

Original Article

Recovery functional condition of sportsmen using individual non-traditional means of rehabilitation

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Abstract:

The aim is to develop a system for the recovery of sportsmen by individual use of medicinal plants. Materials: The study involved 43 athletes - representatives of team sports. To determine the individual compounds of medicinal herbs have been identified characteristics of each athlete based on the indicators of vegetative balance and concentration of insulin and cortisol in the blood. Cluster analysis was used to separate the athletes into groups in terms of vegetative balance and concentration of insulin and cortisol in the blood. It was obtained 6 groups (3 controls and 3 experimental) by pairwise selection of individual features of the functioning of the adaptive systems. The experimental group trained with the use of individual means of recovery, in the control group given method has not been applied. The study lasted 4 months. Medicinal herbs were applied by four cycles of 21 days with intervals of 7 days. Results: have been developed the principles of the individualization of the use of medicinal plants to optimize the operation of adaptive systems. Medicinal plants used in considering the individual characteristics of the athletes and contributed to the normalization of the studied parameters. Conclusions: shows the efficiency of the developed principles of individualization of the use of medicinal plants for the recovery of sportsmen.

**Keywords:** sports, recovery, medicinal plants, individualization, vegetative balance, cortisol.

Introduction

The relevance of the study due to the fact that the current process of sports training requires the utmost stresses of the organism athletes (Borresen, J., Lambert, M.I., 2009 [2]; Buchheit M. Racinais S. Bilsborough J.C Bourdon P.C. Hocking J. Cordy J. Mendez-Villanueva A. Coutts A.J., 2013 [3]; Buchheit, M., Simpson, M.B., Al Haddad, H. et al (2012) [6], Buchheit, M., Voss, S.C., Nybo, L. et al, (2011) [7]; Kozina Zh.L., Gorchaniuk Iu.A., Zashchuk S.G. (2011) [16]; Kozina Zhanneta; Sobko Irina; Bazulyuk Tatyana; Ryepko Olena; Lachno Olena; Ilnitskaya Anna (2015) [17]). Recovery processes are central to the training of athletes (Maher, C.G., Sherrington, C., Herbert, R.D. et al, (2003) [23]; McLean, B.D., Coutts, A.J., Kelly, V. et al, (2010) [24] and require an individual application of effective and practical methods that Do not call adverse effects [18; 19; 20; 21]. That these are natural recovery methods that are used for a long time in the practice of folk medicine [13; 22]. Their combination with effective training program meets the requirements of modern sport, and experimental confirmation of this provision is of particular relevance for modern sport and for the sport of the future. Among the natural resources recovery of working capacity a central place is occupied medicinal herbs [13; 22 42]. Currently medicinal herbs, along with other natural means of restoration of working capacity, are unconventional in connection with the more common uses medicament agents recovery. However, the millennial practice of recovery of natural resources demonstrates their effectiveness, and scientific rationale of these provisions is of particular relevance. It should be noted that the positive impact of natural resources for the restoration of sportsmen noted by many modern scholars [8; 16; 18; 39]. Chulvi-Medrano. I. 1 , LLana-Belloch. S. 1, Pérez-Soriano, P. [8] examined water immersion as a post-effort recovery factor. The authors found that immersion in cold water (15°C) for 10 minutes, split into periods, facilitates regenerative processes post-effort.

In general, the recovery is determined by a variety of physiological processes and depends on many factors. Giorgi Zubitashvili, Darejan Qobelashvili, Marina Chkhikvishvili [12] studied the aim of the research the degree of the functional system recovery (On example of the heart rate) in younger (8) and older (20) age judokas with respect to age and performed work parameters study. Авторы выявили, что In the older age (20) - by 49.3% more work is performed than in the younger age (8). Recovery degree in the older age is by 14.8% better compared to the younger age. The functional system recovery is more subjected to the age determination than to a factor of the amount of the performed work. Age is not the only factor contributing to the recovery processes [1; 4; 5; 10; 15; 25]. Therefore the study of the individual characteristics of the athletes for the selection of means of recovery is an urgent task.

