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# REHABILITATION EXPERIENCE IN PATIENTS WITH POST-COVID SYNDROME

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***Abstract***

*A large number of patients with new coronavirus infection at high risk of developing post – COVID syndrome. Therefore, most patients will certainly require rehabilitation to mitigate the effect of this syndrome.*

**Objective**. *The primary objective of this research was to assess the severity of post–COVID syndrome in individuals upon their admission for sanatorium-based rehabilitation, and to evaluate the feasibility of incorporating aerophytotherapy techniques during the rehabilitation process.*

**Materials and methods**. *A total of 260 patients who had recently recovered from COVID-19 were enrolled in the study and subsequently admitted for sanatorium-based rehabilitation. These patients underwent a thorough assessment and received comprehensive medical care as part of the rehabilitation process. Among them, 54 individuals were selected to receive an additional aerophytotherapy regimen, which involved the administration of sage essential oil in conjunction with audio-relaxation sessions. The integration of these alternative therapeutic interventions aimed to enhance the overall rehabilitation outcome and alleviate lingering symptoms associated with post-COVID syndrome.*

**Results**. *The results of this study may offer valuable insights into the potential benefits of aerophytotherapy as a complementary approach to traditional rehabilitation for individuals recovering from COVID-19. Data analysis revealed that 181 individuals in the control group underwent a comprehensive sanatorium-based rehabilitation program, without the use of aerophytotherapy and audio-relaxation techniques. The study included a detailed statistical examination of the data collected from all participants. Initially, the health status of the patients recovering from the recent coronavirus infection was assessed upon their admission to the sanatorium. The impact of incorporating aerophytotherapy using sage essential oil along with audio-relaxation sessions within the rehabilitation regimen was then thoroughly assessed.*

**Conclusion.** *Notable improvements were observed in various clinical parameters, functional measurements, and responses to dyspnea questionnaires in both groups. However, the addition of sage essential oil as a part of the aerophytotherapy rehabilitation program demonstrated a significant positive effect on emotional well-being, vitality, and overall health status.*

***Keywords:*** *new coronavirus infection, post-COVID, sanatorium-based rehabilitation, aerophytotherapy, sage.*

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### INTRODUCTION

New Coronavirus Infection presents a multidisciplinary challenge. The Russian Federation ranks among the highest globally in term of COVID-19-related mortality, holding the 6th position in the number of confirmed cases [*Gladkikh A et al., 2022*]. Analysis of COVID-19 mortality data indicates that Russia remains one of the countries with highest death rates [*Kobak D, 2021*].

In the fall of 2020, the International Classification of Diseases, 10th revision (ICD-10) included the term "post-COVID syndrome" (code U 09.9), with a definition based on the classification by the UK National Institute of Health and Care Excellence (NICE) "...consequences of disease in which up to 20% of people who have had a coronavirus infection suffer from long-term symptoms that last beyond 4 weeks from the beginning of acute COVID-19" [*Venkatesan P, 2021*]. The U.S. Centers for Disease Control and Prevention defines post-COVID syndromes as first-onset, recurrent, or ongoing health problems occurring ≥4 weeks after the initial infection with SARS-CoV-2, even if the disease was asymptomatic or mild. Several terms have been proposed for this pathology - "ongoing symptomatic or protracted COVID," "long COVID-19" (with clinical manifestations at weeks 4-12), "post-COVID syndrome," "post-COVID condition," "chronic COVID," "distant effects of COVID" (in later periods) [*Scharf RE, Anaya JM, 2023*].

According to a systematic review, dozens of different symptoms are found in post-COVID syndrome, among which the most common are dyspnea, chest pain, reduced exercise tolerance, tachycardia, fatigue, headaches, muscle and joint pain, parosmia and parageusia, increased sweating, and hair loss [*Michelen M et al., 2020*]. Neuroinflammation-induced hypersensitivity of the larynx may be the cause of long-term unproductive cough, which underlies chronic refractory or idiopathic cough [*Visca D et al., 2020; Vertigan AE et al., 2016*]. Given the presence of autoimmune mechanisms involved in the pathogenesis of COVID-19, there remains the possibility of developing systemic disease in the later period. The question of complete resolution of pulmonary changes - or the potential development of pulmonary fibrosis or other interstitial changes in the lungs - remains unresolved [*Silva Andrade B et al., 2020*].

