

REVIEW

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Non-Pharmacological Measures in the Prevention and Treatment of COVID-19 Infection

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ABSTRACT

Background: Previous pandemic and catastrophic events significantly changed the life of every human being, bringing him/her into a state of stress and the need to quickly adapt to new ways of daily activity. COVID-19 has a negative impact on all elements of health: social, physical and mental. Pharmacotherapy, as well as protective measures (isolation, wearing masks and maintaining physical distance) did not give the expected results. Vaccination has not yet led to herd immunity, so it is still jeopardizing every aspect of human health (1, 2). Non-pharmacological methods, such as stress and sleep control, physical activity and contact with nature are of great importance since they can significantly contribute to staying healthy during a pandemic. **Objectives:** The aim of this paper is to evaluate the impact of non-pharmacological measures such as stress and sleep control (with different measures against the negative effects of anxiety and depression on mental state) and the possible positive impact of "forest bathing" on improving the immune response to the virus and its consequences. **Methods:** Available evidence-based studies on ways to combat stress and the effect of the proposed measures on human mental health and the immune system were analyzed. From the mentioned studies, recommended measures have been registered, which refer to stress and sleep control, diet and eating habits, contact with nature ("forest bathing", gardening), virtual communication and meditation (mindfulness practice). **Results and Discussion:** The combined results of these studies indicate that COVID-19 has a chronic course and complications that significantly affect the physical, mental and emotional state of the patient. Proven positive effects of non-pharmacological measures can be applied in the daily practice of primary health care in the comprehensive fight against the COVID-19 pandemic. **Conclusion:** Non-pharmacological measures such as stress and sleep control, spending time in nature, healthy diet, and physical activity may improve the immune response to COVID-19. These measures, with their positive effects on all aspects of health, can make a major contribution to controlling and improving the quality of life during the COVID-19 pandemic.

Keywords: COVID-19, mental health, PCSS, non-pharmacological, forest bathing, immune system.

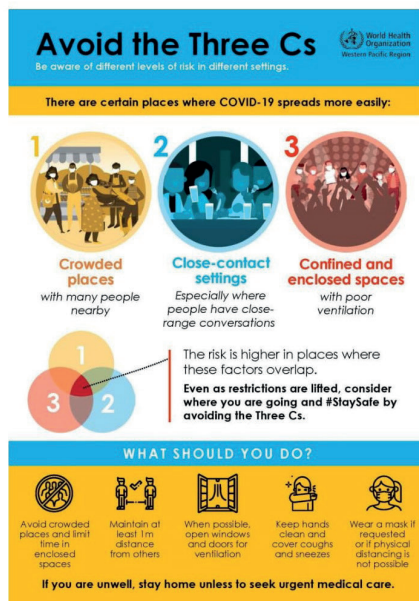
1. BACKGROUND

Previous pandemic and catastrophic events significantly changed the life of every human being, bringing him into a state of stress and the need to quickly adapt to new ways of daily activity. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread across the planet Earth at a rate not yet recorded in the history of infectious diseases. Pandemic of this magnitude has led to tremendous changes in the lives of all the people of the world (1). The World Health Organization (WHO), public health institutions and its experts, using experiences from previous pandemics, are developing different strategies: early interventions with hygiene recommendations, wearing masks, physical distancing, blocking traffic, restrictions on movement, quarantine, banning mass gatherings, closing schools, universities, cultural and sporting events, and other institutions to control the spread of COVID-19 (1). Partly on the basis of crucial WHO infographics, an alternative to lockdown was proposed as the most important measures for prevention COVID-19 infection, namely the Three Cs Strategy (Figure 1), focused on promotion of a healthy lifestyle and fight with indoor air pollution and fever phobia.

Humans, as social beings, find it difficult to bear these measures, especially since social media provide a whole range of information that does not correspond with the real situation. Health systems could not respond to these challenges for many reasons, so Homo sapiens found itself in one of the most

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Let us move a lot outdoors with an uncovered nose, based primarily on two WHO infographics

(<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters#exercising> and <https://www.who.int/malaysia/news/infographics---english>, see also the Three Cs Strategy, <https://www.eimanager.com/mnstemps/10/10-1604859731.pdf?t=1604903670> and <https://www.linkedin.com/pulse/lets-encourage-physical-activity-outdoors-inhaling-through-ufnalska/?published=t>



Figure 1. Illustration created by S. Ufnalska, partly based on WHO infographics about prevention measures against COVID-19 infection (2)

critical situations in the history of civilization, because the question

Figure 1. Illustration created by S. Ufnalska, partly based on WHO infographics about prevention measures against COVID-19 infection (2) arises of maintaining the species and planetary ecosystem in this form (3).