The debate also raises the effectiveness of various measures as indicators of recovery processes [26; 27; 28; 29]. Many scientific studies on the recovery of sportsmen [30; 31; 32] as the test parameters are taken the

most mobile - heart rate, blood pressure and other [40; 42]. These indicators reflect the body's response to the load immediately after its implementation. One of the indicators of long-term adaptations are hormonal changed in the body [35; 36; 38; 40; 41]. For example, cortisol is a stress hormone [42]. On its level in the blood can significantly affect the overall psycho-somatic condition (stress, depression, severe concomitant diseases, intoxication). Therefore, the use of cortisol concentration in the blood as an indicator organism adaptation to stress factor relevant to determine the effect of long-term adaptation (at least three weeks). The use of cortisol as an indicator of "urgent" adaptation is less effective. This may explain the research results M. Buchheit S. Racinais J.C. Bilsborough P.C. Bourdon J. Hocking J. Cordy A. Mendez-Villanueva A.J. Coutts [3]. The authors found that Training load, HRex and wellness measures are the best simple measures for monitoring training responses to an intensified training camp; cortisol post-exercise and LnSD1 did not show practical efficacy here. However, the use of cortisol as an indicator of long-term adaptation is urgent.

One factor of long-term adaptation is the effectiveness of restorative processes [9; eleven; 14; 33; 34; 37]. One of the most effective means of restoration of working capacity are medicinal herbs. However, personal use of the natural resources recovery reviewed is not enough in literature. In this regard, the chosen direction of research is relevant and timely.

### Materials and methods

The aim - to develop a system for the recovery of sportsmen by individual use of medicinal plants.

Methods: theoretical analysis of scientific data, biochemical methods (determination of the concentration of cortisol, insulin and  $\beta$ -endorphin in the blood), method of mathematical analysis of heart rate, methods of mathematical statistics. The study involved 43 athletes - representatives of team sports. To determine the composition of individual medicinal herbs, we have identified the characteristics of each athlete based on the indicators of vegetative balance and concentration of insulin and cortisol in the blood. A blood test for level detection of adaptive capabilities of athletes was held at the Institute of Medical Radiology of the city of Kharkiv, the vegetative balance was determined by continuous recording monitor heart rhythm «Polar». In the first phase of the study was identified individual activity of factor structure of adaptive systems of each athlete with the help of factor analysis by the principal component. In the next phase, cluster analysis was used to separate the athletes into groups in terms of vegetative balance and concentration of insulin and cortisol in the blood. It was obtained 6 groups (3 controls and 3 experimental) by pairwise selection of individual features of the functioning of the adaptive systems. The experimental group trained with the use of individual means of recovery, in the control group given method has not been applied. The study lasted 4 months. Medicinal herbs were applied by four cycles of 21 days with intervals of 7 days.

### Results

1. The study of the causes of ill health or reducing of working capacity and the selection of herbs, helps to eliminate these causes.

2. Accounting "compatibility" of plants and humans on the basis of the properties of plants and features of psychophysiological organization of man.

3. Consideration of territorial compatibility features plants.

Effectiveness of the principle of individual selection of medicinal plants for the recovery of sportsmen has been verified experimentally. In the first phase of the study in athletes used factor analysis by principal components. We found a factor structure of individual activity adaptive systems of the organism in terms of vegetative balance and concentration of insulin and cortisol in the blood.

The results of factor analysis of the studied parameters show that all measured values are divided into two factors (Table. 1). The first factor, which amounted to 50.22%, included the index includes indicators of the voltage amplitude of fashion, cortisol concentration with a high positive correlation coefficient of variation range and performance and fashion duration RR-intervals with a negative correlation coefficient. It characterizes the activity of the sympathetic part of the nervous system. The second factor, which was 37.34% of the total variance, includes indicators insulin concentration, variation range and fashion duration RR-intervals with a high positive correlation coefficient, which characterizes the activity of the parasympathetic division of the autonomic nervous system (Table. 1).