The number of convalescents who have recovered from viral pneumonias associated with new coronavirus infection has exceeded 10 million in Russia and continues to rise daily. Coronavirus infection has posed a significant challenge not only to the global medical community but also to rehabilitation specialists [*Silva Andrade B et al., 2020*]. It is hoped that the result of a large number of international consortiums and WHO will be a more detailed consideration of post-COVID syndrome, including the possibility of its phenotyping and the development of targeted approaches for its prevention and treatment. At present, it is essential to provide patients with clear information regarding the potential duration of COVID-19 symptoms, and how to guide them on where to seek appropriate medical care and medical rehabilitation [*Bajmuhambetova DV et al., 2021*].

The abovementioned factors necessitate rehabilitation. Various rehabilitation techniques are used to relieve residual manifestations of pulmonary insufficiency (antihypoxic methods), stimulate reparative regeneration of lung tissue (reparative-regenerative methods), enhance the level of nonspecific body resistance (immunocorrective methods), strengthen of alveolocapillary transport (ventilation-perfusion methods), restore of balance between inhibitory and activating processes in the cerebral cortex. These interventions also address asthenic, immunosuppressive, anxious-depressive syndromes [*NIH, 2024*].

Rehabilitation measures are most effectively implemented in sanatorium and resort setting. One of the resort factors used is the method of aerophytotherapy, which consists in the use of air saturated with volatile compounds from medical plants for therapeutic purposes. Essential oils from Crimean medicinal plants were used at their natural concentrations; in our study, sage was selected. Due to its phytoncides content, sage exhibits antibacterial, disinfectant, fungicidal, virucidal, secretolytic, anti-inflammatory, expectorant, antispasmodic, immunomodulatory, calming, and tonic properties [*Farrar AJ, Farrar FC, 2020; Reis D, Jones T, 2017*]. Its antimicrobial activity against both Gram-positive and Gram-negative microflora - including antibiotic-resistant strains that cause respiratory diseases - is well documented. Indications for



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its use include inflammatory conditions of the oral cavity; upper and lower respiratory tracts, as well as symptoms such as drowsiness, low mood, nervousness, depression, increased anxiety, and impaired memory.

The aim of this study was to assess the severity of post-COVID syndrome in patients on admission to sanatorium rehabilitation, and to evaluate the potential for incorporating aerophytotherapy methods during the rehabilitation phase.

### *Materials and methods*

The study included 260 patients admitted to the Department of Pulmonology for sanatorium-based rehabilitation following a new coronavirus infection.

Inclusion criterion: Patients who had confirmed new coronavirus infection and were referred to sanatorium rehabilitation more than 14 days after hospital discharge or clinical recovery.

Exclusion criteria: Patients with recurrent or complicated forms of viral pneumonia, those with significant functional pulmonary or extrapulmonary disorders, individuals over 75 years of age, and those with general contraindications to sanatorium-resort treatment were excluded. All patients were enrolled in the study after signing written informed consent.

Methods of investigation: all patients underwent a comprehensive clinical examination, including the collection of medical history related to the viral infection, treatment methods used, chest CT findings, and results from immunological and virological studies. Upon admission and at discharge, patients were subjected to a series of laboratory and functional assessments. Functional studies included: electrocardiogram, spirogram with determination of the following parameters: FVC, FEV1, FEV1/ FVC ratio, and inspiratory capacity. Assessment of dyspnea was performed using validated questionnaires, including the mMRC dyspnea scale, BDI/TDI (transient dyspnea index) OCD (oxygen price diagram), Borg scale, VAS (visual analogue scale). Psychological tests involved FAS (Fatigue Assessment Scale), HADS (Hospital Anxiety and Depression Scale), Health Status Rating, EQ-5D, and SF-36 Quality of Life Questionnaires [*NIH, 2024*; *Hu J et al., 2021*].

Methods of sanatorium-based rehabilitation included climatotherapy on the South Coast of Crimea, tailored to the season [*Tong S et al., 2022*]; therapeutic dietary nutrition; drug therapy as needed; therapeutic respiratory gymnastics [*Lu Y et al., 2020*], terrain therapy (terrenekur) [*Kanayama H et al., 2017*], and various methods of respiratory therapy.

