

MYORELAXATION IN SPECIAL PHYSICAL CAPABILITY OF ATHLETES

¹Denisenko Yu.P., ²Yatsenko L.G.

¹ Naberezhnye Chelny State Pedagogical University, Naberezhnye Chelny, Russia,

²St.-Petersburg State Technological University of Vegetative Polymers, St.-Petersburg, Russia,

E-mail: yprof@yandex.ru

At the present time a number of various ways of sportspersons' special physical capability based mainly on training and competitive loadings ramp up. They are effective enough to reach the main goal, but none of them provides sportspersons' health safety. Moreover, with the increase in volume and intensity of the loadings, which in sport have almost reached their limits, the sport traumatism and morbidity rate grow progressively. Proceeding from this, there was an evident necessity for the search of conceptually new ways for a simultaneous solution of these two the most complex and, in the opinion of many research workers, almost incompatible problems - the problem of achieving the highest levels of special physical working capacity, and the problem of sportspersons' health maintenance and improving - associated by us into one general problem of human motor activity efficiency enhancement. Therefore it is necessary to physiologically substantiated the basic methods and principles of special relaxation training, directed on increase of efficiency of process of training of sportsmen at all stages of the development of athletic skills.

Key words: extreme conditions, protection functional system, muscle relaxation rate, central nervous system, relaxation

INTRODUCTION

Professional tendencies of the last years are connected with steady growth of loadings in practically all kinds of human professional activities. The consequence of this is often the disturbance in the work of regulatory mechanisms, that essentially decreases the level of physical capability and can result in various unfavorable vegetative shifts in health state [3, 6, 12], the problem of providing effective training of sportspersons in extreme conditions of life activity and creating functional preconditions for health saving being more and more topical. One of the ways to solve this problem is attracting modern effective and physiologically substantiated technologies with the simultaneous use of the functional state correction and complex diagnostics rational system. Such an approach allows widening the diapason of compensatory abilities of the body against the maximal volume and intensity of professional and psycho-emotional loadings. The provision of optimal adaptation to muscular loadings can appear one of the conditions for the health level maintenance and professional mastery quality increase [6, 10, 11, 13].

Certainly, the given problem acquires a special meaning in modern conditions of the human professional activity. It finds its reflection in a series of works connected with the idea of loading criticism both in sport and other areas of professional activity [7, 13].

Together with traditional approaches a great experience of using a whole range of non-traditional means (baro-chamber, hypoxic and hyper-pyretic effects, special breathing exercises, methods of biological feedback, methods of active self-adjustment and relaxation, etc.) within the system of sport training has been accumulated. Together with that it is necessary to note that among the non-traditional means of effect on the functional state of the human body a careful attention has lately been paid to myorelaxation methods, which such features as action safety, relative easiness of effect achieving and not high financial expenditures are typical of. Relaxation, on some authors' opinion, is considered as an alternative or compliment to the functional state correction [1, 14, 16]. That is why it is often presented as a means of prophylaxis, correction and emotional stresses elimination. Thereat, as many note [16 and others], it is the leading one in the series of methods allowing achieving necessary changes in the body's functional state.

In physiology an active process of muscular tone and psycho-emotional tension decrease [8, 14, 17] are meant by relaxation. At relaxation there appears a trophotropic state, the level of anxiety, psychological and physiological response to stress effects decreases. Besides, relaxation is attended by a considerable reduction of afferent and efferent impulsation. As a consequence we can speak on the fact that the introduction of relaxation methods aimed at the prophylaxis, correction and negative psycho-emotional states elimination into practice can promote adaptive capabilities of the body [6, 9, 15].

The relaxation methods have also found their application in the correction of a range of pathological states, hypertensive disease treatment, acute and chronic painful states taking down inclusive of sport activity [2, 4, 16]. The state of relaxation lies in the foundation of meditative methods. Meditation and relaxation exercises have a wide diapason of application, most often they are used in transcendental medicine [8, 9, 10, 14].

The value of muscles relaxation function in human sport and labour activities is difficult to overestimate. In a series of works [1, 6, 9, 18, 19] a healthy influence of special exercises enhancing the function of skeletal muscles relaxation on the central nervous system, visceral organs' and systems' activities, rational blood circulation types formation, motion coordination, tempo, stamina, technical skills, special physical working capacity and sport results growth were proved.

