

## Article

# The Influence of the Relationship Between HRV Circadian Rhythms and Self-actualization on the Behavior of Skydivers During the Competitive Period

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**Abstract:** Human health, the development of social roles, inextricably linked with his behavior. Dissatisfaction with basic needs, such as the need for security, love, respect, self-respect, identity and self-actualization, leads to diseases and various disorders that affect the health of athletes and their sports achievements. During a competition, the effects of the circadian rhythms and the power of harmonics on the heart rate variability of skydivers were studied. People reveal the level and features of their self-actualization. The data obtained showed that during the acrophase of circadian rhythms in male skydivers, activation of mental processes is noted. This phenomenon is reliably associated with the need for cognition and spatial orientation. In the bathyphase of the competitive period, they showed a decrease in-group of synchronization, an increase in individual and cross-adaptive response. In female skydivers during the competitive period, according to the circadian rhythm indicators in the bathyphase, the need for protection and support revealed, which show psycho-emotional stress and a stable parasympathetic influence on the control of heart rhythm regulation. Group asymmetric synchronization of harmonic powers also noted. The results of the study of circadian rhythms showed a biorhythmological relationship between self-actualization of the personality of athletes and indicators of heart rate variability.

**Keywords:** circadian rhythm, heart rate variability, self-actualization, health, personality, skydivers.

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## 1. Introduction

The problem of studying the health of an athlete's personality is now again at the forefront of sports and psychological issues. The problem of socio-psychological optimization of interactions (interaction) of athletes occupied a special place in a team [1, 2]. Specialists are paying more and more attention to the mechanisms of "mastering roles" by athletes in the process of interaction. The influence of "role expectations" stimulates the athlete from the side of "significant" persons for him. Especially those with whom he comes into contact [3]. We know various examples of how the effectiveness of an athlete in a team decreases only because his "role expectations" did not coincide with his true capabilities, and, for example, leadership positions in one team came into conflict with the social positions that have developed in a new team [4]. Given that individuals interact in communication through their social roles, it is advisable to consider each act of communication as a socially modeled game [5]. The chain of such game models forms the integrity of communication as a system process.

In this regard, works in the field of humanistic psychology are of particular interest. Especially the concept of A. Maslow on the mental health of the individual. He inextricably linked the development of social roles with mental characteristics [6]. A distinctive feature of A. Maslow's concept is the constant emphasis on the relationship between the health of a self-actualizing personality and the basic (basic) needs and values inherent in human nature. He argued that the inability to satisfy basic psychological needs, such as the need for security, love, respect, self-esteem, identity and self-actualization, leads to diseases and various disorders, which are commonly called neuroses and psychoses. However, even self-actualized people who have a desire for truth, good-



ness, beauty, justice, order, law and other high values can experience derivation at the meta motivational level [7]. Dissatisfaction (frustration) of higher metaneeds (such as the need for perfection, justice, beauty, truth, authenticity) or a person's loss of fundamental value orientations leads to disorders that A. Maslow calls general and particular metapathology [8]. The highest values require from the individual, in addition to subjective experiences, also certain behavioral reactions [8, 9].

Researchers note the importance of self-actualization as one of the important criteria for assessing the health of a person (subject, personality), emphasizing the importance of harmony of the individual with their culture and maintaining internal independence [10]. It inextricably linked human health with natural and social rhythms, in the system of influence of which he is throughout his life [11, 12]. According to B.S. Alyakrinsky and O.G. Gizenko noted that the phase mismatch of the body's circadian rhythms with physical and social time sensors (in conditions, for example, evening and night work shifts) constantly accompanied by desynchronization with disruption of the body's circadian system, designed for 24 hours of work [13, 14, 15, 16, 17].

The aim consists of studying of circadian rhythms and the relationship between some indicators of co-self-actualization and heart rate variability in the example of skydivers during the competitive period.

## 2. Methods

It examined the skydivers at rest (sitting). A total of 74 porters were examined (men - 37; women - 37). It conducted the measurements in the summer between jumps in natural conditions during the competition at the airfield. It held competitions in the territory of the temperate climate zone of Central Russia.