Additionally, a subgroup of patients (54 individuals) was prescribed a course of aerophytotherapy using sage essential oil [*Kalyvianaki K et al., 2020*]. The treatment was administered in a specially designated room where volatile components of sage essential oil were dispersed by a phytogenerator, without heating, at a concentration of 1 mg/m³. Simultaneously, a psychorelaxation audio track was played. Each session lasted 20 minutes and was conducted daily over a course of 10 sessions. Procedures were scheduled before the midday rest period (between10:00 and13:00). With patients positioned in a seated posture.

Statistical processing of the primary results was carried out as follows. For quantitative data, the sample arithmetic mean and standard deviation were used; for qualitative data, absolute and relative frequencies served as descriptive statistics. To assess of statistical significance of differences in quantitative variables before and after treatment in the same group, Student's test for dependent samples in determining the significance of shifts in the indicator level after treatment relative to the baseline value. To compare changes in the indices before and after treatment between the control and comparison groups, Student's criterion for independent samples was used. The critical level of significance of differences, at which the estimates were considered statistically significant, was chosen to be $p<0.05$, which is standard in most biomedical studies.

### *Results.*

Based on the results of the studies, the primary characteristic of patients who had a new coronavirus infection on admission to the sanatorium stage of rehabilitation was compiled.

The study group included 260 people. Of these, 71.5% were women (n=186) and 28.5% (n=74) were men. The mean age was 59.8±10.01 years. Comorbid respiratory pathology (bronchial asthma, chronic obstructive pulmonary



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disease, chronic bronchitis) was detected in 81 individuals (31.5%), cardiovascular diseases (ischemic heart disease, Hypertensive disease) - 110 (42,3%) individuals, thyroid gland pathology - 13 (5%), diabetes - 21 (8,07%), combination of different endocrine pathologies - 4 (1,5%), obesity - 38 individuals (14,6%). Twelve participants (4.6%) worked in harmful conditions, 31 persons (11.9%) were smokers or had been smokers in the past. An average of 162 days elapsed from the onset of the first symptoms to admission to the pulmonology department: 29.6% (77 people) were admitted in the first 3 months after illness, 33.9% (88 people) between the 3rd and 6th months, and 36.5% (95 people) were admitted more than 6 months after illness. SARS-COV-2 was known to be identified by PCR in 165 (63.5%) patients. Anosmia was noted in 112 patients (43%). In 231 (88.8%) people the disease had lung involvement, and in 95% of cases the involvement was bilateral. Computed tomography of the chest organs was performed in 182 patients, among whom CT-1 (up to 25% of lung tissue lesions) was seen in 64 (35.2%) patients, CT-2 (25-50%) in 65 (35.7%), CT-3 (50-75%) in 44 (24.2%), and CT-4 (over 75%) in 9 (4.9%). Hospitalization was required for 181 patients (69.6% of all patients), among them 99 (54.7%) needed respiratory support. We analyzed the drug therapy administered to patients in the acute phase of new coronavirus infection. It was revealed that 225 (86.5%) patients received antibacterial therapy, including 20 (8.9%) who had a mild course of the disease, without lung involvement. Only 26 of 231 cases of viral pneumonia (11.3%) were managed without antibacterials. Antiviral therapy was administered to 122 (46.9%) patients, antifungal drugs to 11 (4.2%), antimalarial agents to 26 (10%), systemic glucocorticosteroids to 196 (75.4%), antithrombotic therapy to 213 (81.9%), and monoclonal antibodies to 16 (6.2%). The general condition of all patients admitted for rehabilitation to the pulmonology department of the institute was assessed as satisfactory. The most frequently reported complaints included dyspnea in 205 patients (78.8%), reduced physical activity in 204 (78.5%), increased fatigue in 146 (56.2%), cough in 121 (46.5%), and a feeling of heaviness in the chest in 82 (31.5%). Additional symptoms included anxiety in 59 patients (22.7%), sweating in 61 (23.5%), palpitations in 57 (21.9%), memory impairment in 57 (21.9%), headaches in 37 (14.2%), dizziness in 36 (13.8%), and chest pain (cardialgia) in 28 (10.8%).On physical examination, 111 patients (42.7%) had altered breath sounds, with either harsh or diminished breath sounds, and dry rales were detected in 45 patients (17.3%).

The results of laboratory tests showed that the leukocyte level of the vast majority of patients was within the normal range. Leukopenia was detected in 9 (3.5%) subjects, leukocytosis - in 10 (3.8%), lymphocytosis in 52 (20%) subjects, monocytosis - in 25 (9.6%), left shift of the leukocytic formula - in 32 (12.3%), eosinophilia - in 36 (13.8%), sed rate was increased in 111 (42.7%) subjects. Hypercholesterolemia was revealed in 185 (71,2%) patients, ALT level was elevated in 43 (16,5%), AST level was elevated in 47 (18%), hyperglycemia was registered in 59 (22,7%) patients.