Envisioned COVID-19 control measures did not lead to the expected results. The emergence of new strains of SARS-CoV-2 virus has also reduced the effectiveness of the vaccine. RNA viruses, such as SARS-CoV-2, mutate over time. This mutation leads to changes in virulence, rate of spread, severity of infection but also has the ability to weaken the effect of a vaccine or drug. So far, 4 variants of SARS-CoV-2 have been reported (Alpha, Beta, Gamma and Delta). Each variant leads to a new wave of pandemic, which further creates panic, fear, anxiety and significantly endangers the mental health of the population. Vaccination due to various circumstances has failed to lead to collective immunity that would prevent the further spread of the disease.

Inadequate patient response and the occurrence of massive chronic stress negatively affected the state of the immune system (4). Natural human defence and natural nonspecific immunity were deficient even before the onset of pandemics due to epidemics of obesity and unhealthy lifestyles.

The pharmacological effects of the treatment also did not give adequate results as there is still no specific drug for COVID-19. Some of the proposed WHO measures, such as quarantine and physical distancing as well as the ban on large gatherings, have further endangered the social and mental health of every human

being. In such cases, the adequate use of non-pharmacological measures in the fight against the COVID-19 pandemic can make a significant contribution to

Prevention and treatment of mental health disorders is one of the important elements in the fight to control the COVID-19 pandemic. Based on the psychophysical status of the person and his/her environment, different procedures in daily activities can be suggested, as shown in Figure 2 (5). There are a number of non-pharmacological procedures in stress control depending on how a person copes in the presence of a disease, such as COVID-19. Figure 3 shows specific methods for stress control.

Meditation and mindfulness practice can significantly improve the emotional status, reduce stress, anxiety and depression, and prevent overeating, and substance use

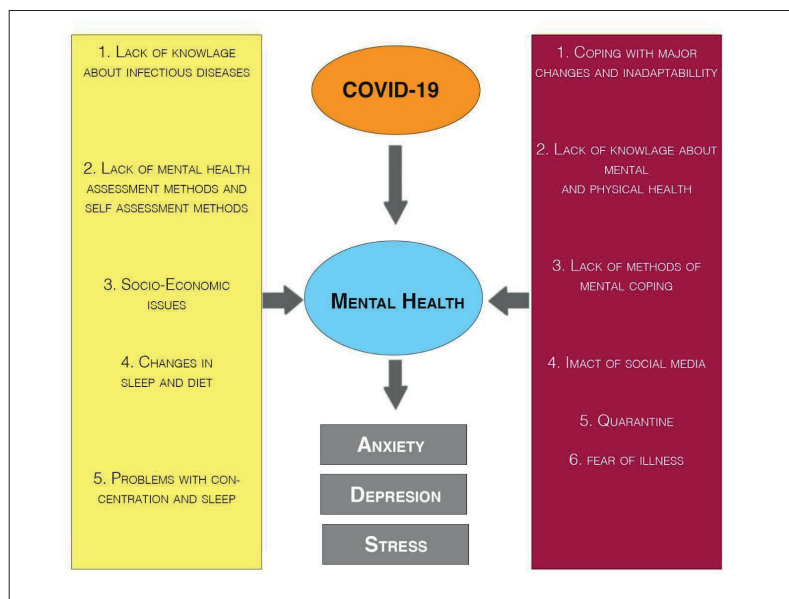


Figure 2. Risk factors for the occurrence of stress and mental disorders

(6). Various procedures, such as breathing exercises, progressive muscle relaxation, listening to music, reading adequate literature, or watching relaxing videos, strengthening the general defense capabilities and improving the quality of life.

Online conversations with loved ones or medical staff can be used as an anxiety and stress relief (5).

Excessive exposure to stress, which occurs during the pandemic, also leads to sleep disorders. Quality of sleep is a basic need for a healthy life. Sleep disorders threaten physical and mental health. Good sleep is a prerequisite for good function of the immune system, but also other organ systems. Healthy sleep habits enable the necessary daily activities.

By maintaining adequate physical activity, it is possible to reduce the risks of many diseases and improve the overall quality of life. Adequate, individualized needs for physical activity depend on age, body weight, gender, occupation, and health status. The need for physical activity is related to the consumption of energy that is ingested with food. Parameters based on the maximum heart rate (HRmax), metabolic equivalent (MET) and basal metabolic rate (BMR) are most commonly used to determine the required intensity and timing of physical activity (3).

