RELAXAION TYPE OF LONG-TERM ADAPTATION TO AN INCREASE IN ORGANIZM STABILITY AGAINST PHYSICAL STRAIN

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INTRODUCTION

A problem of adaptation, stability, physical workability, and preservation of health and sporty longevity of a man in extreme conditions of activities, including sports, occupy a central place in modern physiology and medicine. Numerous medical-biological, clinical-statistic, and sociological researches point us to a great individual variability of people's adaptation to different extreme impacts and unfavourable conditions of environment.

These well-known facts encouraged researchers to look for optimal variants (methods) of classifying people into certain groups or types according to different criterions since the ages of Hippocrate. Most popular are classifications that accord to constitutional types of build, types of temper, higher nervous activity, personal anxiety, stress-stability, workability, blood flow, etc. One can name a number of such classifications, but none of them will not expose physical mechanisms of forming different types or strategies of long-term adaptation or explain reasons of a great individual variability, people's adaptability to inadequate terms of environment and activity.

Functional-temporal structure of flows of information, energy, materials, that provides for an optimal level of morphologic-functional organization of biosystem in inadequate terms of environment, can be described as a strategy of adaptation [1, 12]. According to analysis of numerous clinical-statistic and sociological studies that point to a great individual variability of people's adaptability to different terms of environment, V.P. Kaznacheyev [9] has come to a conclusion of an existence of different types of adaptation strategies and, particularly, two polar types of a strategy. According to the author, under an extraordinary changeability of an environment and expressed oscillations of inadequate conditions biosystems should possess a high reserve of stability. On the contrary, in terms of a continuous impact of unfavourable factors systems that are able to maintain necessary adaptive mechanisms during long periods will be most stable [10, 11].

Strategy of the first adaptation type can be named with a conditional term "sprint", and the second strategy can be named "stayer". Evolutionally-defined general strategies of biosystems' adaptation correspond to certain rhythms and intensity of external inadequate factors. It is considered that genetic mechanisms lie in a basis of adaptation strategies as well as constitution

types of people. However, the question of what specific mechanisms are responsible for forming different types of long-term adaptation strategies has not been studied sufficiently yet. In this case a significant problem remains unsolved. It is the problem of long-term prediction of biosystems' behavior when they are placed in different subextreme and extreme conditions.

METHODS AND MATERIALS

Our many-years studies provide a detailed description of hold-relaxation functional protection system (HRFPS) of an organism from extreme impacts of qualitatively-different, but significant irritants (adaptogenic factors) that come along with phenomenons of tissue hypoxia. Principle of this system operation is that under the impact of hypoxia and disturbances in relations of the most important homeostatic constants (O_2 – CO_2) activation of holding processes takes place in central nervous system, and a sharp increase in (sometimes up to 70%) speed of simultaneous arbitrary relaxation of all skeleton muscles [2, 6, 8].

Activation of HRFPS through a complex chin of interrelated physiological and biochemical processes leads to an extraordinary improvement in regulation and coordination of movements, increase in economy and efficiency of different organs' and systems' activity, significant decrease in energy costs, and increase in speed of regeneration processes, and, as a result, not only to an appearance of a powerful anti-hypoxic effect, but also an effect of an extraordinary increase of physical workability, well-known in sports as an effect of the "second breath". It has been also established that HRFPS is a general reaction of an integral organism that takes place under control and direct participation of central nervous system (CNS). And, as such reactions refer to the category of non-specific ones, we can expect that HRFPS will activate not only under impacts of intense physical strain, but also a number of other adaptogenic factors, that cause similar metabolic alterations in an organism or disturbances in correlation between the most important homeostatic constants [3, 7].

According to our data, all sportsmen or persons who don't go in for sports are characterized by a high, moderate, or low functional activity of HRFPS. Therefore, persons with high activity of HRFPS are most stable against unfavourable impacts, and persons of low HRFPS activity are the least stable. Besides, even one-time impact of a certain adaptogenic factor cause serious disturbances of homeostasis and extreme tension of different organs and systems among the latter, while the same impacts go with insignificant response reactions of the organism and do not cause any significant disturbances in proportions of the most important homeostatic constants [4, 5].

According to the modern data, the basis of long-term adaptation is a system structural track of former urgent adaptation reaction. Considering this idea and the concept of HRFPS, it would be logic to assume that different types (strategies) of long-term adaptation among sportsmen with different

power of HRFPS and different initial level of simultaneous arbitrary relaxation speed of skeleton muscles under a long influence of training physical strain or its combination with hypoxic stress [2, 6, 7].

In a series of experiments, carried out with participation of 597 sportsmen of different age and qualification, our hypothesis that had been provided above, has confirmed completely. Under an impact of training physical stress three different types of long-term adaptation have formed among the sportsmen: hypertrophic, transitive, and relaxation type. Among sportsmen with a low-capacity HRFPS, regardless of age, adaptation took place due to an increase the volume of muscle mass and strength at the background of low speed of muscle relaxation, in other words, hypertrophic type of long-term adaptation or individual development. Transitive type of adaptation formed among the participants with HRFPD of moderate power, and relaxation type formed among the sportsmen with high-power HRFPS. A high speed of relaxation and moderate indexes of muscle strength have been typical for the latter type.

In order to divide sportsmen according to adaptation types, Y.V. Vysochin has developed a classification index of long-term adaptation type or individual development (CIAT), CIAT is estimated according to the coefficient of maximum relative force (CMrF) and speed of attribute skeleton muscled relaxation (SAR) via the formula: CIAT = CMfF / SAR. According to the formula, the higher the strength and the lower the muscle relaxation speed, the higher numerical value of CIAT, and the contrary. Polar values of CIAT have been defined through general methods.

