

## Special Relaxation Preparation for Increasing Athletes' Resistance to Extreme Impacts

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**Abstract:** The problem of resistance to physical overload in extreme conditions of sports activity is one of the most acute problems of sports physiology and medicine. Longitudinal studies using computer polymography, with the participation of athletes from first-class students to international masters, have been undertaken. The approaches and principles of special relaxation training aimed at increasing the body's resistance to extreme activities were found. In this direction, a new integrated system of special physical and functional training should be developed. When it is created, from childhood, it is necessary to purposefully pursue the versatile formation and improvement of inhibitory-relaxation processes and the improvement of the protective mechanisms of the body.

### 1. Introduction

The problem of transferring physical overload in extreme conditions of sports activity should be understood as one of the acute problems in modern pedagogy, physiology, and sports medicine [9, 11, 12]. The lack of scientific knowledge in this direction hinders the solution of a number of significant problems. This includes issues such as: preventing injuries and the health of people involved in sports, increasing the intensity of the training process, increasing its effectiveness, as well as creating advanced techniques for recovering people involved in sports.

At the same time, the researchers found sufficient data that indicate a large variability in the manifestation of the phenomenon of the resistance of individuals to the influence of environmental factors. In addition, the characteristics of the body's resistance to the influence of requirements to ensure an urgent increase in the degree of physical performance, or the manifestation of a "second breath," for a long time remained poorly lit and difficult to explain from the standpoint of a single human body.

### 2. Materials and Research Methods

In order to study the peculiarities of regulation and coordination of motor actions, monitoring the data of excitation and contraction of skeletal muscles, the functional state of the central nervous system and neuromuscular system (NMS), the method of computer polymography proposed by Yu. V. Vysochin was used [2]. This approach is based on the simultaneous graphic fixation of bioelectric activity (electromyograms), lateral hardness (rigidity, tonograms), and strength (dynamograms) of different groups of studied muscles under free tension and relaxation in isometric mode. Six hundred representatives of various sports and skill levels from the first category to masters participated in the studies.

### 3. Results

Opportunities for considering the studied problem appeared as a result of lengthy research by Yu. V. Vysochin [2], where the presence of a relaxation mechanism of urgent adaptation was revealed. Later, it was called the relaxation mechanism of the urgent mobilization of protection (RMUP) of the body from extreme influences [3]. The essence of the action of this mechanism is as follows. In the context of the influence of the hypoxia factor on the athlete's body, which occurs during intense physical exertion, the body activates the inhibition of the functioning of the central nervous system. There is a decrease in its excitability, a sharp decrease in the number of trace potentials of the aftereffect of the bioelectric activity of relaxing muscles. That is, during this period, the normalization of the relaxation process and a significant (sometimes up to 70-80%) increase in its speed occurs. Studies have found that the activation of the RMUP contributes to the onset of the effect of "emergency improve efficiency." It was also revealed that, according to the functional activity or power of the RMUP, the study participants are divided into approximately three types of activity (with high, medium, and low degrees). And it is the activity index of RMUP, estimated by the degree of increase in the speed of voluntary muscle relaxation (SVR) that determines the individual level of body stability during urgent adaptation to physical activity and the influence of other environmental factors [4].

Subsequent work on this problem, taking into account the data of the theory of functional systems of P. K. Anokhin [1], led to the conclusion that the RMUP directly affects the most complex intrasystem and intersystem interactions of body processes. RMUP, to a large extent, determines the value of the total indicator of the beneficial effects of body systems, the level of physical performance, and resistance to extreme influences. Consequently, we have the right to classify the RMUP as a functional system with the following name: "non-specific inhibitory-relaxation functional system of urgent adaptation and protection" (IRFSP) of an organism from extreme environmental disturbances [5].

IRFSP, from the point of view of the theory of P. K. Anokhin, like other functional systems (FS), contains the main central and peripheral mechanisms. According to the data obtained [10], the main components (effectors) of FS for oxygen supply are the cardiovascular and respiratory systems, and the final useful result (antihypoxic effect) arises mainly as a result of an increase in the actions of such effectors. In IRFSP, on the contrary, the main rule is the economization of energy costs and the functions of effectors, and the central nervous system inhibitory systems and relaxation processes of the neuromuscular system are the main components. At the same time, the work of IRFSP is not determined by the actions of either the cardiovascular or respiratory systems. These powerful effectors play a decisive role in the functional systems of homeostasis.

Moreover, studies [4, 7, 8] indicate that with the revitalization of IRFSP, the functional load on the energy supply systems of muscle work becomes lower. Reducing the values of heart rate, BR, blood pressure, the amount of lactate in the blood, creatinine, and stress hormones speak about this. At the same time, due to significant energy savings of the mentioned functions, a clear increase in the integral indicator of the body's overall efficiency is observed, and physical performance is growing significantly.

Differences in the interactions of IRFSP with other FS are important here. Yu. V. Vysochin [2] managed to identify a difference from the known functional systems of homeostasis. IRFSP, not being involved in the competition for effectors, can simultaneously "work" with other leading FS and significantly increase the usefulness of their activities. The body of people involved in sports, with the mild activity of IRFSP, in such cases, tries to eliminate disturbances in homeostasis and hypoxia by continuing to increase the excitability of the central nervous system and increase the intensity of the functions of oxygen transport systems. At the same time, our data [6-8] say that the path described above is largely unprofitable and ineffective due to the influence of a number of factors grouping into a kind of isolated "vicious circle." Its essential element is a high level of central nervous system excitation.

### 4. Discussion

It becomes clear that against the background of large, excessive energy expenditures and low rates of restoration of their own energy reserves, in this mode, the athlete's body cannot maintain a sufficient level of performance for a long time. Manifestations of the effects of acidosis and hypoxia are intensely increasing; accumulations of unoxidized metabolites occur; contractile and relaxing muscle indices become weaker; performance level is getting lower. In addition, 80-90% of students in this group have different

characteristics of overvoltage, injuries and disorders of the musculoskeletal system, myocardial dystrophy, hypertrophy, and other disorders in the heart [3, 4, 7, 8].

The interactions of physiological processes in the body during a period of intense muscle activity occur in a completely different way. Here, students develop IRFSP with great activity, from the moment when the responsible “result receptors” “record” the occurrence of homeostasis disorders. The occurrence of activity of inhibition systems causes a decrease in the state of excitation in the central nervous system and quickly stops the influence of adverse results of high excitability.

As a result of comparing the literature data and our experimental results, we were able to identify an important direction for solving the problem of increasing the effectiveness of the process of training athletes. This is a versatile improvement in the relaxation parameters of the muscles of athletes and the directed development of the relaxation type of long-term adaptation (RTLTA). As a result, a new goal arises, namely the justification of the basic approaches and principles of building the training process by using the special relaxation training techniques, which are aimed at increasing the effectiveness of this process at all stages of the formation of sports professionalism.

## 5. Conclusion

Research data suggests that under the influence of a diverse set of adaptogenic stressors, the activity of IRFSP increases. At first, a short-term (after each exposure), and then a steady (with prolonged use) increase in the level of muscle SVR and the formation of RTLTA occurs. Thus, at the same time, there is ensuring the achievement of the best result, in terms of a combination of efficiency measures and adaptation of complex biological systems, namely: 1) a high level of energy-saving; 2) a high-speed recovery processes; 3) stability of transfer of physical and psychoemotional overloads; 4) saving the level of health and sports achievements; 5) a high degree of preservation of physical performance and technical and tactical preparedness of students.

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