Physical activities stimulate the body to release a large number of hormones such as endorphins, endocannabinoids, which help improve sleep and relieve anxiety.



Figure 3. Selection of stress control procedures during a pandemic

Common activities during restrictive measures can be running outside, e.g. cycling, aerobics or yoga (3, 7).

Returning to nature, from a health point of view, is not just a physical activity, but a walk through a deciduous forest allows the intake of a larger amount of oxygen with the forest air (3).

Figure 4. Forest bathing and gardening help with stress control

Today, the symbolic term “forest bathing” is also used. This term originated in Japan in the 1980s, as a physical activity and psychological relaxation called “shinrin-yoku” (“shinrin” means forest and “yoku” means bath). The purpose was twofold: to offer an ecoantidote to compromised health, created by the development of technology and an accelerated life-style. In ecological terms, the population is encouraged to return to their original nature, reconnect and protect the forest. It was quickly accepted as a form of ecotherapy, similar to thalassotherapy in the Kvarner Bay (8, 9). The three most important benefits of walking in the woods are: non-stereotypical physical activity, inhaling the right amount of oxygen, and inhaling microparticles secreted by plants. Staying in nature, especially in the mountainous parts of the country (500m and more) has an anti-stress, positive effect.

Forest bathing satisfies both spiritual and psychological needs. Inhalation of forest air brings in useful essential oils of plant origin and negatively charged ions. During each stay in the forest, the lungs inhale oxygen without harmful gases. Phytoncides have a strong anti-allergic and anti-inflammatory effect, and they are emitted by plants and trees in the forest. During the period of forced isolation, gardening is also recommended. Working in the garden can bring benefits from physical activity, and at the same time can have relaxing effects



Figure 4. Forest Bathing and gardening help with stress control



Figure 5. Physical activity in pandemic times.

in the occurrence of anxiety and stress, as working with plants leads to self-awareness of the importance of helping the environment and maintaining health (Figure 4) (10).

The impact of food and eating habits on the immune system are well researched. Adequate food choices, healthy eating habits are of utmost importance in strengthening natural defence against COVID-19 pandemic (11).

Diet should be filled with these micronutrients: vitamins A, B, C, D, zinc, selenium, calcium, magnesium, since they have a significant effect on strengthening immunity during COVID-19. Eating disorders can have a negative effect on the immune system, so mindful eating is recommended as part of mindfulness practice (12).

2. OBJECTIVE

The aim of this paper is to evaluate the impact of non-pharmacological measures, such as stress and sleep control (with different measures against the negative effects of anxiety and depression on mental state) and the possible positive impact of “forest bathing” on improving the immune response to the virus and its consequences.

3. MATERIAL AND METHODS

Available evidence-based studies on ways to combat stress and the effect of the proposed measures on human mental health and the immune system were analyzed. From those studies, recommended measures have been registered, which refer to the stress and sleep control, diet and eating habits, staying in nature (“forest bathing”, gardening), virtual communication and meditation (mindfulness practice).

4. RESULTS AND DISCUSSION

Physical and mental health depends on proper food and micronutrients but also the ability to adapt to the

stress, fear and panic that occur in the COVID-19 pandemic (13).

Numerous studies have reported that adequate nutrition rich in micronutrients, physical activity, sleep control, gardening and forest bathing have a proven impact on strengthening the immune system. These non-pharmacological measures have proven effects in maintaining emotional and mental health (14).

COVID-19 most often attacks the lungs. If enough oxygen is inhaled and if the proportion of pollutants in the air is reduced, there is no doubt that the respiratory system will be strengthened. More T lymphocytes will be created in the body, blood pressure will be balanced, and the body will relax (feeling of calmness and clarity).

The scientific community has also noted a positive influence of outdoor activities on specific hormones, including effects on stress reduction. For all these reasons, it is recommended for all persons, especially those older than 65, to plan the time for “forest bathing” in order to strengthen their immune system and improve the state of all organs and systems.

Symptoms of an excessive CO₂ level in the blood (hypercapnia) can progress from breathlessness, headache, confusion and lethargy, flushed skin, rapid breathing, muscle twitches, and hand flaps to heart beat disorientation, panic, hyperventilation, convulsions, unconsciousness, and even death. To prevent this, some authors have recommended simple first-aid advice that may improve blood oxygenation and reduce the CO₂ level when oxygen saturation starts to decline (hypoxia): (a) ensure access to fresh air; (b) breathe in through the nose only; and (c) listen to relaxing sounds (e.g. birds, music). The advice may seem obvious, but both patients and caregivers tend to panic in such situations, so these simple tips may help them act sensibly and relax, to reduce the level of stress, as it strongly disturbs breathing and our immune response (16-19).

