Assessment of driver biorhythms as a factor of labor safety

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Abstract. The paper provides a biorhythmological assessment of the health of a driver's team in conditions of joint activity in terms of heart rate variability. Measurements were taken during the working day using Holter monitoring in AnnaFlash2000 software and statistical processing ISCIM6. The cardiogram of the heart was recorded during the working day from 8.00 to 18.00 hours. It was revealed that the rhythmic processes of acrophase and heart rate bathyphase, which testify to the leading role of hypoxia, hypercapnia and desynchronosis of ultradian rhythms, influence the joint professional activity of drillers. The examined drivers found a violation of the synchronization of biological rhythms and desynchronosis at various levels of regulation of heart rhythm regulation. Both drivers, working in different biological rhythms, have a low degree of compatibility and belong to the group of production risk, which negatively affects occupational safety.

1 Introduction

An urgent problem in modern society is labor safety in various conditions of professional activity, especially extreme. Labor safety involves regulatory measures aimed at preserving the life and health of workers in the process of labor activity [1-2]. However, we do not think what constitutes the physiological, psychophysiological, somatic or physical condition of a person driving. These conditions are not well understood for the prevention of not only road traffic accidents, but industrial injuries and industrial accidents.

The following conditions for classifying the extremeness of professional activity are distinguished: hazard levels; state of tension of the body; factors exposure time; reserve capacity of the body; the need for recovery [2; 4]. The conditions for the implementation of activities are divided into: 1) ordinary; 2) special; 3) extreme; 4) superextreme.

Researchers in the field of physiology of labor express the opinion that it is necessary to study a person's readiness to carry out professional activities from such positions as: 1)

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work (service) should not be destructive to the mental and physical health of a working person; 2) damage the social status of the individual; 3) meet the needs and qualifications of the employee; 4) allow individual or collective influence on working conditions and professional systems; 5) contribute to the development of the employee's personality by stimulating hidden opportunities and expanding competence, as the adult's personality develops significantly in the context of his professional activity [2].

Drivers of vehicles are one of the largest professional groups that carry out their labor activities in various climatic and industrial conditions. In the process, drivers (more often they are representatives of other professional groups, for example: drillers, electricians, installers, etc.) are exposed to the negative impact of a whole range of various harmful production factors [1-3]. Performing professional activities of drivers leads to an increased risk of health problems, increasing the risk of work-related injuries, traffic accidents [1]. All of the above determines the high relevance of studying the health status of drivers, including diseases of the circulatory system as having the greatest social and economic significance, and which are one of the leading causes of mortality among the able-bodied male population of the country [5].

Correspondence of the human body's resources to professional activities is often associated with stress tolerance and adaptive response to environmental factors under the conditions of human activity, which leads to physiological selection, which implies the matching of the human body's resources to complex professional tasks and psychological selection aimed at identifying those activities that are most fit a specific person [4; 7].

Effective professional activity of a person, carried out in a group, depends on mutual understanding, compatibility of partners, each of which has its own psychological, psychophysiological, and biorhythmological features. They are very persistent and are characterized by the periodic repetition of an event in the biological system at more or less regular intervals [6]. According to researchers, the biorhythm in any conditions is a self-sustaining, self-reproducing process in which the passage of one cycle always requires the same time [1; 5; 7]. There are several classifications of biological rhythms. According to F. Halberg, a medium-frequency rhythm with a duration of 0.5 to 20 hours is called ultradian or ultradian [6]. Synchronization of biological rhythms, as a socio-psychological phenomenon, has an important adaptive value, contributing to the survival of people, including extreme situations.

2 Method

The studies were conducted in accordance with the "Guidelines for assessing occupational health risks for workers. Organizational and methodological foundations, principles and evaluation criteria. R.2.2.1766-03 " [1].

The features of professional activity are studied on the example of a brigade of drivers who are simultaneously drillers. The measurements were carried out during the working day according to the indicators of the analysis of heart rate variability (HRV) using Holter monitoring in the AnnaFlash2000 software and the statistical processing ISCIM6. The cardiogram of the heart was recorded during the working day from 8.00 to 18.00 hours.

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The following indicators were analyzed: stress index (SI), pulse (HR), spectral analysis indicators (HF - activity of the parasympathetic regulation link; LF - activity of the

vasomotor center,, VLF - activity of the sympathetic regulation link, ULF - activity of higher vegetative centers), activity of the parasympathetic link regulation (RMSSD), the total effect of autonomic regulation of blood circulation (SDNN) and others.