Several questionnaires were used to determine the level of dyspnea. According to the BDI/TDI breathlessness questionnaire, 208 (80%) individuals had an overall baseline level of dyspnea below the normal level. On the Borg scale, dyspnea from mild to maximal was observed in 88 (33.8%) individuals. On the mMRC scale, 101 (38.8%) people noted a dyspnea level of 2 or higher.

The questionnaire results also showed that, on the Hospital Anxiety and Depression Scale (HADS), 89 (34.2%) patients had subclinical or clinically pronounced anxiety, and 52 (20%) had depression. The Fatigue Assessment Scale (FAS) revealed pathological fatigue syndrome in 119 (45.8%) participants.

Quality of life was analyzed by the SF-36 and EQ-5D questionnaires [*Lins L, Carvalho FM, 2016; Feng YS et al., 2021*]. The most pronounced impairments according to the SF-36 questionnaire were noted for such quality-of-life parameters as the role of physical problems - the degree of limitation of daily activities by health problems (30.19±36.94%), the role of emotional problems (43.72±41.79) and general health (45.33±13.67). According to the EQ-5D questionnaire, 130 patients (50%) reported mobility impairments, 22 (8.5%) reported self-care impairments, 103(39.6%)



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reported limitations in performing usual (household) activities, 174 (66.9%) experienced pain/discomfort, and 141 (54.2%) patients reported anxiety and depression, with 120 patients (46.2%) felt that their current health level was worse than before.

In this article we analyzed the additional use of aerophytotherapy of sage medicinal in the complex of sanatorium and spa rehabilitation of patients who underwent new coronavirus infection. The experimental group consisted of 54 patients and the control group - 181 patients who received comprehensive sanatorium rehabilitation, without the use of aerophytotherapy and audio relaxation.

The control and experimental groups were almost identical in degree of severity of pneumonia (1,87±0,06 and 1,81±0,10 *points* on a scale from 0 to 4 respectively), time from onset of symptoms to admission to the sanatorium (159,36±7,85 and 159,72±10,58 days respectively). The experimental group had 66.7% women and 33.3% men, while the control group had 69.6% women and 30.9% men, respectively. The groups were balanced according to all initial parameters, which allowed us to talk about qualitative randomization and made it possible to trace the contribution of the therapeutic factor of aerophytotherapy by the essential oil of clary sage. All patients noted good tolerability of the procedure.

Table 1 shows the dynamics of the indicators before and after treatment for the control and experimental groups and a comparison of the changes that occurred between the two analyzed groups.

The table shows that both in the experimental and control groups there was a pronounced positive dynamic under the influence of the rehabilitation program. In the table includes examination indices for which statistically significant changes and some data of spirographic examination were observed, to reflect which it seemed important for this contingent of patients. Clinical manifestations (cough, dyspnea, feeling of heaviness in the chest, physical activity, fatigue) significantly decreased in both groups. Diastolic blood pressure in the experimental group statistically significantly decreased, compared with the control group. Regarding external respiratory function indices: forced vital capacity remained within normal limits, however, both groups showed statistically significant improvements following treatment, with greater changes observed in the experimental group. These differences were statistically significant in favor of the group receiving aerophytotherapy. FEV1 increased statistically significantly only in the experimental group. The 6-minute step test had positive reliable dynamics in both groups. Dyspnea questionnaires: mMRC and oxygen price diagram in both groups showed positive dynamics, more pronounced in the control group, but reliable differences between the groups were not revealed. The BDI/TDI dyspnea scale showed statistically significant shifts during rehabilitation in the control group.

According to the additional questionnaires, there were significant improvements in fatigue scores in both groups. The Hospital Anxiety and Depression Scale (HADS) scored decreased in both groups, with no statistically significant difference between them and no notable change in depression levels. The Visual Analogue Scale (VAS) demonstrated positive dynamics in both groups, more pronounced in the control group. Quality of life assessments using the SF-36 revealed that vitality and general health scores significantly increased in the experimental group. In contrast, improvements in physical activity and the role of physical problems were observed only in the control group. The role of emotional problems showed no statistically significant dynamics in either group, although a positive, albeit statistically insignificant, trend was noted in the group receiving aerophytotherapy. According to the EQ-5D questionnaire, a significant difference between groups was observed in the "household activity" domain, favoring the control group. Positive and statistically significant changes were reported in the "pain/discomfort" domain for both groups. In addition, patients in both groups reported a higher self-assessed health status following the sanatorium rehabilitation course.

