Use of low-intensity laser radiation in sports activity of boxers

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Abstract

Objective of the study was to identify changes in the regulation of the heart rhythm in highly skilled boxers in the preparatory period against the background of the potentiating effect of low-intensity laser radiation (LILR).

Methods and structure of the study. To solve the problems, a seven-course effect of LILR was used. To register the desired parameters of heart rate variability, the Omegawave V.4. hardware-software complex was used. Processing, analysis and subject study of the research materials were carried out using the methods of mathematical statistics.

Results and conclusions. After stimulation with LILR, signs of optimizing the functional state of boxers were found: an increase in RMSSD by 28.1% was observed; TR by 27.3%, the contribution of HF waves to the total spectrum by 101% (at $p<0.05$); VLF by 41.7%, as well as a decrease in the stress index by 30.8% and LF / HF by 44.9%. The data obtained indicate an increase in cerebral ergotropic and humoral-metabolic reactions under the influence of the course application of LILR.

Conclusions. The efficiency of using low-intensity laser radiation as a means of stimulating recovery processes after intense situational loads of various powers has been established.

Keywords: *LILR, heart rate variability, boxing.*

Introduction. The relevance of the use of low-intensity laser radiation (LILR) in recent years is associated with the non-invasiveness, availability and effectiveness of this method. The effect of using LILR to increase general [7] and special physical performance in cyclic [4, 6] and situational sports [2] has been proven. Experts pointed out that as a result of the use of LILR, an increase in anaerobic performance in various sports was noted [8]. The neurogenic, humoral, and microcirculatory mechanisms of the formation of responses to a single exposure and course application of low-intensity laser radiation have been described [3]. Of particular interest is the study of the laser effect on the course of recovery processes in highly skilled boxers. In our study, we determined the result of the course impact of LILR on the recovery processes by modulating the parameters of heart rate variability (HRV).

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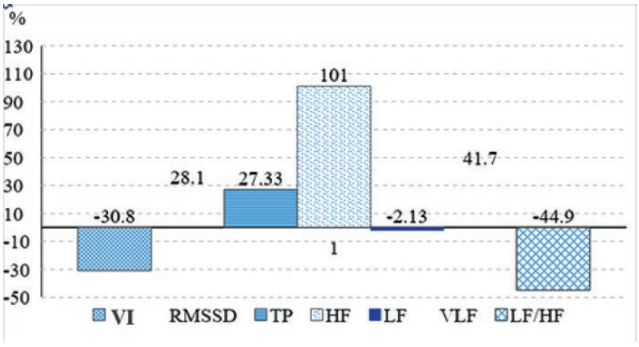
Methods and structure of the study. The study involved boxers of the master of sports aged 19-21 years, the athletes performed training loads according to a single program. The study was carried out on the basis of a training center. The HRV parameters of interest to us were recorded daily, which was included in the mandatory program of medical and biological support for the training of boxers to control their functional status. The effects of LILR were applied to the neck symmetrically from both sides in the region of the sleepy triangle using a two-channel laser therapeutic apparatus “Uzor-A-2K / 2” in the near infrared spectrum, with an emission wavelength of 0.89 ± 0.02 μm, an impulse power of 10 W, pulse repetition rate 1500 Hz. Exposure time - 8 minutes, course - seven procedures. Processing, analysis and subject study of the research materials were carried out using the software of statistical packages “Statistics 6.0”. An

Omegawave V.4 telemetric hardware and software system manufactured by Omegawave (Finland) was used to study heart rate variability. The popularity of this system in practice is associated with the speed of its use, the non-invasiveness of testing, the formation of conclusions taking into account Western standards [9–11], and the focus on the methodology of Soviet and Russian specialists [1, 5]. A two-minute recording of the heart rhythm was carried out in a room isolated from external noise at an air temperature of 20-22°C in the supine position with eyes closed after a five-minute rest, approximately 100 cardiac complexes were recorded in three standard leads. The time and frequency parameters of the heart rhythm were assessed in accordance with the Standards of measurement, physiological interpretation, and clinical use [6].

Results of the study and their discussion. The initial results of monitoring heart rate variability are presented in the table. There is a significant scatter of indicators, indicating both the specifics of the functional state of athletes, and a different degree of reaction to the training load being performed in the middle of the preparatory period.

RMSSD has stable statistical properties, which ensures its validity for short HRV records and is designed to prevent overtraining during increasing physical activity [1]. This indicator is a marker of the activity of the parasympathetic link of the autonomic nervous system, which controls the course of the recovery process. In the intense training process of boxers, intense physical loads of variable power are combined, intense activity of sensory systems, which ensure the adequacy of the reaction to the actions of the opponent, and this is against the background of emotional excitement. The combination of influences causes an increase in the activity of sympathetic regulation, as indicated by a decrease in the RMSSD value. This phenomenon is also confirmed by increased values of the voltage index (VI), power indicators of high-frequency and very high spectrum fluctuations. The indicator of the total power of the spectrum, TP, indicates the stability of the adaptation systems [1], together with the power of high-frequency oscillations of the heart rate, HF, reflect the activity of the autonomous regulation circuit. The autonomic balance reflects the balance of the sympathetic and parasympathetic systems [5], according to our data, there is a predominance of sympathetic activity in the regulation of HRV. In addition, heart rate was recorded on ANOT, the mean values for the group were 165.3±1.4 beats/min. The dynamics of these indicators in the preparatory period of training testifies to the tension in the activity of the boxers' body systems and the decrease in their adaptive potential as the competition approaches.

After a single exposure to LILR, multidirectional changes in the studied parameters in the values of the statistical error were established. After applying the LILR course, significant changes from 27 to 100% in HRV parameters were recorded (see figure).



Changes in the parameters of heart rate variability under the influence of low-frequency laser irradiation

Stimulation of the activity of the autonomous HRV regulation circuit was confirmed by an increase in

Values of HRV parameters in highly skilled boxers

Name	RMSSD	IN	TP	LF/HF	HF	LF	VLF
R.I.	41	57	1353	6,11	174	1063	116
T.I.	58	78	1662	2,3	447	1030	185
S.A.	43	103	1129	3,73	232	865	32
V.P.	35	160	918	0,84	149	125	44
I.A.	54	60	1196	2,34	324	758	114
T.I.	60	64	1170	1,92	343	657	170
N.A.	26	210	829	4,65	131	144	54
M	45,29	104,57	1179,57	3,13	257,14	663,14	102,14
m	5,15	24,03	112,68	0,74	48,03	158,41	24,96
S	12,62	58,87	276,00	1,81	117,64	388,02	61,13

RMSSD by 12.71 ms; an increase in the value of the total spectrum power by 275.57 ms2; a twofold increase in the value of high-frequency oscillations and 42.57 ms2 of very low-frequency waves in the overall spectrum; as well as a decrease in the stress index by 36.57 c.u. and LF/HF by 1.4 c.u. When considering the course application of LILR at the level of autonomic regulation of the heart rate, one can state a decrease in the activity of the sympathetic regulation circuit against the background of an increase in the contribution of the parasympathetic link in the autonomic regulation of HRV. A 41.7% increase in the VLF spectral index indicates activation of the cortical-humoral centers of the autonomic nervous system during course exposure to LILR.

Conclusions. Transcutaneous laser exposure without additional modification of training loads allows you to expand the functionality of the athlete's body. Changes in HRV parameters after a course of exposure to laser exposure testify to the effectiveness and allow us to recommend LILR in the educational and training process of highly qualified boxers.

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