Physical education and health improvement methodology as a means of preventing maladaptive disorders in students under self-isolation caused by the Covid-19 pandemic

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Abstract

Aim. The purpose of the study is to prevent the adverse effect of the self-isolation regime caused by COVID-19 by attending remote physical education classes with students of III-IV health groups. **Materials and methods.** The study involved 38 first-year female students aged 18.1 ± 0.3 years (South Ural State University). The experiment was conducted remotely and lasted three months. A methodology for remote physical education and health improvement classes was developed and justified. This methodology consists of modern programs of physical therapy (exercise therapy) and fitness and also includes emotional and muscle relaxation (EMR) techniques and ideomotor movements (according to M. Sandomirsky, 1995). The individual minute test and tapping test were used for assessing signs of maladaptation. The assessment of psycho-emotional state was carried out using the integrative anxiety test (IAT) by A. Bizyuk, L. Wasserman, B. Iovlev. **Results.** Desynchronosis associated by an accelerated subjective perception of time, low functional mobility of nervous processes with a dominant below average and average to below average working capacity, as well as high anxiety, both personal and situational, were identified during the study. Our methodology of physical education and health improvement classes contributes to the development of stable adaptation processes and reliably ($p < 0.05$) brings the disturbed biorhythms of female students to their physiological norm. The use of this methodology allows successfully overcoming mental maladjustment, reducing the level of situational anxiety, stabilizing the functional state of the central nervous system, improving working capacity and increasing the strength of nervous processes. **Conclusion.** The results obtained indicate the importance of physical activity adequate to the functional state of students for the prevention of maladaptive disorders in conditions of self-isolation.

Keywords: a new type of coronavirus, maladjustment, desynchronosis, physical inactivity, prevention.

Introduction.

On March 11, 2020, the World Health Organization (WHO) announced that the spread of a new type of coronavirus COVID-19 had become a pandemic. According to the order of the government of the Chelyabinsk region, high alert status was introduced to counter the spread of the coronavirus COVID-19. This status included, among other things, the mandatory wearing of personal protective equipment, the cancellation of public events, the education based on distance technologies and the self-isolation mode. The total duration of the abovementioned activities was more than 3 months.

It has been established that the spread of the coronavirus (COVID-19) is not only an epidemiological but also a psychological crisis (Fedosenko, 2020). It is known that during forced isolation, a person experiences severe stress due to a dramatically changed lifestyle. Distance learning or teleworking, a decrease in social contacts and physical activity, fear of getting sick and anxiety for relatives, the inability to cope with stress using available methods negatively affect physical and mental health (Pan, Chang, & Yu, 2005, Reynolds, Garay, Deamond, Moran, Gold, & Styra, 2008, Wang, Xu, Zhao, Cao, He, & Fu, 2011, Makarowski, Piotrowski, Predoiu, Görner, Predoiu, Mitache, & Nikkhah-Farkhani, 2020. According to a number of authors, the following most common psychological disorders were recorded during and after quarantine: anxiety, fear, apathy, stupor, depression, insomnia, symptoms of post-traumatic stress, anger and emotional exhaustion, low mood and irritability (Hawryluck, Gold, Robinson, Pogorski, Galea, & Styra, 2004, Braunack-Mayer, Tooher, Collins, Street, & Marshall, 2013, Pellicchia, Crestani, Decroo, Van den Bergh, & Al-Kourdi, 2015, Caleo, Duncombe, Jephcott, Lokuge, Mills, Looijen, & Greig, 2018, Ostrovskiy, Ivanova, 2020).

It should be noted that in this situation, the negative impact of low physical activity on the human body is of great importance. It is well known that physical inactivity contributes to oxygen starvation, which results in significant functional changes in the cardiorespiratory system, central nervous system, musculoskeletal system,

as well as in metabolic processes. Low physical activity causes deconditioning of the cardiovascular system, blood circulation disorders, deterioration of exercise tolerance, changes in emotional reactivity, and a decrease in stress resistance (Kovalenko, Gurovsky, 1980). Therefore, the study of the psychophysiological state in university students with health problems is considered relevant.

The purpose of the study is to prevent the adverse effect of the self-isolation regime by attending remote physical education classes with students of III-IV health groups. **Materials and methods.** In the course of the research, an emphasis was made on the symptoms of maladaptive states, as well on the psycho-emotional state of female students during self-isolation. The research was carried out at South Ural State University (National Research University), Department of Physical Education and Health. 2 groups of first- year students with health problems were formed ($n = 38$, 20 - the main group, 18 - the control group). All female students attend physical education classes in a special medical group. The study involved female students aged 18.1 ± 0.3 years of III – IV health groups (in accordance with Appendix No 1 of the Order of the Ministry of Health of Russia dd. 03/01/2016 No 134H). The study was carried out in 2 stages: in the early days of self-isolation (late March - early April) and at the end of the academic year (late June - early July).