### Discussion

The above analysis of the patients' initial condition revealed a wide range of health disorders, involving both on the part of the respiratory organs and psychosomatic aspect. The condition was conditioned by both the disease and the amount of therapy used in the period of acute course of the disease, mostly during hospitalization. It is also necessary to highlight the drug therapy received by the patients. Prescription of antimalarial drugs is practically not noted and in the total mass of the



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**TABLE 1.**

Dynamics of examination parameters before and after sanatorium rehabilitation and comparison of changes in patients with previous new coronavirus infection in control (n=181) and experimental (n=54) groups

| Parameter | Group | Before treatment M±σ | After treatment M±σ | $p_1$ | $p_2$ |
|---|---|---|---|---|---|
| Cough frequency, (points) | Ctr | 0,912±0.079 | 0,331±0.050 | <0.001 | >0.1 |
| | Exp | 0,630±0.128 | 0,204±0.067 | <0.001 | |
| Cough severity, (points) | Ctr | 0.652±0.063 | 0.271±0.038 | <0.001 | >0.1 |
| | Exp | 0.537±0.120 | 0.167±0.058 | <0.001 | |
| Dyspnea severity, (points) | Ctr | 1.287±0.061 | 0.735±0.048 | <0.001 | >0.1 |
| | Exp | 1.074±0.115 | 0.519±0.078 | <0.001 | |
| A feeling of heaviness in the chest, (points) | Ctr | 0.464±0.055 | 0.099±0.025 | <0.001 | >0.1 |
| | Exp | 0.389±0.104 | 0.037±0.026 | <0.001 | |
| Physical activity during the day, (points) | Ctr | 1.066±0.054 | 0.641±0.041 | <0.001 | >0.1 |
| | Exp | 0.870±0.080 | 0.463±0.073 | <0.001 | |
| Fatigue, (points) | Ctr | 0.994±0.071 | 0.326±0.039 | <0.001 | >0.1 |
| | Exp | 0.778±0.117 | 0.167±0.051 | <0.001 | |
| Diastolic blood pressure, *mm Hg* | Ctr | 78.840±0.520 | 79.149±0.330 | >0.1 | <0.05 |
| | Exp | 80.630±1.048 | 79.074±0.837 | <0.05 | |
| FVC, *%* | Ctr | 102.607±1.842 | 104.280±1.767 | <0.05 | <0.1 |
| | Exp | 102.306±3.137 | 106.361±3.345 | <0.01 | |
| FEV1, *%* | Ctr | 98.299±1.852 | 99.121±1.828 | >0.1 | >0.1 |
| | Exp | 96.639±3.671 | 98.892±3.632 | <0.1 | |
| Inspiratory capacity, , *%* | Ctr | 99.032±2.397 | 102.656±2.561 | <0.05 | >0.1 |
| | Exp | 93.760±4.166 | 101.800±4.115 | <0.05 | |
| 6-minute step test, *м* | Ctr | 504.286±8.604 | 534.133±8.847 | <0.001 | >0.1 |
| | Exp | 501.317±14.757 | 530.488±13.278 | <0.001 | |
| mMRC dyspnea scale, (points) | Ctr | 1.450±0.065 | 1.204±0.070 | <0.001 | >0.1 |
| | Exp | 1.300±0.108 | 1.122±0.112 | <0.05 | |
| Oxygen price chart, (points) | Ctr | 6.678±0.180 | 7.463±0.188 | <0.001 | <0.1 |
| | Exp | 7.104±0.246 | 8.208±0.225 | <0.001 | |
| Visual analogue scale, (points) | Ctr | 4.338±0.189 | 3.323±0.177 | <0.001 | <0.05 |
| | Exp | 2.800±0.263 | 2.500±0.254 | <0.05 | |
| Health Status Rating, (points) | Ctr | 5.720±0.137 | 6.444±0.158 | <0.001 | >0.1 |
| | Exp | 6.563±0.215 | 7.063±0.231 | <0.05 | |
| Hospital Anxiety and Depression Scale (anxiety level), (points) | Ctr | 6.828±0.308 | 5.597±0.286 | <0.001 | >0.1 |
| | Exp | 6.813±0.568 | 5.122±0.480 | <0.01 | |
| Hospital Anxiety and Depression Scale (Depression Rating Scale), (points) | Ctr | 6.040±0.297 | 5.947±0.299 | >0.1 | >0.1 |
| | Exp | 5.633±0.510 | 5.979±0.549 | >0.1 | |
| Fatigue Rating Scale, (points) | Ctr | 23.819±0.524 | 21.951±0.489 | <0.001 | >0.1 |
| | Exp | 24.313±0.930 | 22.188±0.936 | <0.001 | |
| Baseline Dyspnea Index/Transitional Dyspnea Index score (BDI/TDI) | | | | | |
| Functional impairment questionnaire), (points) | Ctr | 2.631±0.068 | 2.901±0.062 | <0.001 | >0.1 |
| | Exp | 2.771±0.104 | 2.833±0.113 | <0.001 | |
| Questionnaire Activities, (points) | Ctr | 2.599±0.062 | 2.709±0.062 | >0.1 | >0.1 |
| | Exp | 2.972±0.129 | 2.796±0.130 | >0.1 | |
| Questionnaire degree of effort, (points) | Ctr | 2.401±0.067 | 2.543±0.067 | <0.05 | >0.1 |
| | Exp | 2.688±0.138 | 2.694±0.108 | >0.1 | |
| Questionnaire overall score, (points) | Ctr | 7.612±0.165 | 8.168±0.167 | <0.001 | >0.1 |
| | Exp | 8.250±0.294 | 8.333±0.298 | >0.1 | |



