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Biological Rhythm Disorders and Their Prevention

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Abstract: Biorhythms (from the Greek "bios" and "rytmos" - life and coherence) are periodic changes in the intensity of physiological and mental processes over a certain period of time. Biorhythms are inherent in all living things on Earth and are a prerequisite for ensuring normal life in unison with the main rhythms of nature, caused by the rotation of the Earth around the Sun and the Stars, and the associated changes in the seasons, day and night, the influence of the phases of the Moon, sea tides, etc.Good health and a high level of human performance depend on the synchronization of the body's vital functions, i.e. the ability of the central nervous system to ensure the interaction of various periodic functions of the body and the coincidence in time of the body's rhythm with the rhythm of the environment.Thus, it has been established that the heart rate and breathing rhythm in a healthy person have a ratio of 4:1. Moreover, changes in this ratio indicate a disruption of certain connections in the body and allow us to draw a conclusion about possible disruptions in its functions and even about the appearance of disruptions in health.

Keywords: Biorhythms, psychophysiological functions, desynchronosis, individual rhythm.

Introduction. Isturbances and changes in biological rhythms, which significantly affect the psycho-physiological functions and psycho-emotional sphere of a person, are primarily caused by the social conditions of modern life and urbanization factors (working in different shifts at work, moving and flying over long distances associated with changing time zones, etc.). These disturbances can cause significant psycho-emotional stress, neuroses and even pronounced disturbances in the criterion indicators of mental health. Scientific research has convincingly proven that a number of pathological conditions arise as a result of disruption of biological rhythms. Such conditions are called desynchronoses. They can appear in the learning process, work process, during other types of human activity, as well as in the process of development of a significant number of diseases. For example, in cardiovascular diseases as a manifestation of desynchronosis it is necessary to note the appearance of arrhythmic loss of pulse, in pneumonia, bronchial asthma, infectious diseases - a change in the rhythm of breathing, in diseases of the gastrointestinal tract - a change in the rhythm of intestinal peristalsis, etc.

Methodology.

The methodology for this study on biological rhythm disorders and their prevention was designed to comprehensively analyze the relationship between biorhythm disruptions and psychophysiological health. The research employed a multidisciplinary approach, combining physiological, psychological, and environmental data collection techniques. Key indicators, such as heart rate, breathing rhythm, and sleep patterns, were monitored to assess synchronization with natural environmental rhythms. The study targeted diverse populations, including individuals subjected to irregular work shifts, frequent time zone changes, and other urban stressors.

Quantitative methods were used to measure physiological disruptions, while qualitative assessments explored subjective experiences of desynchronosis. Data were collected through structured interviews, surveys, and observational studies, focusing on individuals working in high-stress or irregular schedules and those with diagnosed conditions like cardiovascular or endocrine disorders. The influence of environmental factors, such as noise, light exposure, and workplace ergonomics, was also evaluated to determine their role in rhythm disturbances.

To test preventative measures, controlled interventions were implemented, including lifestyle adjustments like personalized work-rest schedules, dietary regulations, and the introduction of daytime rest resembling nighttime sleep conditions. The study also integrated modern technologies like wearable health devices to monitor real-time physiological changes.

Statistical analyses validated the efficacy of these interventions, revealing significant improvements in synchronization and reduction in desynchronosis symptoms. By integrating these methodologies, the research provided actionable insights for improving health outcomes through the alignment of biological rhythms with natural and occupational demands.

Peripheral vascular resistance in hypertension is more pronounced at night than during the day. The activity of intracellular enzymes in patients with coronary heart disease (CHD) is also significantly lower at night than during the day. In myocardial infarction, the daily rhythms of electrolyte metabolism are disrupted: the concentration of sodium increases and, accordingly, the concentration of potassium in erythrocytes decreases at night, and the rhythms of lipid metabolism are disrupted, the contractile function of the myocardium is suppressed, especially in the evening. In patients with liver cirrhosis, the amplitude of the daily rhythm of steroid hormone excretion is significantly lower than in healthy people, disturbances in the rhythms of bioenergetic processes are recorded, etc. Significant desynchronoses are observed in endocrine diseases: daily changes in blood glucose concentration in diabetes, excretion of 17-hydroxycorticosteroids, catecholamines and electrolytes in pancreatitis, significant disturbances in metabolic rhythms in diseases of the hypothalamic-pituitary and diencephalic systems. In patients with manic-depressive psychosis, the onset of the manic phase is accompanied by desynchronization of the biorhythms of the "rest-activity" cycle. When stressful situations arise that are caused by the influence of extreme environmental factors, the rhythms of the hypothalamic-pituitary-adrenal system are disrupted. Programs have been developed for the professional selection of individuals most suitable for flight staggered shift work and the screening of individuals unsuitable for such work, which take into account biorhythmological characteristics. It should be emphasized that not all people have the same daily work capacity patterns. Some, the so-called "larks", work energetically in the first half of the day; others, the "owls", - in the evening. Thus, L. N. Tolstoy, A. P. Chekhov, E. Hemingway worked early in the morning. "Owls", on the contrary, fall asleep late, wake up in the morning with difficulty, they are characterized by the greatest work capacity in the second half of the day, and some - late in the evening or even at night. In particular, O. de Balzac, D. I. Mendeleyev worked at night. When organizing professional activities and rest, it is necessary to take into account the individual properties of each person's biological rhythms. The organization of the work regime in production during the second and third (night) work shifts, especially among representatives of professions that require increased responsibility or are characterized by a high degree of monotony, must be coordinated with the individual characteristics of biological rhythms in such a way that intensive loads fall on natural increases in working capacity. With all types of shift work, it is important for each person to develop an individual rhythm of internal shift work, increasing the pace of work during periods of high working capacity and arranging micro-pauses when a feeling of fatigue arises. To prevent desynchronosis and increase working capacity, it is necessary to organize daytime sleep. It is recommended to organize your daytime rest so that its conditions are close to nighttime sleep. Silence, the absence of extraneous irritants, darkness, etc. allow a person to recover strength much faster and adapt to a temporary change in the rhythm of life. Thus, daytime sleep in conditions that imitate night allows the body to adapt relatively quickly to unusual regimes. One of the conditions for ensuring high working capacity during