We studied circadian rhythms in terms of spectrum power (HF - total activity level of the parasympathetic link 0.40-0.15 Hz; LF - total level of activity of the vasomotor center 0.15-0.04 Hz; VLF - total level of activity of the sympathetic link of regulation 0, 04-0.0033 Hz, ULF - the total level of activity of higher autonomic centers less than 0.0033 Hz) of heart rate variability using the hardware-software complex "Varicard" in the statistical processing "ISCIM6.0". According to literature sources, HF reflects trophotropic influences on the regulation of the heart rhythm, LF - changes in the activity of baro- and chemoreceptors, VLF - ergotropic processes [18]. These indicators have a lognormal distribution.

The acrophase (the phase with maximum values) and bathyphase (the phase with minimum values) were calculated in circadian rhythms.

It studied self-actualization according to the methodology "Questionnaire of Personal Orientations by E. Shostrom" modified by L.Ya. Gozman and M.V. Kroz M.V. Shostrom".

The mean statistical indicators and their deviations ( $M \pm m$ ), standard deviation ( $\pm \sigma$ ), it calculated in the Microsoft Office Excel 2019 program. The significance of differences determined by the Student's t-test for parametric indicators by checking the equality of the average values in the two samples. The correlation was determined by r-Pearson, and by using the coefficient of determination ( $R^2$ ), showing the contribution of a particular parameter to the total value of the variables.

## 3. Results

Both men and women athletes-skydivers, because of the details of sports, have the right kind of personal qualities that propel them to achieve success in their undertakings, and satisfy the requirement for activity related to the obligation of making decisions in an extreme circumstance [19, 20, 21] Therefore, in the study of the personality psychology of skydivers, in order to substantiate the characteristics of the circadian rhythm, we turned to the concept of A. Maslow [8].

The results of the study showed the range of self-actualization in 25% of men and 41.6% of women, mental and statistical norm in 75% of men and 58.4% of women. Mental disorders and pseudo-self-actualization are not revealed. In general, their own beliefs, attitudes and principles guided skydivers, they are not conformal. They have internal support. Accept the values offered by society to the full, quickly respond to a changing situation. Deep enough and subtly to feel their feelings and needs. Respect themselves for the strength. Athletes are willing to take themselves in spite of their weakness. They see a person as good rather than bad; they easily recognize the truth, good, evil. They see opposites in nature and in life. The surrounding world perceived holistically. Skydivers are able to accept their aggression as a natural property. Easily and quickly encountered others try to play a significant role in the lives of their loved ones and friends. They have a high need to acquire knowledge about the world around them. They are individuals with a creative focus.

For men, creativity and the need for cognitive activity are important, and for women, flexibility of behavior. Both men and women do not need support.

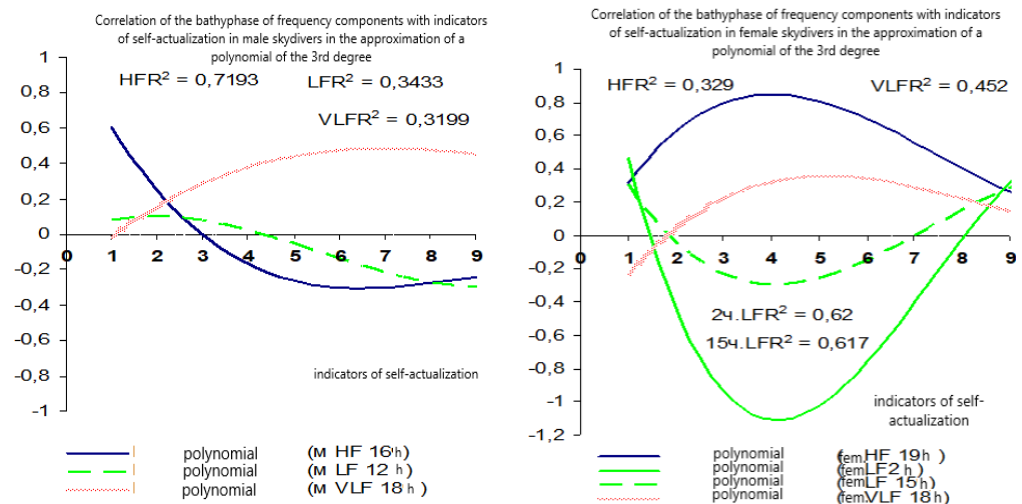


A correlation analysis of the acrophase conducted in terms of frequency components of the heart rate variability spectrum with psychological indicators of self-actualization in men and women during the competition.

