

INFLUENCE OF A WHEY PRODUCT ON THE DAILY DYNAMICS OF HEART RATE VARIABILITY IN SKI RACERS

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Annotation. Systematic physical activity of large volume and intensity increases tension in the regulatory systems of the body. An accessible and diagnostically significant object for assessing the state of regulation mechanisms is the heart rate. In 16 athletes involved in ski racing, using the method of mathematical analysis of heart rate, we have identified the daily dynamics of temporal and spectral indicators of heart rate variability. A promising direction in reducing tension in regulatory systems is the use of animal-based bioproducts which include a bioadditive obtained from bovine whey. The article discusses modern ideas about the daily dynamics of heart rate variability before and after a course of dietary supplement intake. The state of regulatory systems was analyzed depending on the time of day.

Keywords: athletes, physical activity, circadian rhythm, heart rate variability, bioproduct.

Introduction. In modern sports, nearly extreme and extreme physical activity takes the body to the level of functionality beyond which the premorbid state begins. This is the reason why the scientists search for new ways of optimization in order to improve the adaptive potential. One of these ways is a search for the optimal time of day for the training process, taking into account the daily rhythm of activity of the body's functional systems. It is known that the indicator of rhythmic fluctuation stability of physiological processes in the body (chronoresistance) significantly characterizes its functional capabilities and efficiency of motor activity [1-2]. Special attention is paid to the study in limits in fluctuations of functional characteristics in case of changing time zones. In order to alleviate the case caused by disturbances in the circadian rhythm, the biocorrectors of the functional state are used in sports [3-5]. Among synthetic products, plant-based and animal-based physiologically active substances become more and more recognized [6-7].

The abovementioned has determined the choice of our study's direction. The main purpose of the study – to reveal objective patterns confirming the rhythm-based nature of the daily dynamics of the heart rate variabil-

ity indicators, as well as the effect of the whey bioproduct intake course.

Methods and organization. The study involved 16 young male ski racers aged 17-25 years. We have registered the heart rate variability indicators with the R.M. Baevskij's cardiointervalography method and the "Varikard 2.51" device ("Ramena", Ryazan). The daily dynamics of these indicators were registered thrice: in the morning – from 7 to 9 o'clock, in the afternoon – from 14 to 16 o'clock and in the evening – from 21 to 23 o'clock. Before using the bioproduct based on whey, the registration was carried out for 14 days. Then, for 21 days, the athletes' daily diet included the bioproduct in an amount of 0.5 g per 1 kg of body mass for the first 5 days, and from 6 to 21 days the dosage was increased to 1 g/kg of body mass. We have calculated following standard indicators: heart rate (HR, beats/min), range (MxDMn, ms), mode amplitude (AMo, %), stress index (SI, c.u.), total power (TP, ms²), high-frequency (HF, ms), low-frequency (LF, ms), very-low-frequency (VLF, ms) spectral characteristics of the heart rate variability in accordance with methodological guidelines. The data obtained were processed with methods of variational statistics.

Results and discussion. The results obtained (table) confirm the daily frequency of the heart rate regulation activity. In the morning, the regulatory systems are minimally stressed. In the afternoon, the stress increases to maximum values followed by a decrease in the evening. According to time (MxDMn, root

mean square of successive differences – RMSSD) and spectral (HF, TP) characteristics, the maximal activity of the autonomic regulation mechanisms and the minimal activity of the central regulation mechanism (AMo, LF) occur in the morning.

Table

Daily dynamics of the heart rate variability indicators in ski racers before and after the course of the bioproduct intake (M±m)

Time of day	HR, beats/min	MxDMn, ms	SI, c. u.	TP, ms ²
before the bioproduct intake				
morning	51.0±2.1	325.1±38.01	96.5±8.2	2448± 555.2
afternoon	68.5±3.65	260.7±30.94	231.4±38.1	1903± 429.1
evening	55.1±3.19	223.5±24.61	199.5±26.3	1498± 392.1
after the bioproduct intake				
morning	46.5±2.20	406.9±51.85	51.9± 12.88*	4892± 771.5*
afternoon	61.3±2.83	259.2±27.33	87.7± 17.7**	4404± 600.5**
evening	50.1±2.64	245.4±24.18	101.2±22.3***	2613± 408.3

Note: * p<0.05 (morning); ** p<0.05 (afternoon); *** p<0.05 (evening)

The stable adaptive state is described with a high level of the activity in cortical and humoral regulation centers (VLF). By the afternoon, the functional stress increases. It is firstly confirmed by the strengthening of the management centralization of the heart rate. Thus, the AMo indicator increases significantly by 70% (p<0.05), LF – by 66% (p<0.05). The contribution in the autonomic curve regulation declines, as well as the RMSSD indicator by 36% (p<0.05), HF – by 42% VLF – by 26% (p>0.05). Value of the stress index (SI) also significantly decreases by 138% (p<0.05). In the evening, the reduced adaptive potential remains, as evidenced by the continued decrease in autonomous curve the indicators compared to the morning: MxDMn – by 117% (p<0.05), RMSSD – by 81% (p<0.05), HF – by 46% (p>0.05), VLF – by 95% (p<0.05), TP – by 63% (p>0.05) and the increase in LF by 20% (p>0.05), SI – by 107% (p<0.05). After the bioproduct intake course, daily fluctuations in the regulatory processes from the minimum stress remain in the morning, followed by the expansion of functional capabilities in the daytime and the “fade” of functional potential in the evening. Moreover, after the bioproduct intake, we have

revealed a tendency for enhancing the autonomic curve's contribution to the heart rate regulation in the morning. Compared with the control values, the MxDMn, RMSSD and HF indicators increase by 25% (p>0.05), 44% (p<0.05) и 437% (p<0.01) respectively. Simultaneously, the vascular center of the body (LF) activates – by 86% (p<0.05), as well as the cortical and the cortical and humoral curve (VLF) – by 34% (p>0.05). The total activity according to TP increases by 99% (p<0.05). As a result of enhancing the adaptive potential, the stress index (SI) decreases by 86% (p<0.05). In the afternoon, after the bioproduct intake, the functional capabilities of the body, the basis of which includes the increase in the activity of the studied regulation level, significantly enhance. In particular, the following spectral powers increase: TP – by 131%, HF – by 144%, LF – by 150% (p<0.05), VLF – by 38% (p>0.05), the RMSSD indicator – by 37% (p>0.05), SI reduces by 163% (p<0.05). In the evening, there is a not so noticeable decrease of stress. The comparative analysis has discovered the statistically reliable increase of the LF value by 94% (p<0.05), RMSSD – by 70% (p<0.05) and the decrease in SI by 98% (p<0.05).

Conclusion. Therefore, daily fluctuations in the activity of the heart rate regulation mechanisms in ski racers have a genetic nature. Moreover, the environmental influencing factors are able to cause changes in the contribution of separate compartments in the regulatory process of the body and systems' functioning. In particular, the bioproduct intake activated the adaptability of the regulatory systems in the morning, afternoon and evening. In the morning, we have registered the maximum parasympathetic activity. After the bioproduct intake, its

contribution in the regulation increases abruptly. The adaptive abilities in ski racers are mainly defined by HF and LF and to a lesser extent – by VLF fluctuations, which is also noted in one of the studies [8]. In the afternoon, the functional potential enhances as a result of the combined increase in the role of central and autonomous mechanisms of the heart rate regulation. The evening segment of the day is characterized by multidirectional dynamics of regulatory processes.

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