

# Circavigintan Rhythms as an Indicator the Cardiovascular System of Students in the Context of Distance Learning During COVID-19

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## ABSTRACT

The article presents the results of studying the circavigintan rhythms of students in distance learning conditions in connection with the COVID-19 pandemic and self-isolation showed. It revealed that the state of the cardiorespiratory system of the students corresponded to the average level. On the second During Distance Learning Week, we noted positive adaptive responses. In general, students assessed their condition positively during the period of distance learning. The data obtained allow us to state that distance learning is gentle for the body of students. Despite the low physical activity, students had the opportunity individually regulate the time of rest. Many noted the possibility of normalizing the feeding time, which was not possible under traditional conditions. The results of the study revealed the need to develop sanitary and hygienic norms that regulate the time that is safe for the health of users.

**Keywords:** distance learning, cardiovascular system, circavigintan rhythms, COVID-19

## 1. INTRODUCTION

Generally accepted that biological rhythms are changes, the frequency of which preserved when isolated from external sources of time counting for two cycles (periods) or more. Biological rhythms are fluctuations in the change and intensity of processes and physiological reactions. They based on changes in the metabolism of biological systems due to the influence of external and internal conditions. The factors that affect the rhythm of the processes occurring in a living organism defined as "synchronizers" or, by definition of E. Buning (1961) - "time transducer" [1].

A living organism has a Spatio-temporal organization without coordination in time, the functioning of an integral organism is impossible, consisting of systems that are heterogeneous in their temporal parameters. The human body, as a whole, can exist only with a particular ratio of different oscillatory processes in cells, tissues, organs and functional systems, and their synchronization with environmental conditions [9].

Mismatch and restructuring of biological rhythms manifest itself in objective (change in blood pressure, heart rate, sleep disturbance, poor appetite, etc.) and subjective indicators (irritability, loss of strength; fatigue) [6].

Desynchronosis divided: 1) by duration - into acute and chronic; 2) by the strength of the mismatch - into explicit and hidden; 3) in terms of the volume of manifestation - into partial and total. Desynchronosis, as changes in the rhythmic structure of physiological functions, are early precursors of borderline disorders and an obligatory component of pathological conditions. In this regard, biological rhythms considered as a signal of distress. Disruption of any body function leads to disease. In this connection, there is a change in the daily rhythm. Desynchronosis accompanies any disease often detected before the onset of pronounced symptoms of the disease [5].

In March 2020, Russian universities switched to distance learning due to the high rate of spread of the coronavirus infection, dubbed COVID-19 [3].

For the first time, we faced the need to conduct classes not in traditional classroom conditions but with the intensive use of information and communication technologies [4; 7; 10-11].

How the low level of physical activity associated with the fact that they have to spend a long time at the computer affect the health of students? In conditions of muscle rigidity, hypodynamia develops [8]. We are interested in the students' opinion on how this training format will affect their health.

We believe that the biorhythmological approach to the phenomenon of time as a biological parameter and the study of the regularities of the temporal organization of living systems open up new possibilities for regulating the control of the processes taking place in the body [12]. In connection with the above, the goal set: to study the three-week cycle (circavigintan rhythms) in terms of the cardiorespiratory system in students in distance learning during the COVID-19 period [2].

## 2. METHOD

Everyone knows that the cardiorespiratory system is the first to respond to the influence of various factors of the external and internal environment. Significant changes in the indicators of this system indicate violations of the process of adaptation to the organism of the studied conditions.

Studies carried out for three weeks or more correlate to macro-rhythms. During April 2020, the indicators of the cardiorespiratory system studied using the well-known Belgian test "The reaction of the cardiovascular system to a load in the form of torso bends." Measurements of heart rate taken: 1) at rest; 2) after performing inclinations for one and a half minutes (20 inclinations); 3) after a minute of rest. The formula used to calculate the indicator of the cardiovascular system following the guidelines. The range of indicators includes the following states: 1) 0-0.3 - excellent; 2) 0.31-0.6 - good; 3) 0.61-0.9 - average; 4) 0.91-1.2 - below average; 5) more than 1.2 - unsatisfactory.

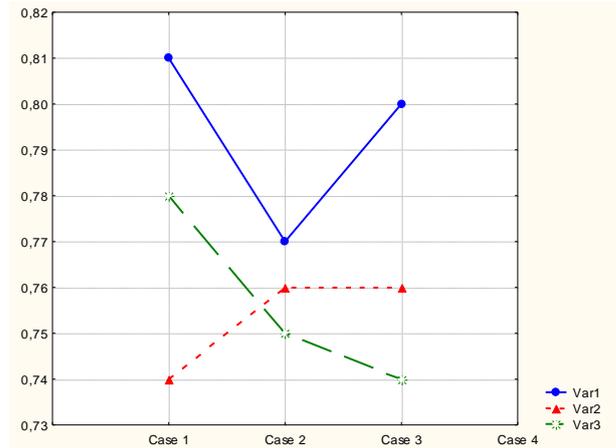
The students conducted the study every day at different intervals for three weeks at 8:00, 12:00 and 16:00. Circavigintan rhythms wick selected ( $20 \pm$  three days) represented for the analysis three-week cycle.

The study involved students from various fields of study at the age of 19-21.

## 3. RESULTS AND DISCUSSION

Observations showed that the variability of the functional state of students in terms of the cardiorespiratory system ranged within the average level (0.74-0.81). In the first week of distance learning, the minimum indicators observed in the range of 0.77;  $\delta \pm 0.02$ ; in the second week - 0.75;  $\delta \pm 0.02$ ; on the third - 0.78;  $\delta \pm 0.02$ .

