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REVIEW

Investigation of Current Approaches in Rehabilitation of Chronic Respiratory Diseases: Salt Therapy and Exercise

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Objective: This study aims to examine studies that evaluated salt therapy (speleotherapy and halotherapy) and exercise together in chronic respiratory diseases.
Material-Methods: The research is a descriptive screening study aiming to examine studies that address salt therapy (speleotherapy and halotherapy) and exercise together between 2020 and 2024. For this purpose, studies in Pubmed, Cochrane Library, Google Scholar, Reseachgate, and Scopus academic databases were examined. The keywords "Halotherapy", "Speleotherapy", "Salt therapy", and "Exercise" were used.
Results: The findings of the obtained studies showed that the combination of salt therapy (speleotherapy and halotherapy) and exercise increased the functionality, muscle strength (respiratory, upper extremity, and lower extremity), flexibility, balance, chest mobility, and endurance of individuals with chronic respiratory diseases. However, it is noteworthy that the studies addressing salt therapy and exercise together are quite limited.
Conclusion: Studies that examine the combination of salt therapy (speleotherapy and halotherapy) and exercise show that the combination of both types of treatment can further strengthen the therapeutic effect obtained. In this direction, more studies with high evidence are needed in which salt therapy, called speleotherapy and halotherapy, is considered together with exercise.
Keywords: Exercise, Halotherapy, Pulmonary Rehabilitation, Salt Therapy, Speleotherapy

INTRODUCTION

Chronic respiratory diseases represent a group of diseases characterized by multiple comorbidities resulting from lesions in the trachea, bronchi, alveoli, and chest cavity due to various causes, increasing the prevalence of morbidity and mortality. [1] Asthma, chronic obstructive pulmonary disease (COPD), bronchiectasis, and interstitial lung disease are the most common chronic respiratory diseases. These diseases cause a significant burden on the health ecosystem worldwide. Therefore, preventive and rehabilitative methods are needed to reduce the burden on the health systems and negatively affect patients' quality of life. This need can only be met with practical and economical interventions. Speleotherapy, halotherapy, and pulmonary rehabilitation based on exercise training are some of these methods. [2,3]

The pulmonary rehabilitation approach comes to the forefront for relieving symptoms and maintaining and increasing functionality in chronic respiratory diseases. Pulmonary rehabilitation, a comprehensive and multidisciplinary intervention, improves the quality of life by increasing the participation of patients in physical and social activities. It helps to reduce healthcare costs by stabilizing or reversing the systemic symptoms of respiratory diseases. [4,5] Pulmonary rehabilitation programs based on exercise training have a significant place in treating chronic respiratory diseases. Rehabilitation programs based on exercise training have a significant place in treating chronic respiratory diseases. Physical inactivity and exercise intolerance are common in these patients. While avoiding exercise and physical activity provides momentary

relief for these patients, in the long term, it becomes a situation where problems gradually increase. This situation does not only affect the lungs but also the entire body outside the lungs. [6] The underlying cause of physical inactivity and exercise intolerance often stems from physiological disorders caused by respiratory distress. In addition, the effects of peripheral muscle weakness are undeniable. [7] Exercise plays a key role in correcting respiratory distress and muscle strength disorders. With resistance exercises, exercise tolerance and muscle strength of chronic respiratory patients increase, and with aerobic exercises, patients' maximum oxygen consumption, heart rate control, and quality of life can be improved. [8-10]

Salt therapy is another non-pharmacological approach used to reduce chest disease symptoms. There are two types of salt therapy: speleotherapy (natural salt cave environment) and halotherapy. The climate of natural salt caves provides a therapeutic environment for patients with respiratory distress. This type of therapy is called speleotherapy. Being protective against air pollutants and pollen, having constant air temperature and medium-high humidity, and being rich in fine aerosol elements (sodium, potassium, magnesium, and calcium) strengthen the therapeutic effects of the cave environment. [11] Since the natural cave environment is not available everywhere, creating this environment artificially is called halotherapy. Halotherapy is a form of therapy that provides an effect by releasing small salt particles from a source into a room and causing individuals to inhale these salt particles. In other words, in halotherapy, the natural microclimate of a salt cave is created. [12] Salt therapy has antibacterial, antimycotic, and anti-inflammatory effects. It can provide effective results, especially in treating respiratory diseases such as asthma, COPD, and cystic fibrosis. It is also stated that the natural environment provided by the environment is also beneficial in psychological and emotional terms. [13]