In Table 1, Ufnalska S. explained the profound role of breathing in through the nose. Nitric oxide produced in nasal cavities is particularly important in COVID-19 primarily because it improves blood oxygenation in lungs and inhibits coronavirus replication. She also emphasized the need to fight the widespread fever phobia,

Breathing in through the nose	Breathing in through the mouth
+ filters, warms and wets the air	- does not filter, warm, and wet the air
+ nitric oxide produced in nasal cavities disinfects (by blocking the replication of viruses and the multiplication of bacteria in the lungs), broadens the airways, improves blood supply to the lungs, and stimulates the production of surfactant, “lubricating” the lungs	- does not make use of nitric oxide (which disinfects, stimulates surfactant production, etc.)
+ improves oxygenation of the body, facilitating concentration	- causes shrinking of our airways and blood vessels in the lungs, slows down the release of oxygen from haemoglobin (so-called Bohr effect)
+ prevents drying of the mucosa in our airways	- lowers oxygenation of the body, making it difficult to concentrate
+ reduces the mucosa surface exposed to infection	- dries the mucosa in our airways
	- increases the mucosa surface exposed to infection
	- slows down the development of speech in children, can lead to malocclusion and hearing impairment

Table 1. Major advantages of breathing in through the nose and disadvantages of breathing in through the mouth (19)

“because fever helps to fight the virus by both slowing down its replication and accelerating antibody production. Obviously, adequate hydration of the organism is then necessary, and in some groups of patients fever must be avoided for medical reasons. In conclusion, promotion of breathing in through the nose, relax, and fight with fever phobia are crucial in slowing down the spread of COVID-19 and lowering the risk of its severe symptoms” (19). The cited author stated that the risk of infection is increased mainly if you talk to an infected person for a long time or breathe in a lot of polluted air indoors.

In many studies, it has been proven that more time spent in green areas leads to a reduction in the levels of stress hormones, such as cortisol. It has been shown to reduce heart pressure and the risk of coronary heart disease. Studies examining the effectiveness of the immune system have indicated that subjects who spend more time in the woods have an increased number of immune cells and have a lower chance of contracting COVID-19 (9, 13, 14).

Studies on the application of meditation and mindfulness practice have led to an improvement in psychophysical stability during the pandemic and enable daily activities by reducing anxiety and fear (6).

WHO defines SARS-CoV-2 variant of concern if there are genetic changes known to change virus essence, increase in transmissibility, virulence and clinical disease presentation, decrease in effectiveness of vaccines, therapeutics or preventive measures (4).

The appearance of new strains of the virus, the possibility of further mutations and the unpredictable course of the disease with the appearance of complications additionally jeopardized all aspects of health.

Social isolation, loneliness, sudden changes in daily habits, unemployment and financial insecurity become risk factors for major depressive and post-traumatic stress disorder (Post-Coronavirus Stress Syndrome–PCSS) described and published by the same authors of this paper one year ago, as one of most important consequences of the COVID-19 pandemic, as it potentially has long-term effects on physiology and brain function. Unfortunately, our prognoses were realized in the health practice within the population globally (15,21). Illness-related fear and anxiety and its consequences can cause strong negative emotions. It is important to keep a person’s mental and physical status to overcome the risk of developing stress-related symptoms related to COVID-19 (13, 17-21).

The intensity of physical activity depends on age, so it is advisable to take the determination of daily physical activity based on the maximum heart rate (HR_{max}). (Figure 5). Furthermore, body weight differs in humans, so the needs for a person of 120 and 50 kg are not the same, so it is recommended to consider the metabolic equivalent and the energy of basal metabolism increased by the energy of activity. However, a simple recommendation for adults is a minimum of 5 days of daily physical activity for 1 hour (3).

5. CONCLUSION

Non-pharmacological measures – such as stress and sleep control, spending time in nature, healthy diet, and physical activity – may improve the immune response to COVID-19. These measures, with their positive effects on all aspects of health, can make a major contribution to controlling and improving the quality of life during the COVID-19 pandemic.

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- **Conflict of interest:** None declared.

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2. Illustration by Ufnalska S. available from: <https://www.linkedin.com/pulse/lets-encourage-physical-activity-outdoors-inhaling-through-ufnalska/>, based on two WHO infographics: “Avoid the Three Cs” <https://www.who.int/malaysia/news/infographics---english> and “Can people wear masks while exercising?” <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters#exercising>
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