It has been established that the number of sportsmen that refer to a certain long-term adaptation type, has been different among sportsmen of different qualification (table 1).

For example, hypertrophic type of long-term adaptation (HTLA) has been typical for the most junior sportsmen (77%), and relaxation type (RTLA) has been most frequently established among masters of sports (61,1%). The number of sportsmen with transitive type of long-term adaptation (TTLA) has been approximately equal at all qualification levels. Analysing dynamics of adaptation types presence frequency (%) along with an increase in sportsmen qualification (picture 1) draws a special interest as in allows us to receive new important scientific data.

The study has shown that along with an increase in sport experience and qualification from junior categories (JC) to masters of sports (MS) number of sportsmen with the most beneficial relaxation type of long-term adaptation increases from 13,8% (JC) to 64,1% (MS), and the number of sportsmen that refer to the least beneficial hypertrophic type decreases from 77% to 17,2 %.

RESUME

The received data allows us to make a number of conclusions that are important in both theoretic and practical aspects. First of all, it is obvious that adaptation types are not strictly determined by genetics, but they suffer significant alterations under an impact of athletic training. Secondly, athletic training has a beneficial influence on formation relaxation type of long-term adaptation that is the most beneficial type for an organism. Thirdly, strategy of long-term planning of sportsmen' training process becomes clear. If relaxation type of long-term adaptation is typical for the sportsmen of high qualification, then it is necessary to plan training process and select means of training that allow one to achieve the formation of this adaptation type as quickly as possible, at the earliest stage of athletic mastership.

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ANNOTATION

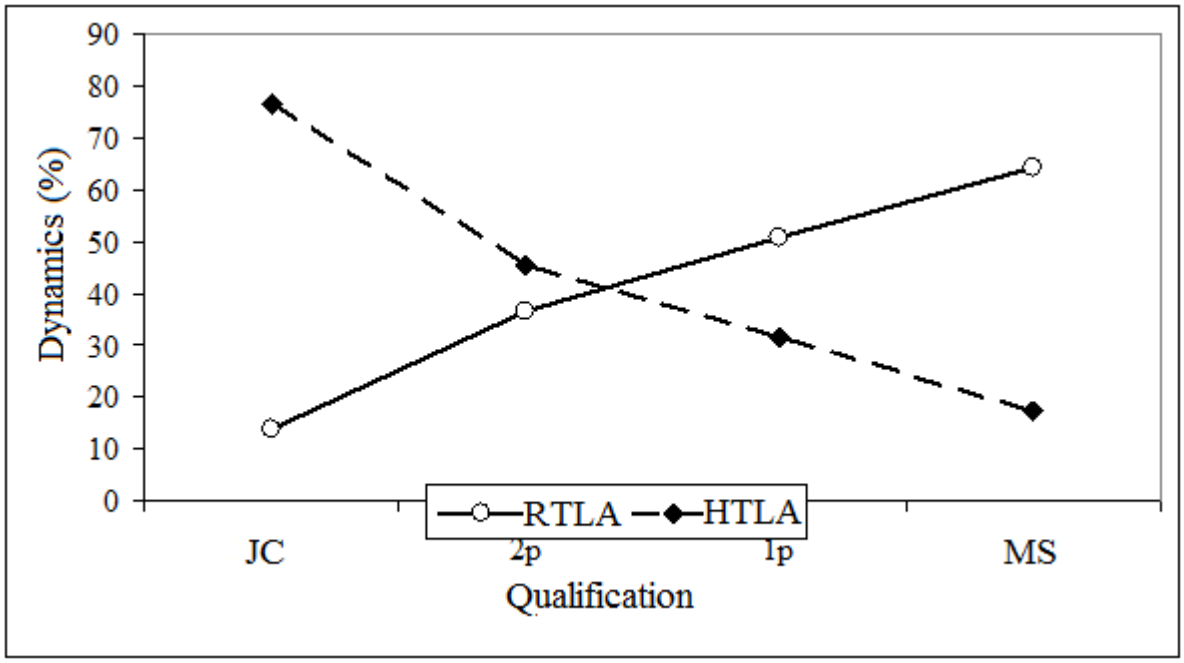
Problems of adaptation, stability, physical workability, and preservation of health and sporty longevity of a man in extreme conditions of activities, including sports, occupy a central place in modern physiology and medicine. Numerous medical-biological, clinical-statistic, and sociological researches point us to a great individual variability of people's adaptation to different extreme impacts and unfavourable conditions of environment. It has been established that under the impact of training stress three different types of long-term adaptation form among sportsmen: hypertrophic, transitive, and relaxation type. Adaptation types are not determined strictly by genetics, but suffer significant alterations under an impact of athletic training. Athletic training has a favourable influence on the formation of relaxation adaptation type that is the most beneficial one for an organism.

Key words: adaptation, sportsmen, functional activity, speed of muscle relaxation, physical workability.

Table 1

Percent distribution of different adaptation types among sportsmen of different qualification

Qualification	HTLA	TTLA	RTLA
Master of sports	17,2%	18,7%	64,1%
First category	31,7%	17,5%	50,8%
Second category	45,5%	18,1%	36,4%
Junior categories	77,0%	17,2%	13,8%



Picture 1. Dynimic of adaptation types according to an increse in sportsmen qualification