3 Result and discussion

The study of ultradian rhythms during working hours showed that the acrophase of the stress index (SI) for the first driver-driller fell at 18.00 hours, and for the second - at 13 hours and was above the norm for the first driver at 65.9, and for the second at 6 , 3. The SI bathyphase in the first and second drivers was noted at 13.00 hours, which coincides with the daily minimum of human biological rhythms working capacity. In general, the stress index remained above the norm for both drillers throughout the working day, the heart rate was above the norm (in the former it ranged from 108 to 127 beats / min, in the second - from 82 to 110 beats / min.), which indicates sustained tachycardia.

According to the phase portrait of the first driver, overvoltage of adaptation systems is observed, which indicates a state of stress, and the second driver has a phase of mobilization to the conditions of work. The ratio between the RMSSD and SDNN indices of the second driver is the basis for the prerequisites for the occurrence of arterial hypertension, the presence of distress, and a high level of functioning of the circulatory system, which corresponds to the voltage (Figure 1 and 2).

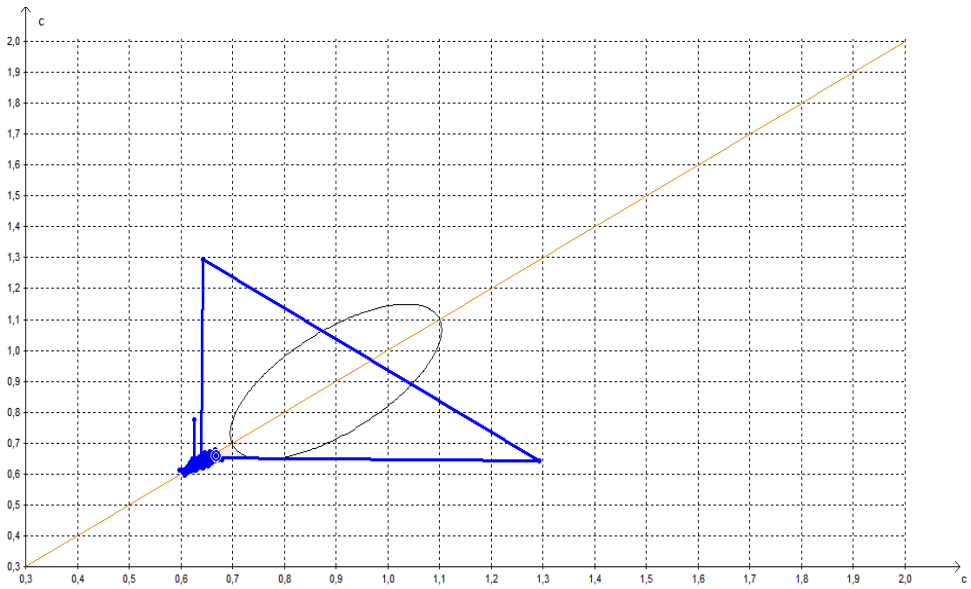

Fig. 1. Phase portrait of cardio intervals and indicators of spectral analysis of ultradian rhythms of the second driller driver in a joint professional activity (recording HRV during the working day).