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***TABLE 1.***(Continuation)

| Parameter | Group | Before treatment M±σ | After treatment M±σ | $p_1$ | $p_2$ |
|---|---|---|---|---|---|
| Short Form 36 health survey questionnaire (SF-36) [*Gusi N., et al., 2010*] | | | | | |
| physical function, % | Ctr | 54.688±1.898 | 60.625±2.086 | <0.001 | >0.1 |
| | Exp | 57.347±3.726 | 58.878±3.937 | >0.1 | |
| role physical, % | Ctr | 28.621±3.056 | 32.965±3.150 | <0.1 | >0.1 |
| | Exp | 31.633±5.493 | 36.735±5.262 | >0.1 | |
| bodily pain, % | Ctr | 56.855±2.031 | 60.840±1.872 | <0.01 | >0.1 |
| | Exp | 58.694±3.265 | 64.837±2.825 | <0.01 | |
| viability, % | Ctr | 52.552±1.177 | 58.889±1.215 | <0.001 | <0.05 |
| | Exp | 54.286±2.138 | 64.388±2.185 | <0.001 | |
| social functioning, (points) | Ctr | 62.241±2.210 | 68.285±1.921 | <0.001 | >0.1 |
| | Exp | 67.857±3.136 | 75.595±3.042 | <0.01 | |
| role emotional, (points) | Ctr | 45.747±3.498 | 46.759±3.387 | >0.1 | >0.1 |
| | Exp | 45.578±6.046 | 50.367±5.924 | >0.1 | |
| mental health, (points) | Ctr | 58.979±1.654 | 64.938±1.538 | <0.001 | >0.1 |
| | Exp | 61.714±2.824 | 70.633±2.436 | <0.01 | |
| general health, (points) | Ctr | 44.207±1.127 | 51.125±1.358 | <0.001 | <0.05 |
| | Exp | 45.755±1.738 | 57.980±2.719 | <0.001 | |
| The EuroQOL five dimensions questionnaire (EQ-5D ) [*Anderson C., et al., 1996*] | | | | | |
| mobility, (points) | Ctr | 1.589±0.039 | 1.474±0.040 | <0.001 | >0.1 |
| | Exp | 1.500±0.071 | 1.429±0.071 | <0.05 | |
| self-service, (points) | Ctr | 1.108±0.025 | 1.091±0.023 | >0.1 | >0.1 |
| | Exp | 1.100±0.043 | 1.102±0.044 | >0.1 | |
| domestic activity, (points) | Ctr | 1.510±0.040 | 1.458±0.040 | <0.1 | <0.1 |
| | Exp | 1.320±0.067 | 1.388±0.070 | >0.1 | |
| pain/discomfort, (points) | Ctr | 1.803±0.038 | 1.647±0.043 | <0.0001 | >0.1 |
| | Exp | 1.800±0.081 | 1.694±0.073 | <0.05 | |
| anxiety/depression, (points) | Ctr | 1.682±0.044 | 1.497±0.042 | <0.001 | >0.1 |
| | Exp | 1.500±0.082 | 1.449±0.077 | >0.1 | |
| general health, (points) | Ctr | 2.446±0.054 | 1.974±0.069 | <0.001 | >0.1 |
| | Exp | 2.120±0.117 | 1.837±0.118 | <0.05 | |