In the first ( $R^2 = 0.704$ ;  $P < 0.001$ ) and the third ( $R^2 = 0.691$ ;  $P < 0.01$ ) weeks, students have significant synchronization of the state of the cardiovascular system according to the Belgian test (Fig. 1).



**Figure 1** Circavigintan rhythms ( $20 \pm$  three days) of the cardiovascular system according to

The minimum the Belgian test in students from the first to the third week in the context of the COVID-19 pandemic and distance learning (April 2020).

Note Cose - weeks (1, 2 and 3); Var - dynamics of indicators of each week (1-3 weeks).

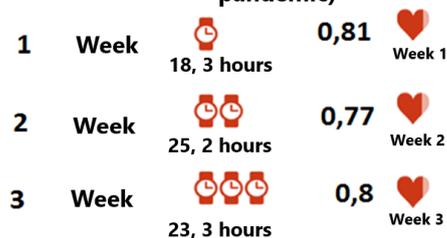
The learning process proceeded most favourably in the second week (in the middle of the month) of the survey. Overstrain of functional systems found in 7.1% of the examined.

In general, the results of the study of circavigintan rhythms of the cardiovascular system indicators in students showed that the body was in the range of the average level. We pay special attention to circadian rhythms, which allow observing the state of the organism of students in long-term conditions of research.

Acrophase during the study period was  $0.8 \pm 0.02$  ( $R^2 = 0.78$ ;  $P < 0.001$ ) and was noted in the third week of the study. Batiphase was detected in the second week of distance learning -  $0.47 \pm 0.03$  ( $R^2 = 0.38$ ;  $P > 0.05$ ).

The state of health of students in the conditions of distance learning in connection with the COVID-19 pandemic and self-isolation corresponded to the working state. The operating time at the computer shown in Figure 2.

### Circavigintan rhythms of the cardiovascular system according to the Belgian test for distance learning (in the context of the Covid-19 pandemic)



**Figure 2** Circavigintan rhythms ( $20 \pm$  three days) of the cardiovascular system according to the Belgian test in students and the time of work in the information and communication conditions of the COVID-19 pandemic and distance learning in self-isolation (data: April 2020)

The obtained data of the circulatory rhythm of the cardiovascular system indices according to the Belgian test showed that 92.1% of students had their organism in the range of 0.61-0.9, which corresponds to the average level. Of interest is the opinion of the students who took part in the study. Here are some conclusions that students came to because of the analysis of the information they received.

1. When I study the indicators of the cardiovascular system, I carried out following the recommendations during the period of training at the computer. The daily time was from three to 8 hours concerning the number of tasks. Indicators during the study did not exceed the coefficient - 0.91, which corresponds to the upper threshold of the average level. I felt much better than the traditional learning environment. I tried to be outdoors more. I noticed a deterioration in vision, so it is necessary to regulate the time of work in digital.

2. Based on the data I received, there is a slight dependence on the indicators on the number of hours spent at the computer. Overall, I had good cardiovascular health on the Belgian test throughout the study. I liked the work in remote mode. Habitual communication in university classrooms was still lacking.

3. Using the data obtained, I concluded that my state of health corresponds to the Belgian test was at an undesirable level. In the morning, the state of health was close to the average level, and during all other hours, fatigue, irritability and drowsiness observed.

4. The results of my observation showed that changes in the indicators of the cardiovascular system are cyclical. A relative improvement followed by deterioration. I liked distance learning because it was possible to get enough sleep and independently determine the time of intensive work. There was time for self-development.

5. The number of hours spent at the computer did not significantly affect the state of health. The cold contributed to the deterioration of the indicators, which caused general malaise and low physical activity. With distance learning, academic classes take place on a computer, and teachers give a large amount of homework with work on the Internet. Due to low physical activity, this negatively affects your well-being. It is necessary to develop guidelines for regulating the time of operation at the computer.

6. I think that working at the computer did not vastly affect my health during distance learning. I devoted about the same amount of time to computer work before distance learning. I believe that distance learning is advisable to use in education. However, educational platforms need to be technically improved.

All surveyed students noted that the time they determined for independent work in ICT was not efficient and the most favourable for their body. Because the individual style of educational activity not formed.

Analysis of students' opinions during the study period showed that students positively assessed their health status during distance learning in self-isolation. The positive experience of distance learning surveyed acquired 83.7%. There were no complaints of negative mental state or depression. All students noted the difficulties of adapting

to this format of education in the early days. The time of awakening was unusually satisfying since there was an opportunity to get enough sleep. In the traditional learning model, everyone stressed by getting up early and transport time. More than 54.8% of students spend more than 2 hours travelling to and from the university.

#### 4. CONCLUSION

In general, the results of studying the circavigintan rhythms of students in distance learning conditions in connection with the COVID-19 pandemic and self-isolation showed that the state of the cardiorespiratory system corresponded to the working state and was in the range of the average level. Positive adaptive reactions noted in the second week of distance learning, but in this week, students had the maximum time to work at the computer (25.2 hours). In general, students assessed their condition positively during the period of distance learning. Many indicated that there was more time for self-development. The data obtained allow us to state that distance learning is gentle for the body of students. Despite the low physical activity, students have the opportunity to independent and individually control the time of rest. Many noted the possibility of normalizing the feeding time, which was not possible under traditional conditions. The results of the study revealed the need to develop sanitary and hygienic norms that regulate the time that is safe for the health of users.

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