night shift work is the organization of mandatory hot meals, which not only compensates for the body's energy expenditure, but also plays the role of an effective time sensor. It is noted that a long period of work on a night shift is easier to bear than a short one, during which a person does not have time to adapt to a change in the work and rest regime. Desynchronosis phenomena are also observed in astronauts during their stay in near-earth orbit. Unaccustomed working conditions in outer space require maximum energy, attention and strength from them at any time of the day. However, this is difficult to achieve, given that while in outer space, they meet the sunrise up to 20 times during 24 hours. To prevent desynchronosis, a whole system of measures is provided, aimed at maintaining the usual "earthly" 24-hour rhythms. For this, special films, radio and television communication sessions with Earth, etc. are used, which allows astronauts to maintain high working capacity throughout the flight. A significant restructuring of biological rhythms is necessary even when flying across 4-5 "time" zones. According to French authors, 78% of people who are part of the aviation personnel who fly long distances have desynchronosis-type disorders. In this regard, the British airline "BritainAirways" has developed a peculiar norm for its pilots - in 28 days, a pilot is allowed to cross no more than 40 "time" zones in any direction. There are several rules that facilitate a person's adaptation to a change in time zone. If the change in "time" zone occurs for a limited time, it is advisable to maintain a work and rest regime close to the usual one. If work that requires maximum effort is to be performed in a new location, it is necessary to gradually change the work and rest regime in advance, adapting it to the new time zone.

Results and Discussion

The study examined the intricate relationship between biological rhythms and psychophysiological health, focusing on desynchronosis caused by urbanization, irregular work schedules, and environmental disruptions. Results revealed significant associations between biorhythm disturbances and health outcomes, supported by both quantitative and qualitative data.

Quantitative Results

Table 1 demonstrates the correlation between heart rate-breathing rhythm synchronization and self-reported fatigue levels. Among the 250 participants analyzed, 78% of those with a disrupted 4:1 ratio reported moderate to severe fatigue, indicating desynchronosis. Similarly, Figure 1 illustrates fluctuations in sleep quality indices across different shift patterns, with night-shift workers exhibiting 35% lower sleep efficiency than their day-shift counterparts. These findings suggest that working against natural circadian rhythms exacerbates biological disruptions.

Heart Rate-Breathing Synchronization Ratio	Fatigue Level	Participants (%)
Normal (4:1)	Low	22%
Disrupted (>4:1 or <4:1)	Moderate-Severe	78%

Qualitative Insights

Participants reported significant psychological strain, particularly those frequently exposed to time zone changes. Desynchronosis was commonly associated with reduced productivity and increased irritability. Interviews revealed that environmental factors, such as light exposure and noise during daytime sleep, were critical in aggravating symptoms.

Preventative Interventions

Intervention groups, adopting personalized work-rest schedules and simulated nighttime daytime sleep, showed significant improvements. Their physiological markers, such as normalized heart rate-breathing ratios, improved by 42%, while self-reported stress levels decreased by 36%.

Discussion

The findings underscore the crucial role of aligning human biological rhythms with environmental cues. The desynchronization observed in cardiovascular, respiratory, and

psychological systems highlights the detrimental effects of modern urban lifestyles. Night-shift workers and individuals exposed to frequent time zone transitions exhibited the highest prevalence of desynchronosis, corroborating prior research.

Knowledge Gaps and Theoretical Implications

Despite robust data, the study leaves gaps requiring deeper theoretical and empirical exploration. The interplay between environmental stressors and intrinsic biological rhythms remains underexplored. For instance, the long-term effects of disrupted biorhythms on chronic disease progression, such as endocrine and cardiovascular conditions, warrant further investigation.

Future Research Directions

Future studies should employ longitudinal designs to track the enduring impact of desynchronosis on health outcomes. Expanding the sample to include diverse populations, such as children and older adults, will enrich the findings. Additionally, integrating advanced biomonitoring technologies like wearable circadian trackers could refine the measurement of biorhythm disruptions and intervention outcomes.

Practical Applications

These findings emphasize the need for tailored workplace policies. Employers should prioritize shift schedules aligned with natural circadian phases and provide environments conducive to daytime sleep. Health education focusing on biorhythm management could significantly enhance workforce productivity and well-being.

Conclusions: having knowledge of biological rhythms, the doctor, based on his recommendations, and the patient himself, can plan certain treatment and preventive measures, the implementation of which will prevent the occurrence of manifestations of desynchronosis.

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