Individuals with chronic respiratory disease may be severely affected by environmental factors, including tobacco smoke, pollen, molds, and other aeroallergens. Therefore, keeping them away from unfavorable environmental conditions is very important. Because unfavorable environmental conditions can exacerbate the diseases of individuals with this disease, various substances called bioaerosols (a wide variety of organisms and substances such as airborne particles of biological origin, bacteria, fungi, viruses, pollens, and spores) can cause respiratory diseases, inflammation, and allergic reactions when inhaled. [14,15] In this respect, environments such as speleotherapy and halotherapy offer significant opportunities for environmental modification in managing these diseases. This environment provides an isolated environment from particles that can exacerbate chronic respiratory diseases. [16] It has been reported that with speleotherapy, sputum discharge becomes easier, respiratory muscles relax, the self-cleaning function of the lungs is stimulated, and an anesthetic effect is provided. [11,17] In another study, it was stated that halotherapy could be used as an adjuvant treatment for respiratory diseases. Halotherapy has been shown to reduce airway inflammation and improve pulmonary function by improving mucociliary function. It has been emphasized that this treatment can be used as an adjuvant treatment because it is safe and does not cause serious side effects. [18]

The proven benefits of salt therapy (speleotherapy and halotherapy) and exercise in respiratory diseases can be further strengthened by considering both methods. Although the number of studies on this subject has recently increased, studies considering both therapy methods are limited. Therefore, this study aimed to examine the studies evaluating the effectiveness of studies that consider salt therapy (speleotherapy, halotherapy) and exercise together.

MATERIALS AND METHODS

This study is a systematic review that refers to the retrospective systematic scanning of articles on the subject. This study was completed according to the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) checklist, which guides authors in reporting systematic review and meta-analysis studies. PRISMA provides researchers with a roadmap for conducting systematic review analyses. It is stated that this method contributes to the creation and evaluation of studies included in the systematic review in a better quality. [19]

Eligibility criteria

Male and female participants aged 18 years and over with lower and upper respiratory tract diseases were included in the study. Supervised intervention studies that evaluated the combined effectiveness of salt therapy (speleotherapy and halotherapy) and exercise interventions designed for adults were included. Quantitative studies of these interventions were preferred. Retrospective studies, conference abstracts, theses, books, book chapters, and articles published in languages other than English were not

included. Pre-test-post-test without a control group, comparative studies with a control group, and comparative studies without a control group were considered. Main outcome measures included studies assessing quality of life, physical and functional capacity, cardiovascular capacity, pulmonary function testing, and chest mobility.

Study design

PICOS (Population, Intervention, Comparison, Outcomes, Study design) standards were used to determine the study design.[20] (Tablo 1).

Table 1. PICOS Method in Determining Study Design

P	Population	Participants with chronic respiratory diseases
I	Intervention	Salt therapy (speleotherapy, halotherapy), aerobic exercises, resistance exercises, breathing exercises
C	Comparison of Groups	Pre-test-post-test without a control group, comparative with a control group, comparative without a control group
O	Outcomes	Quality of life, physical and functional capacity, cardiovascular capacity, pulmonary function testing, chest mobility
S	Study design	Interventional study

Search strategy

An electronic search strategy was used to determine the studies targeted by the research. A search was conducted using five electronic databases (Pubmed, Cochrane Library, Google Scholar, Reseachgate, and Scopus). All studies conducted between 2020 and 2024 were included. The publication of these studies in the specified databases between 2020 and 2024 was taken as the basis. The keywords "Halotherapy," "Speleotherapy," "Salt therapy," and "Exercise" were used as keywords. The search terms were related to salt therapy, which was the main theme of the study. The second stage consisted of associating salt therapy with exercise. In these stages, the words AND, NOT, and OR were used to ensure that studies that combined the topics were addressed.