Table 1. The results of the factor analysis of indicators of concentration of cortisol and insulin levels and vegetative balance among representatives of team sports (n=26)

Indicators	Компоненты (Факторы)	
	Sympathetic nervous system	Parasympathetic nervous system
Index of tension of regulatory systems of heart activity (IN), y.e.	0,99	
Amplitude of mode (the of the most frequent RR-interval) (AMoRR), %;	0,92	
The concentration of cortisol in the blood, nmol·l <sup>-1</sup>	0,60	-0,44
The concentration of insulin in the blood, pmol·l <sup>-1</sup>		0,99
Variation range of the RR – intervals ( $\Delta$ RR), s;	-0,63	0,72
Mode (the duration of the most frequent RR-interval) (MoRR), s	-0,66	0,69

We surveyed the athletes was identified individual activity of factor structure of adaptive systems. And so all the subjects using hierarchical cluster analysis were divided into three groups according to the individual characteristics of the operation of adaptive systems.

The resulting group of subjects differ in levels of cortisol, insulin and  $\beta$ -endorphin levels and indicators of vegetative balance. One group was the high-cortisol (500-650 nmol · L<sup>-1</sup>), it was designated as group 1 and evaluated as a group with a very high activity adaptive systems related to any stress; group with low cortisol levels (220-350 nmol · L<sup>-1</sup>), it was designated as Group 2 and evaluated as a group with the suppression of adaptive systems due to overwork; other subjects were included in the group 3, with an average concentration of cortisol. It should be noted that subjects with high cortisol have low insulin levels, and, in contrast, in subjects with low Cortisol indicated high content of insulin. Subjects with high cortisol and low insulin at the same time indicated increased activity of the sympathetic nervous system. In subjects with high insulin and low cortisol observed increased activity of the parasympathetic nervous system. These data confirm the known fact about the relationship sympathetic activity of the nervous system with the level of cortisol, and the relationship parasympathetic activity of the nervous system with the level of insulin concentration. The level of concentration of  $\beta$ -endorphin is a reflection of the activity of the regulatory mechanisms of adaptive systems of the organism, the highest level of concentration of  $\beta$ -endorphin was found in groups where rates of cortisol and insulin concentrations were significantly different from the average. Thus, reducing the efficiency and effectiveness of competitive activity in different athletes determined by different reasons, and in determining the composition of herbs has been used the first principle of individual selection of medicinal plants. The subjects of each of the three formed groups were divided into control and experimental (Table. 2).

Table 2. Allocation of test groups as a result of cluster analysis of heart rate parameters and insulin and cortisol concentration in the blood

Group	Initial data	Experimental effects
1 control	High concentrations of cortisol and low concentration of insulin in the blood, high activity of the sympathetic part of the nervous system	Regular training process
1 experimental	Low concentrations of cortisol and low concentration of insulin in the blood, low activity of the sympathetic part of the nervous system	Nontraditional methods of recovery
2 control	Medium concentrations of cortisol and low concentration of insulin in the blood, medium activity of the sympathetic part of the nervous system	Regular training process
2 experimental	High concentrations of cortisol and low concentration of insulin in the blood, high activity of the sympathetic part of the nervous system	Nontraditional methods of recovery
3 control	Low concentrations of cortisol and low concentration of insulin in the blood, low activity of the sympathetic part of the nervous system	Regular training process
3 experimental	Medium concentrations of cortisol and low concentration of insulin in the blood, medium activity of the sympathetic part of the nervous system	Nontraditional methods of recovery

The experimental group trained with the use of individual means of disaster recovery, in the control group developed a method has not been applied. The study lasted 4 months. Drug charges were applied by four cycles of 21 days with intervals of 7 days.