In men, found a positive relationship between the acrophase of the frequency components HF ( $\rho=0.482$ ;  $P<0.05$ ), LF ( $\rho=0.578$ ;  $P<0.05$ ), VLF ( $\rho=0.498$ ;  $P<0.05$ ) and time. Significant differences noted between HF bathyphase ( $\rho=0.65$ ;  $P<0.01$ ) with time orientation and VLF ( $\rho=0.498$ ;  $P<0.05$ ) with cognitive needs and creativity.

We can say that during the competitive period, during the acrophase of circadian rhythms, male skydivers show activation of mental processes. This phenomenon is reliably associated with the need for cognition and spatial orientation. In the bathyphase of the competitive period, there was a decrease in-group synchronization, an increase in individual and cross-adaptive response.

In female skydivers during the competitive period, it found a significant positive correlation between the bathyphase of the HF spectra ( $\rho=0.77$ ;  $P<0.001$ ) and the need for support, LF ( $\rho=0.74$ ;  $P<0.001$ ) - with time orientation (fig.).



**Figure.** Correlation of the bathyphase of circadian rhythms of the frequency components of the HRV spectrum with the psychological indicators of self-actualization (SA) in male and female skydivers during the competition

In female skydivers during the competitive period, according to the circadian rhythm indicators in the bathyphase, there was a need for protection and support, which show psycho-emotional stress and a stable parasympathetic effect on the control of heart rhythm regulation. It observed a group asymmetric synchronization of harmonic powers.

#### 4. Discussion

The study of the relationship of circadian rhythms [22] between heart rate variability and self-actualization in men revealed positive relationships with acrophase and bathyphase, and in women-only with bathyphase.

In male skydivers during the competitive period, the acrophase of circadian rhythms of the frequency components HF, LF, VLF shows an increase in the relationship with orientation in time. It can state that in male skydivers, the greatest activity of the power of parasympathetic and sympathetic influence on the control of the regulation of the heart rhythm enhances the ability to navigate in time. This indicates that they have a "biological clock" or sensitivity to biological rhythms, processes, and phenomena. In the bathyphase, the period of minimum HF values, sensitivity to orientation in time, remains. During the period of minimum VLF values, the need for creative knowledge, a critical analysis of one's actions, and the search for alternative solutions increases. It can conclude that in male skydivers in the acrophase of circadian rhythms, there is a close relationship and mutual influence between the biological and social response to the impact of a complex of factors of various nature. In the bathyphase, group synchronization decreases, and individual and cross-adaptive reactions increase.

In male skydivers, the need for cognition, which significantly affects the control of the heart rhythm, falls at 6.00 in the morning. This time can called the time-setter of the mental state and mental needs of men. The need for self-esteem performed correction of social behavior.

During the competitive period in female parachutists, there was evidence of a positive correlation between parasympathetic influence on heart rhythm regulation and the need for support in the bathyphase of circadian rhythms. Since the neurons of the parasympathetic nervous system are



cholinergic, it can assume that women show an increased sensitivity to the psychological and behavioral responses that accompany them. The cardiovascular center during periods of minimal activity in women is sensitive to rhythmic processes.

The largest number of high correlations of psychological characteristics, social behavior in female skydivers, causing circadian tension of regulatory systems, occurs at 8.00, 15.00 and 22.00 hours, this is due to the rhythm of reassessment of values, which can consider as the timing of the mental state and mental processes.

## 5. Conclusions

Thus, the results of the study of circadian rhythms showed a biorhythmological connection between the self-actualization of the personality of athletes and their mental processes, and the state during the competitive period. Evidence of circadian rhythms shows the correlation between heart rate variability and self-actualization. Self-actualization can be considered as a criterion of social timing that affects the health and behavior of athletes during the competitive period. Important in the social life of the personality of athletes is productive longevity, which depends on the harmony they create between the resources of their body and the natural and social rhythms of the surrounding world.

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