A methodology for improving physical and psychological health was developed taking into account the recommendations of the World Health Organization . This methodology is based on state of health estimation, individual students' characteristics and their physical fitness. In the main group, physical education classes consist of modern programs of physical therapy (exercise therapy) and fitness that are in demand among young people and meet the clinical and pathogenetic features of the disease: callanetics, resistance band training, stretching, pilates. At the same time, as a result of stress associated with the self-isolation regime, these PE classes included emotional and muscle relaxation (EMR) techniques, as well as ideomotor movements (according to Sandomirsky, 1995). Therefore, a physiologically oriented technique was created based on the reflex theory of higher nervous activity and the well-known psychophysiological laws of nervous system functioning (Sandomirskiy, 2007).

All classes were conducted remotely using modern video technologies, 3 times a week, for an hour. At the beginning of the lesson, breathing exercises with elements of corrective gymnastics were used. The main part of the lesson consisted of fitness programs adapted for home classes. In the final part of the lesson, emotional and muscle relaxation (EMR) techniques, as well as ideomotor movements were used, which consisted of exercises for the development of muscle perception through inner sensations. Initial relaxation occurs automatically after stress, being a physiological consequence of fatigue (central mechanisms of fatigue) (Sandomirskiy, 2007). In the control group, physical education classes were carried out in accordance with a program of general exercises (GE).

The following research methods were used for assessing the psychophysiological parameters and the effect of the proposed technique: the individual minute test (the subjects' own time scale) for signs of maladaptation and tapping test. The assessment of psycho-emotional state was carried out using the integrative anxiety test (IAT) by A. Bizyuk, L. Wasserman, B. Iovlev B.V. (2005).

The study of the individual minute is one of the criteria for assessing the biological rhythms of a person, which allows us to assess not only human performance in general but also the stress level of regulatory mechanisms and their functional reserve, adaptive capacities and psycho-emotional state (Moiseeva, 1989). Testing consists in comparing an individual's minute with an astronomical minute. Due to the fact that the duration of the individual minute can vary during the day, testing was carried out at the same time of the day.

In the main group, the study of the individual minute at the beginning of self-isolation revealed an accelerated perception of time in 83% of cases, a delayed one in 8% of cases, and those corresponding with the physical one in 9% of female participants. In the control group, accelerated perception was recorded in 86% of cases, a delayed one in 7% of cases, and those corresponding with the physical one in 7% of female participants. The results in both groups did not have significant differences ($p > 0.05$). The results obtained are shown in table 1.

Table 1

Results for the individual minute test (s)

	At the beginning of self-isolation (March-April)	At the end of the academic year (June-July)	P
Main group (n=20)	43.2±1.7	52.6±1.8	<0.05
Control group (n=18)	44.1±2.0	47.4±2.1	>0.05
P	>0.05	<0.05	

In our opinion, the data obtained in the control and main groups are primarily associated with the fact that female participants have functional problems. Moreover, desynchronosis is aggravated with increased mental stress, which can be explained by pandemic-related restrictions, the transition to distance learning, the new realities of university education, and the changed living conditions of first-year students. The obtained data correlate with other studies stating that any stress-provoking factors result in accelerated time perception (Yu.M. Zabrodin et al., 1983; N.A. Barbarash et al. et al., 1999,2005; M.Yu. Kamenskov, 2005). At the same time, it is important to note that the obtained values indicate a reduced level of adaptive reserves among first-year students in the main and control groups.

The results obtained in the main group at the end of the first academic year (end of June - beginning of July) indicate the positive effect of physical education classes. Despite the fact that the individual minute values still do not correspond to physical time, its duration is reliably approached ($p < 0.05$) the norm in comparison with the control group. In our opinion, these changes are due to the effect of breathing and relaxation exercises, which improve the psycho-emotional state. Moreover, such exercises enhance the trophotropic effects of the autonomic nervous system resulting in a decrease in excitation processes. It is important to note that testing took place during exams and against a long-term self-isolation regime, which imposed an additional psycho-emotional load on female students; nevertheless, the results of the main group allows us to make a conclusion about the mobilization of students' compensatory-adaptive reactions and the development of a stable adaptation process.