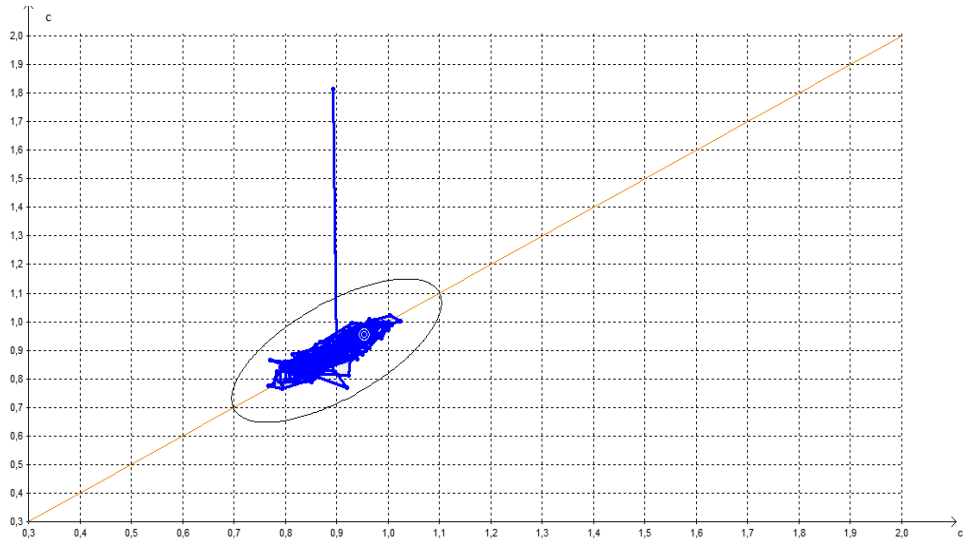

Fig. 2. Phase portrait of cardio intervals and indicators of spectral analysis of ultradian rhythms of the second driller driver in a joint professional activity (recording HRV during the working day).

Compare the power of the respiratory center (HF) under workload conditions. The first driver of acrophase was detected at 8:00 a.m., and the bathyphase at 2:00 p.m., which indicates a pronounced oxygen deficiency, an increase in hypercapnia, the second driver of acrophase was noted at 11:00 a.m., the bathyphase at 8:00 a.m., which also indicates hypercapnia, impaired respiratory center activity. In the first driver, the acrophase was observed at 12:00, in the second at 8:00, the bathyphase at 18:00 and at 11:00, respectively. The activity of the vasomotor center (LF) among drivers is also noted above the norm, which indicates an adaptive disruption in the regulation of heart rhythm regulation (Figure 3).

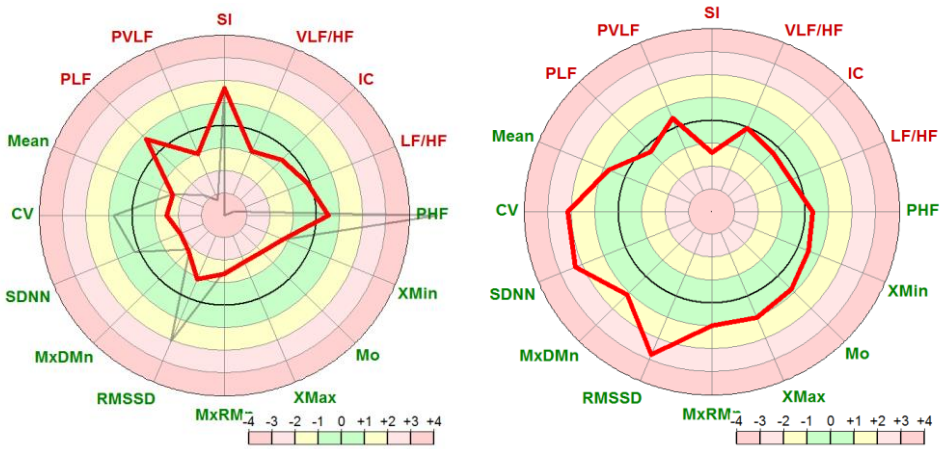

Fig. 3. Pie chart of the functional state according to the HRV indicators of the crew of drillers during the working day. Note: drillers: 1- first; 2 - second.

The results of the study showed a violation of the synchronization of biological rhythms in the examined drivers-drillers and desynchronosis at various levels of control of heart rhythm regulation.

It is known that a sharp violation of the activity of the respiratory center leads to reflex motor reactions and reduces the volume, concentration, stability of attention and, as a result, can lead to traffic accidents and other types of technological disasters.

Both drivers, working in different biological rhythms, have a low degree of compatibility. According to biorhythmological features, this team can be attributed to the production risk group.

4 Conclusion

Thus, it was revealed that the rhythmic processes of acrophase and heart rate bathyphase, which testify to the leading role of hypoxia, hypercapnia and desynchronosis of ultradian rhythms, influence the joint professional activity of drivers, using the example of drillers. Violation of the synchronization of biological rhythms in the examined drivers-drillers and desynchronosis at various levels of regulation of the rhythm of the heart was revealed. Both drivers, working in different biological rhythms, have a low degree of compatibility and belong to the group of production risk. Drivers during the day recorded an overstrain of the functional state in terms of heart rate variability. Studies on the issue of studying the biorhythmological assessment of the health of transport drivers in a joint activity remain insufficiently studied in the aspects of psychophysiological and biorhythmological compatibility for the prevention of labor safety (for example, drillers), industrial accidents, including industrial accidents, in particular, road traffic incidents.

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