The investigations proving the leading role of inhibitory systems of the central nervous system and skeletal muscles' arbitrary relaxation rate in the most important manifestations of life activity of the whole body: in the mechanisms of timed and long-term adaptation to more physical, hypoxic and hyper-pyretic loadings; in the mechanisms of heart adaptation and various blood

circulation types formation; in the mechanisms of muscles blood supply and muscular activity energy supply; in the mechanisms of physical overwork stability improving, prevention of risks, traumas and diseases, and also in the body's mechanisms of defence from extreme conditions or factors and sportspersons rehabilitation [4, 5, 7, 16], are especially meaningful, in our opinion.

It should also be noted that all the most effective methods of psycho-regulation, self-adjustment and auto-training used in special psychological preparation of sportspersons and the latest health-improving technologies [8, 14, 15] are based on relaxation.

METHODS

To study the mechanisms of regulation and coordination of arbitrary movements control the contractile and some relaxation characteristics of skeletal muscle, functional state of the central nervous system (CNS) and neuromuscular (NMS) systems we used the method of computer polomyography, designed by Yu.V. Vysochin, which is used for preparation of sportsmen of national teams of Russia and St.-Petersburg. Marked indicates its high informativeness and reliability [5, 6].

Polymyography is based on synchronous graphic recording of the bioelectric activities and strengths (in the form of the èlektomyogram and the dynamogram, respectively) of the quadriceps muscles of both thighs during their maximally rapid and strong contraction and relaxation in the isometric mode. When deciphering polymyograms, we estimated the rates of the motor reactions of contraction and relaxation; the rate of development and the strength of excitatory and inhibitory processes in the CNS; the inhibition-excitation balance in the CNS; the relative rate of voluntary muscle contraction, or the so-called explosive characteristics of muscles; the relative maximum voluntary muscle strength; the rate of voluntary muscle relaxation; and the general functional states of the muscles, CNS and NMS. In addition, we used the ratio between the relative maximum voluntary muscle strength and the rate of voluntary muscle relaxation to calculate the classification index of the type of long-term adaptation or individual development.

RESULTS AND DISCUSSION

In a series of experiments was attended by about 600 sportsmen of different skills. Summarizing the results of our longstanding research we can substantiate the main ways and principles of special relaxation training, aimed on higher effectiveness of training process of sportsmen at all stages of development of sport skills. Under effectiveness of motional activity we understand achievement of the highest levels of special exercise performance (SEP) at condition of total preservation and improvement of sportsmen's health.

Nowadays there are known different means of sportsmen's SEP improvement, based basically on increasing of training and emulative loads. They are quite effective for achieving the main target,

but none of them provides preservation of sportsmen's health. Moreover, when the amount and intensity of exercise stress increase, sport traumatism and morbidity increase progressively. As well as the amount and intensity of exercise stress in sport almost reached their limits already. There are well known different means of health improvement; most of them consider moderate physical activity of low intensity to have the leading health-improving role. However this approach does not contribute to progress in special exercise performance and sport results. That is why it was obviously necessary to find fundamentally new ways to solve these two very complicated problems at the same time - how to achieve the highest levels of special exercise performance and how to preserve and improve sportsmen's health. In opinion of many investigators, these problems are almost incompatible. We have combined these problems into one common problem - to make man's motional activity more effective. In several sets of experiments, in which sportsmen of different levels of proficiency and different specialization took part, we have found direct significant dependence between SEP and, of course, sport results and velocity of voluntary relaxation (VVR) of skeletal muscles [12]. In most kinds of sport (in 17 from 20) meaning of SEP in the progress of sport results, especially at the stage of higher sport mastery was considerably higher than meaning of contractile properties of muscles. In such kinds of sport as box, hockey, football, skating, decathlon and swimming SEP was not only leading, but also the only one of all polymyographical parameters, which defines qualification growth. In some kinds of sport (football, skating, decathlon, swimming), for example, maximum muscles force of the sportsmen of high level of proficiency was slightly (not authentic) lower, than at the sportsmen of lower level of proficiency. This fact in no way means that contractile properties of muscles do not play any role in efficiency mechanisms. On the contrary, they are very important because muscles contraction provide physical action. And duration of this work, i.e. exercise tolerance and, correspondingly, special exercise performance considerably depend on relaxation characteristics of muscles. That is why our data should be considered only as a proof of the fact that the level of development of muscles contractile properties, acquired, for example, by candidates to master of sports and 1-grade sportsmen in the process of long-term sport training, is already sufficient for achieving the top of sport skills; and achievement of this top is limited mainly by the level of muscles VVR.