In the control group, a low reactivity to stress was revealed (47.4 ± 2.1 s), which did not imply a significant improvement in the perception of time. Subjective underestimation of time perception is associated with overstrain of adaptation mechanisms (Moiseeva, 1989).

During self-isolation, when psycho-emotional stress increases, increased demands are made on psychological adaptation. In this regard, the relevance of studying anxiety as a fundamental personality characteristic and anxiety as an emotional state is obvious. Being one of the most important signs of acute and chronic stress, anxiety performs both a mobilizing function and a destabilizing one if its intensity and duration exceed the individual compensatory abilities in terms of adaptation (Bizyuk, Wasserman, Iovlev, 2005)

In addition to the general assessment of situational and personal anxiety, the integrative test provides 5 subscales that allow analyzing the structure of anxiety and identify the component responsible for stress such as emotional discomfort, asthenia, phobia, anxious assessment of prospects, and socially-determined protective reactions.

By the time of the implementation of restrictions in both groups of female students, a high level of personal and situational anxiety was found, which, according to A. Bizyuk et al, (2001) confirms the presence of general psychological discomfort and disharmony with the environment. Analysis of situational anxiety showed high values of emotional discomfort, which indicates emotional disorders, a negative emotional background, dissatisfaction with life, and emotional tension. Also, high values were recorded on the phobia scale associated with a feeling of an incomprehensible threat, self-doubt, self-uselessness, as well as on the anxious assessment of prospects scale reflecting a general concern about the future. Other components of anxiety at the beginning of the study corresponded to the normal values.

The dynamics of situational anxiety and its components is shown in Table 2.

Table 2

The dynamics of situational anxiety and its components in first-year female students (in stanines)

Component	Main group (n=20)		P	Control group (n=18)		P
	March-April	June-July		March-April	June-July	
General situational anxiety	7.2±0.9	6.3±1.1	<0.05	7.3±0.9	6.8±1.2	>0.05
Emotional discomfort	7.1±0.7	5.3±0.8*	<0.05	7.0±1.1	6.7±0.9*	>0.05
Asthenic component	4.6±0.7	5.5±1.2	>0.05	4.5±0.8	6.6±1.0	<0.05
Phobic component	6.7±0.6	5.5±0.9*	>0.05	6.6±0.4	6.8±0.8*	>0.05
Anxious assessment of prospects	7.2±0.8	5.6±1.2*	>0.05	7.3±0.9	7.1±0.9*	>0.05
Protective reactions	5.4±0.5	6.2±1.2	>0.05	5.3±0.4	6.6±0.9	<0.05

Note: * - statistically significant difference between the main and control groups at $p < 0.05$.

A high level of personal anxiety (6.5 ± 1.2 stanines) in the main group was determined by the following components: emotional discomfort - 6.2 ± 0.9 , anxious assessment of prospects - 5.9 ± 1.2 and the phobic component - 6.4 ± 1.1 . Personal anxiety remains more rigid in terms of the qualitative change of its components. Our methodology of physical education made it possible to reliably ($p < 0.05$) reduce situational anxiety in the main group closer to the upper limit of reference values. Whereas in the control group, only a tendency towards a decrease was revealed. According to a number of researchers, stress and anxiety are associated with muscle tension. Regular, methodologically correct techniques for emotional and muscle relaxation allows reducing the contractile tension and nervous activity of the skeletal muscles, thereby, helping to reduce the level of anxiety and the severity of autonomic imbalance. At the same time, the use of breathing exercises in physical training, which reduce the severity of sympathetic influences, also contributes to the normalization of the psycho-emotional state of female students.

By the beginning of July, a statistically significant (from 7.1 ± 0.7 to 5.3 ± 0.8 stanines) improvement in the emotional state of first-year students was observed in the main group, where the values studied decreased to the upper limit of reference values. At the same time, no significant changes were found in the control group (from 7.0 ± 1.1 to 6.7 ± 0.9 stanines). In the control group, the asthenic component of anxiety, which is responsible for fatigue, sleep disturbance and lethargy worsened significantly ($p < 0.05$). In the main group, a tendency towards an increase in these indicators was revealed, which are, nevertheless, within the normal range, despite of the increased load by the end of the academic year associated with exams. In our opinion, the statistically significant difference ($p < 0.05$) between the groups is associated with the fact that the intensity of

anxiety in the control group is of a long-term nature and, therefore, it disorganizes students in the control group by reducing the productivity of their work (Yerkes-Dodson law). In the main group, the indicators of the "phobic component", in particular the feeling of an incomprehensible threat, show a downward trend and approach the upper limits of reference values, which is explained by both the epidemiological situation and medical and social activities in the region. At the same time, female participants had health problems, which contributed to the already existing fears about health. It is important to note that at this stage, a significant difference ($p < 0.05$) was revealed between the indicators of the main and control groups, which is explained by the use of popular fitness programs and activation of competitive influence that switches the pathological dominant in the cerebral cortex.