The experimental group trained with the use of individual means of disaster recovery, in the control group developed a method has not been applied. The study lasted 4 months. Medicinal herbs charges were applied by four cycles of 21 days with intervals of 7 days.

For athletes who dominated the activity of the sympathetic division of the autonomic nervous system, it was recommended that the use of disaster recovery funds sedative nature. For this purpose the dosage collect the following composition: *Méntha piperíta*, *Verónica officinalis*, *Origanum vulgáre*, *Crataégus sanguínea*, *Melilótus officinális*, *Tília cordáta*, *Thýmus serpyllum*, *Tussilágo fárfara* [22].

For athletes who dominated the activity of the parasympathetic division of the autonomic nervous system with symptoms of exhaustion of adaptive systems, it was recommended that the use of restoration of working capacity funds neutral or tonic character. For this purpose the dosage collect the following composition: *Hypéricum perforátum*, *Artemisia vulgáris*, *Rhodíola rósea*, *Urtica dióica*.

For athletes with normal autonomic balance were recommended charges herbs neutrality regarding the activation of different parts of the autonomic nervous system.

Herbal taken as an infusion of 250 mg per day.

The results showed that the developed system of individualization of use of natural resources restoration of sportsmen is a modulator of the activity of adaptive and regulatory systems. This conclusion follows from the results obtained. It has been revealed different changes in indicators of cortisol, insulin and  $\beta$ -endorphin in the blood of athletes control and experimental groups.

In the first experimental group showed a significant decrease in cortisol concentration ( $p < 0.001$ ), a significant increase in insulin concentration ( $P < 0.001$ ) and a significant increase in the concentration of  $\beta$ -endorphin ( $p < 0.05$ ) (Figure 1).

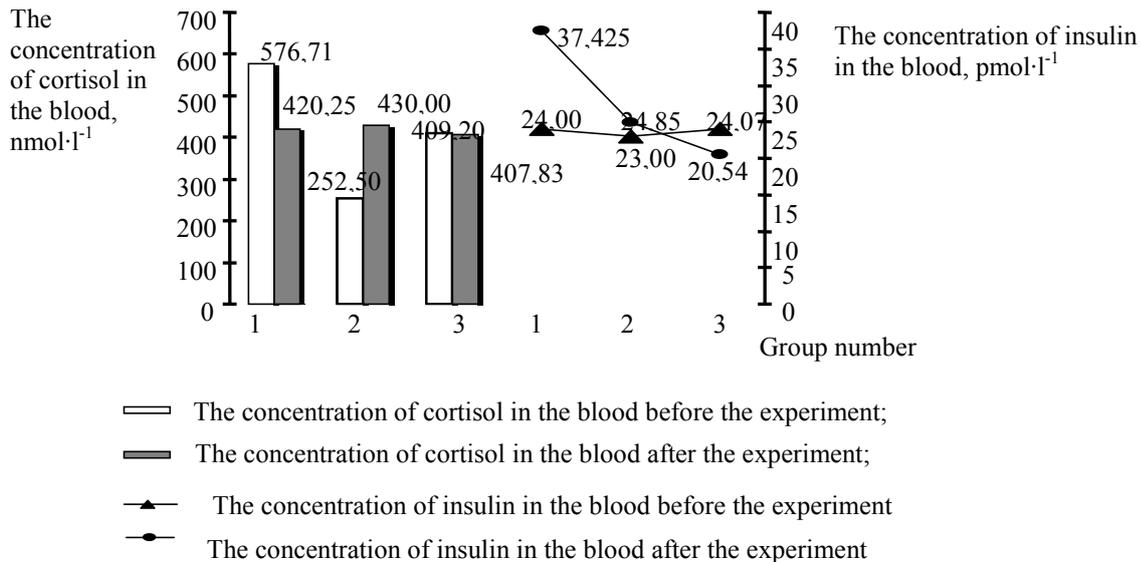


Fig. 1. Indicators cortisol and insulin levels in experimental groups before and after the experiment

In the first control group decreased concentrations of cortisol were not as pronounced as in the intervention ( $p < 0.05$ ). Increased insulin was not significant, and increasing the  $\beta$ -endorphin less pronounced compared with the experimental group.