The above-mentioned facts, in our opinion, are quite important for understanding of the role of myorelaxation in increase of SEP in all kinds of sport activities, because in each of them there are very high requirements in velocity, velocity tolerance or coordination, or different combination of these qualities, which directly depend on muscles VVR.

However the most important role in understanding and interpretation of physiological mechanisms of SEP and tolerance to physical activity, especially in extreme conditions, is played by common nonspecific inhibitory-relaxation functional protective system (IRFPS) of organism against extreme

impacts and influence of its activity (capacity) on forming of three different types of long-term adaptation. Experimentally big advantages of relaxation type of long-term adaptation were proved; this type of adaptation develops at sportsmen with high VVR of muscles and highly active IRFPS, and it provides achievement of the highest levels of exercise performance and preservation of health in extreme conditions at the same time. We also ascertained that heightened excitability of CNS is the main factors limiting the capacity of IRFPS [8, 12].

The relaxation type of individual development is the most profitable in all intents. For relaxation type persons the CNC exciting and inhibitory processes' balance, high rate of muscles' relaxation, excellent regulation and movement coordination, perfect reaction to moving objects, that guarantees the sport, everyday and street traumatism minimization, are specific. The most economical - eukinetic circulation type prevails in them, the cardiac performance high economical efficiency, the minimal level of energy consumption, a decreased concentration of energy exchange metabolites in blood, a high rate of reparative processes and resynthesis of energy resources, excellent physical performance and stamina prevail in them. They excel with an increased stress tolerance, twice or trice as seldom they are subject to overwork and diseases, as compared to the hypertrophic type persons. Relaxation type sportsmen, as contrasted with hypertrophic type ones, enjoy considerably greater sport longevity, stand physical and psychological stresses far easier, are subject to various overworks, traumas and diseases 8-10 times as seldom and achieve the highest sport results [5, 8, 11].

With the increase VVR and the formation of relaxation type of long-term adaptation the sport traumatism decreases progressively from 95-100% (at the VVR less than 4,01/sec) to 5-0% (at the VVR more than 9,01/sec) and, therefore, their health improves the same progressively. Our multiyear investigations testified that even in the most traumatic kinds of sport, one can almost fully make away with injuries (except for the traumas emerging at gross violation of game rules by the rival) due to the correct organization of the work-out session aimed at the CNC nervous processes' balance normalization, muscles' VVR increase and long-term relaxation type formation.

In the next series of experiments 320 schoolchildren and qualified sportsmen (aged from 6 to 32) took part. As an adaptogenic factor a veloergometric exercise of maximal intensity was used.

At the age of 6-11 already a very high muscles' VVR was registered. Then it gradually decreased and by 14 years old became minimal, having deteriorated by 22, 3%. After 14 the muscles' VVR started gradually increasing again up to the age of 29, and the early age (6-11) VVR level was achieved only by 20-25. The age-dependent dynamics of the IRFPS was analogous. Then it progressively decreased (by 12, 6%) achieving its minimal values by 13-15 years old. After 14-15 years old the IRFPS capacity increased and by 23-25 years old took its peak level, and by 29 years old decreased a little. The same character of these parameters' dynamics was observed in women as

well, only their decrease at the age of 13-15 was less vividly expressed [4, 7].

CONCLUSION

The above-mentioned facts, in our opinion, are quite important for understanding of the role of myorelaxation in increase of SEP in all kinds of sport activities, because in each of them there are very high requirements in velocity, velocity tolerance or coordination, or different combination of these qualities, which directly depend on muscles VVR.