When studying the anxious assessment of prospects component in the main group, a tendency towards a decrease (from 7.2 ± 0.8 to 5.6 ± 1.2 stanines) was revealed, which can be explained by abnormal situation in the world, which makes impossible to anticipate the outcomes of the current situation. An additional load on the emotional state of students is provided by innovations in the teaching system. Therefore, there is a statistically significant ($p < 0.05$) difference in indicators that are responsible for expectations associated with the future.

The study of the protective reaction component characterized by anxiety in social contacts or the subject's perception of the social environment as the main source of stress and self-doubt revealed that, by the beginning of July, in both groups, there was an increase in these indicators to the values exceeding reference levels. In the main group, there was a tendency to increase (from 5.4 ± 0.5 to 6.2 ± 1.2 stanines), in the control group, there was a significant reduction of indicators (from 5.3 ± 0.4 to 6.6 ± 0.9 stanines). The determining factor may be the long-term self-isolation of female students accompanied by distance learning and the lack of socialization, which are essential at a given age. When monitoring the functional state of the central nervous system (CNS) and the features of adaptation to stress factors, the classic tapping test was used. The analysis of the results obtained before the experiment showed the following values: in the main group, 5% of female students with high working capacity, 30% with average working capacity, 35% with average to below average and 30% with below average working capacity. In the control group, the same data were distributed as follows: 5.5% (high), 27.8% (average), 33.3% (average to below average) and 33.3% (below average). The results in both groups did not have significant differences ($z \geq 0.05$). R. Baevsky showed that persons with low functional mobility of nervous processes were predisposed to a more rapid development of signs of fatigue, which was a consequence of the desynchronization of physiological processes (Chelyshkova, Khasanova, Grechishkina, Namitokova, Kornik, & Frolova, 2014). These data correlate with those obtained in our study when recording the duration of an individual minute. The results are presented in Table 3 and Figure 1.

Table 3

The features of the nervous system depending on the psychomotor indicators of female students (number of cases)

Dynamics	Strength of nervous processes in participants	
	Main group (n=20)	Control group (n=18)
Positive	12	6
Negative	3	6
Without dynamics	5	6
Significance	$Z \leq 0.05$	$Z \geq 0.05$

Figure 1- Dynamics of changes in the strength of nervous processes

As can be seen from Table 3 and Figure 1, after the introduction of special training, the functional state of the central nervous system significantly improved in the main group. The proportion of persons with high working capacity increased to 10%, average working capacity was revealed in 40% of the female students, the

average to below average values were found in 35% and below average – in 15% of female participants. There was also a slight improvement in the control group: 5.5% and 27.7% for students with high and average working capacity of the nervous system, the number of female students with average to below average working capacity increased to 38.9% and with below average - to 27.7%. Thus, in the control group, changes are considered statistically insignificant. This indicates that our methodology of physical education classes combined with emotional and muscle relaxation and ideomotor movements (M. Sandomirsky, 1995) has a positive stabilizing effect on the central nervous system despite the changes in learning conditions of female students. In our opinion, this is due to the harmonization of mental processes, the normalization of excitation and inhibition in the cerebral cortex, a decrease in the level of concomitant stress and a decrease in the signs of fatigue.

Conclusion.

When studying the psycho-emotional state of female students in self-isolation conditions caused by the spread of COVID19, a high level of anxiety was revealed both personal and situational. First of all, this was manifested by a reduced emotional background and general tension, as well as dissatisfaction with life and emotional disorders. In addition, first-year students had a pronounced feeling of an incomprehensible threat accompanied by self-doubt, the feeling of their uselessness and general concern for the future against the background of increased emotional sensitivity. The following maladaptive states caused by the regime of self-isolation were identified in female students: desynchronization manifested by an accelerated subjective perception of time, low functional mobility of nervous processes with a dominant average to below average and below average working capacity. Our methodology of physical education for female university students with health problems contributes to the activation of their compensatory and adaptive mechanisms and the development of stable adaptation process. This results in bringing the disturbed biorhythms of female students to the physiological norm. It allows successfully overcoming mental maladjustment, reducing the level of situational anxiety, stabilizing the central nervous system, improving performance and increasing the strength of nervous processes.

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