***NOTE:*** *CTR- control group, EXP-experimental group, FVC - forced vital capacity, FEV1 – forced expiratory volume in 1 second, $p_1$ – statistical significance of differences in indicator values before and after the rehabilitation course (Student's t-test for related samples); $p_2$ – statistical significance of differences in indicator changes between the control and Experimental groups during rehabilitation (Student's t-test for independent samples), EG-5D - The EuroQOL five dimensions questionnaire; SF-36 - Short Form 36 health survey questionnaire.*

examined patients is 10%, the most widespread and justified prescription of systemic glucocorticosteroids - in 75.4% and antithrombotic drugs in 81.9% of cases. Despite extensive warnings, indications in the updated guidelines for prevention, diagnosis and treatment of new coronavirus infection COVID-19 [*NIH, 2024*] about using antimicrobial drugs only when developing bacterial complications, analysis shows that only 26 viral pneumonias from 231 cases (11.3%) were cured without using antimicrobial drugs.

The findings condition confirm the presence of post-COVID complications in these patients and underscore the need for rehabilitation measures.

This publication is devoted to the potential integration of an aerotherapy modality – specifically aerophytotherapy - into the rehabilitation program for patients recovering from new coronavirus infection. Essential oil of sage was used as an active substance. The positive dynamics of the clinical parameters in both groups testified to the fact that these parameters were influenced by the entire complex of sanatorium rehabilitation, containing the methods of kinesio- and respiratory therapy, which were of principal importance for this contingent of patients. In our earlier publications we touched upon the peculiarities of functional examination in such patients. We noted that by routine



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methods of functional examination we could not detect changes correlating with patients' respiratory complaints. For this purpose, it is necessary to investigate pulmonary diffusion capacity and this material is being accumulated. According to the available data, we should note positive dynamics, though within normal limits, by the main indices of FVC, FEV1 and inspiratory capacity, more pronounced in the group with aerophytotherapy.

Positive dynamics in the degree of reduction of dyspnea, increase of tolerance to physical load, reduction of the influence of physical problems on the quality of life of patients was observed in both groups, or had some advantage in the control group, and it was 3 times larger than the experimental group, indicating the influence on these mechanisms of rehabilitation methods used in both groups.

The positive influence of aerophytotherapy on the emotional component, vitality and general health should be emphasized, which for this contingent of patients is extremely important in terms of their return to normal social life.

Considering the specific properties of the peculiarity of sage oil, particularly its bactericidal and immunomodulatory effects [*Wińska K et al., 2019*], the effect on the long-term results should be expected, the material for the study of which is currently in the state of recruitment.

### CONCLUSION

The number of convalescents recovering from of new coronavirus infection who require rehabilitation continues to grow. The condition of patients after new coronavirus infection upon admission to the sanatorium-resort stage of rehabilitation present with a range of conditions, among which respiratory complaints, reduced tolerance to physical activity, fatigue, anxiety and reduced quality of life are the most pronounced. Comprehensive sanatorium-based medical rehabilitation leads to improvement in overall condition, reduction of expression of clinical symptoms, dyspnea, increased physical tolerance, decreased pathological fatigue syndrome and enhanced quality of life. The additional inclusion of aerophytotherapy with sage essential oil in the rehabilitation program contributes to further improvements in patients' functional and emotional status, vitality, and general health.

Upon admission to the sanatorium-resort stage of rehabilitation, patients recovering from COVID-19 present with a range of conditions, most notably respiratory complaints, reduced tolerance to physical activity, fatigue, anxiety, and diminished quality of life. Comprehensive sanatorium-based medical rehabilitation leads to improvement in overall condition, reduction of clinical symptoms and dyspnea, increased physical tolerance, decreased pathological fatigue, and enhanced quality of life. The additional inclusion of aerophytotherapy with sage essential oil in the rehabilitation program contributes to further improvements in patients' functional and emotional status, vitality, and general health.

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