It should also be said here about the VVR highly authentic correlation relationships with all the principal components of motion coordination and sport results in various sports. The data for a significant influence of the VVR on the contractile muscles' properties realization degree also deserve attention. The enumerated facts, from our point of view, are meaningful enough to understand that important role, which is played by myorelaxation in the special physical capacity growth in all kinds of sport activity and sportspersons' health maintenance.

In the conclusion we will note that it is necessary development of a brand new complex system of special physical and functional training, the use of which from the early child age will provide the all-round development and perfection (training) of inhibitory-relaxation processes, one's own defence mechanisms and formation of the best rational types of long-term adaptation and individual development for an organism.

References:

1. Aivazyan T.A. Relaxation therapy using biological feedback in treatment of hypertension patients // *Biomangement // Theory and practice* - Novosibirsk, 1988, pp. 133-141.
2. Bayevsky R.M., Motylyanskaya R.Ye. Cardiac rhythm in sportspersons - M.: P&S, 1986, p. 144.
3. Balsevich V.K. Human ontokinesiology - M.: Theory and practice of physical culture, 2000, p. 275.
4. Vysochin Yu.V., Denisenko Yu.P., Yatsenko L.G. Physiology, medicine, pharmacology, high technologies, the theory, practice: the collection of articles of the Fourth international scientifically - practical conference «The high technologies fundamental and applied researches in physiology, medicine, pharmacology».- SPb, 2012, v. 1, p.p. 188-190.
5. Vysochin Yu.V. Myorelaxation in mechanisms of orthopedic injuries // *Sport and Nation's health: Collection of scientific works*, SPb, 2001, pp. 74-84.
6. Vysochin Yu.V. Physiological mechanisms of defence, stability and physical working capacity improving in extreme conditions of sport and professional activity: Thesis of Dr. Sc. (Medicine) - L.: HMA named after S.M. Kirov, 1988, p. 550.
7. Vysochin Yu.V., Denisenko Yu.P. Modern ideas on physiological mechanisms of terminable adaptation of sportspersons' body to physical loadings effects // *Theory and practice of physical culture*. -2002, N7, pp. 2-6.
8. Vysochin Yu.V., Denisenko Yu.P., Health as national property // *Collective monograph*. – SPb.: SAPC named after P.F. Lesgaft 2010. – p. 669.

9. Vysochin Yu.V., Denisenko Yu.P., Yatsenko L.G. The contemporary concepts of structural and functional organization of the neuromuscular system and of the contraction and relaxation mechanisms of skeletal muscles // pedagogiko-psikhologicheskie i mediko-biologicheskie problemy fizicheskoi kultury i sporta (<http://kamgfk.ru/magazin/journal.htm>).- 2011.- N4 (21)
10. Vysochin Yu.V., Lukoyanov V.V. Active myorelaxation and self-adjustment in sport: Monograph -SPb.: SAPC named after P.F. Lesgaft, 1997, p. 85.
11. Denisenko Yu.P. Myorelaxation in football players' training system: Synopsis of thesis of Dr. Sc. (Biology) - M, 2007, p. 48.
12. Denisenko Yu.P. Relaxational characteristics of skeletal muscles in increase of physical working capacity of football players // Vestnik sportivnoi nayki, 2007, N1, p. 27-30.
13. Platonov V.N. Adaptation in sport - Kiev: Zdorovye, 1988, p. 257.
14. Sentyabrev N.N. Body's directed relaxation at intensive human muscular activity - Volgograd: VSAPC, 2004, p. 142.
15. Sudakov K.V. Main principles of functional systems' general theory // Functional systems of the body: Guidance / under the editorship of Sudakov K.V. - M.: Medicine, 1987, pp. 26-49.
16. Tkharevsky V.I. Blood supply of skeletal muscles at static and dynamic work: Synopsis of the-sis of Cand. Sc. (Medicine) - M., 1967, p. 24.
17. Huxley H.E. The mechanism of muscle contraction // Science, 1969, v. 164, p. 1356-1366.
18. Steg G. Efferent muscle innervation and rigidity // Acta Physiol. Scand., 1964, v. 61, suppl. 225. – P. 52.
19. Vallbo A.B. Cutaneous mechanoreception // Sixth International Congress of Electromyography in Stockholm, Sweden, 1979, p. 14-19.