under the influence of strength exercises: congenital and acquired (the latter include biomechanical and didactic) (see figure).

Let us present a brief description of the selected factors.

The group of congenital factors included:

– the ratio of FMF and SMF (an athlete with a large percentage of FMF has an advantage in the hypertrophic response of muscles to a power load than an athlete with a large percentage of SMF),

– the dominant side of the body (the muscles of the dominant side of the body have priority in innervation from the CNS and may show a more pronounced response to hypertrophic training).

The group of didactic factors included:

– the ability to recruit 100% MU (the more high-threshold motor units (MU) are involved in the exercise, the higher the hypertrophic response),

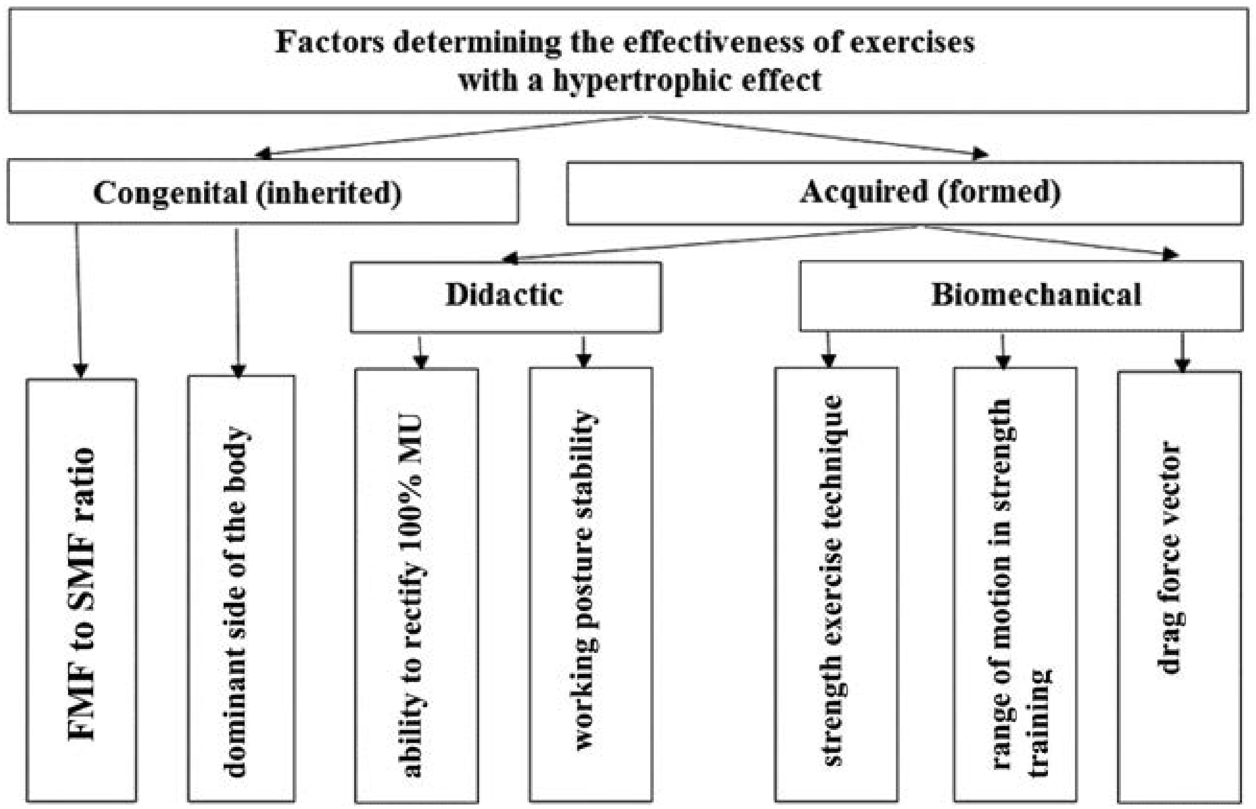
– stability of the working posture (an unstable posture limits the innervation of the muscles from the side of the central nervous system, which reduces the hypertrophic stimulus).

The group of biomechanical factors included:

– strength exercise technique (changing technique causes a redistribution of load among muscle groups, which causes selectivity of hypertrophy of specific muscles),

– amplitude of movement in a strength exercise (with an increase in amplitude, the amount of muscle stretch increases, causing increased mechanical stress and the creation of a hypertrophic stimulus),

– vector of action of the resistance force (depending on the direction of action of the external resistance force, there is a selectivity of muscle hypertrophy with a similar vector of traction force).



Factors affecting the hypertrophic "response" of skeletal muscles during strength training

With regard to the methodological aspects of the development of hypertrophy, a number of authors agree that myofibrillar hypertrophy is caused by traumatization of contractile elements in the process of strength work [3, 4, 6].

At the same time, foreign experts single out the amount of mechanical tension in muscle fibers as the leading hypertrophic stimulus [7, 9]. According to the authors, the creation of maximum mechanical stress on muscle fibers requires:

– recruitment of a significant number of high-threshold MU,

– decrease in the speed of movement in the joints.

It is possible to achieve the recruitment of high-threshold MUs both through the use of a significant amount of external resistance (more than 85% of 1 RM), and due to unlimited weighting (70-75% of 1 RM), performed to “failure” [4, 6, 8] .

The task of reducing the speed of motor action as a factor in increasing the level of mechanical tension in muscle fibers can be solved in two ways: natural or artificial slowing down of movement. “Artificial” deceleration involves conscious control of speed due to the coactivation of agonist-antagonist muscles, which can adversely affect the speed of ski jumping [10].

The methods of “natural” deceleration include:

– high external resistance, including rubber shock absorbers and steel chains, which increase the load in the final part of the working amplitude of the strength exercise;

– performing the exercise “to failure” within the framework of the approach,

– increased coordination complexity of the power exercise (unstable support, asymmetric resistance, etc.).

Given that one of the key negative consequences of muscle hypertrophy in ski jumpers is a decrease in the rate of contraction of muscle fibers, we suggest adhering to the following recommendations:

– apply the value of external resistance not lower than 80% of 1 RM, which will eliminate the need to perform each power approach “to failure”,

– increase the duration of rest, both between sets within a workout (3-4 minutes), and between workouts, during which exercises “to failure” were performed (three to four days),

– do not overestimate the volume of strength exercises (in a weekly cycle, the volume of strength work per muscle group should not exceed 10-15 approaches).

Conclusions. Exercises with a hypertrophic effect create a morphofunctional basis for increasing maximum strength.

Strength exercises must meet two requirements: due to the magnitude of external weights, ensure the involvement of the maximum number of muscle fibers in the composition of the working (loaded) muscles and ensure the creation of maximum tension for each muscle fiber due to the low speed of weight movement.

An increase in muscle power potential due to hypertrophy requires the subsequent transformation of the hypertrophic effect into the power of motor efforts through the use of high-speed exercises.

Muscle hypertrophy poses a threat of reducing the angular velocity in the repulsion phase on the take-off table, which requires caution in performing strength exercises by jumpers to “failure”, with a shortened rest pause, as well as in an increased volume of such exercises.

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