In the second experimental group, by contrast, it noted a significant increase in cortisol concentration ( $p < 0.001$ ) and a decrease in insulin concentration in the blood ( $P < 0.05$ ).

Reduced insulin in the second experimental group was significant at  $p < 0.05$ . In the control group, this change was not significant. Increasing the concentration of  $\beta$ -endorphin in the second control and second experimental group was significantly at  $p < 0.05$ , while in the experimental group the change is expressed more.

In the third experimental as well as control groups in the third variation of cortisol concentrations was not significant (Fig. 1), which can be explained by the initial value of its concentration close to the average rates and the absence of the need for such changes.

Thus, application of principles developed by the individual receiving medicinal plants had modulatory effect on adaptive systems of athletes calling individually needed changes in the functional state.

## Discussion

The results show the effectiveness of individual use of medicinal plants according to the characteristics of adaptive functioning of body systems. The use of medicinal plants in recreational and sports practice preferable to use synthetic drugs, since no side effects [21; 42]. Medicinal plants close in chemical composition to other living organisms, including a human, and therefore better absorbed than synthetic drugs. Furthermore, most synthetic drugs are extracted from medicinal plants active substance [13 16; 22].

As experts in the field of herbal medicine [13; 16; 22; 42], the efficacy of the medicinal plants stems from the fact that they operate integrally as a single complex containing biologically active substances. In some substances which are integrally connected with the other, acting in conjunction with each other.

To carry out such an effect synthetically much more difficult. Therefore, treatment of medicinal plants has been and remains an effective means of restoring and maintaining the health and efficiency.

Currently, for treatment of various diseases and recovery of sportsmen medicinal plants are selected based on the chemical composition. However, the greatest difficulty is in conjunction with each of various herbs, as some substances in medicinal plants can both enhance and inhibit the action of others. [22] Therefore, despite the development of herbal medicine and biochemistry of plants, treatment and *vosstnovleniya* performance using medicinal plants it remains largely an art than a science, teaching that require years of practice under the direct supervision of a specialist.

In this connection, the methods of selection of medicinal plants is currently more difficult to scientific justification. Currently, with the help of scientific methods of research synthesis occurs, analyzing the experience of the centuries-old traditional medicine regarding the use of medicinal plants [22], but the future - the merger of the scientific analysis of art and folk medicine.

A particular challenge is the selection of individual medicinal plants, as the same herb may vary to show its effect when used by different people. Therefore, the use of individualization of medicinal plants remains a priority of intuitive knowledge of individual experts.

To intuitive knowledge of traditional medicine have continued, their removal is necessary on a scientific basis, and the task of science is to grasp the basics of folk traditions.

An attempt of combining scientific knowledge and the art of traditional medicine for the formulation of the principles of individual selection of medicinal plants.

The studies revealed that the herbs in the individual selection may have a catalytic effect, relaxing effects.

In terms of positive influence of natural factors as a means of recovery of athletes Our study confirms the results of other authors. Revealed the possibility of individual selection of medicinal plants for the recovery of sportsmen. The data obtained can be used in the practice of sports training.

### Conclusions

1. The principles developed by individual selection of medicinal plants for the recovery of sportsmen allow us to find optimal compositions of herbs according to the individual characteristics of functional and psycho-physiological state of athletes.

2. An individual approach when choosing a collection of medicinal plants contributes to the optimization of adaptive systems of the organism athletes. This is reflected in the normalization of autonomic balance, and blood concentrations of cortisol, insulin and  $\beta$ -endorphin in the experimental groups.

**Conflicts of interest.** Author have any conflicts of interest to declare

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