Study selection and data collection process

Three researchers (RCY, DDK, AP) independently reviewed the titles and abstracts of the studies to determine whether the studies met the inclusion criteria. The studies that met the criteria were recorded, and the full texts were evaluated. The obtained studies were prepared in the context of the title, journal, publication year, authors, purpose of the study, therapy method, and results. The researchers ensured that the form was completed after the evaluation using this form.

Assessing the risk of bias

The review authors, RCY, DDK, and AP, used the PEDro risk of bias tool to assess the risk of bias in the included studies. This tool assesses sources of bias such as inclusion criteria and source, random allocation, concealed allocation, comparability at baseline, blinded subjects, blinded therapists, blinded assessors, outcomes for more than 85%, intent-to-treat analysis, between-group comparisons, means, and variability data. The authors report that total PEDro scores of 0-3 are considered ‘poor’, 4-5 ‘fair’, 6-8 ‘good’, and 9-10 ‘excellent’. [21]

Assessment of methodological quality

Information on the authors, physical characteristics of the included participants (age and gender), methodological features of the included study (inclusion criteria, severity of disease, sample size), details of the interventions (supervised intervention, frequency, intensity, type, and duration), comparison groups, outcomes assessed, follow-up period and side effects were recorded. Quality assessment of the included studies was performed using the PEDro scale, which has been shown to have good validity and reliability. [21]

The ethical aspect of the research

The study was conducted in accordance with the systematic review design. Ethics committee approval is not required for systematic reviews. The studies included in the evaluation were cited in the article.

RESULTS

The results obtained from different databases revealed 277 studies. From these studies, those that were repetitive and did not meet the search criteria were eliminated. The initial screening, titles, and abstracts of potential studies suitable for the purpose of the study were read and reviewed by the researchers. Finally, a total of 5 studies were included in the review. Table 2 summarizes the reviewed studies on salt therapy and exercise.

Freidl et al. (2020) conducted randomized controlled studies investigating the effects of winter exercise and speleotherapy on adults with allergic rhinitis or asthma; the speleotherapy group (n=23) was given a ten-day winter exercise and speleotherapy program, and the exercise group (n=18) was given winter exercise. In the baseline evaluation, differences were observed in the age of the individuals and the six-minute walking test results. It was observed that the speleotherapy group was younger compared to the exercise group ($t_{(32.2)}$ =

2.22, p = 0.03), and the speleotherapy group had better six-minute walking test results ($t_{(37.1)} = -2.26$, p = 0.03). In this study, where allergic airway inflammation, quality of life, spirometry parameters, and cardiorespiratory fitness were evaluated, it was seen that winter exercise alone and combined with speleotherapy could improve quality of life and allergic symptoms. In this study, fractional exhaled nitric oxide (FeNO) and nasal nitric oxide (NO) parameters were examined to evaluate allergic airway inflammation. FeNO and NO values did not show any significant change due to the applied treatment. It was observed that changes in mucociliary clearance time, nasal eosinophilic cell count, and differential blood count were better in the speleotherapy group. It was stated that the lack of significant change in spirometry values was due to the participants' initial spirometry values not being too bad. The 6-minute walk test results also showed no difference between the two groups.

Table 2. Studies Reviewed on Salt Therapy and Exercise

Title	Winter Exercise and Speleotherapy for Allergy and Asthma: A Randomized Controlled Clinical Trial	The influence of speleotherapy combined with pulmonary rehabilitation on functional fitness in older adults – preliminary report	Dynamic Balance and Chest Mobility of Older Adults after Speleotherapy Combined with Pulmonary Rehabilitation, Endurance, and Strength Training—A Prospective Study in Chronic Respiratory Diseases	Pulmonary rehabilitation in subterranean chambers combined with neuro-orthopedic activity-dependent plasticity therapy influences patients' quality of life – A preliminary study	Respiratory Muscle Function in Older Adults with Chronic Respiratory Diseases after Pulmonary Rehabilitation in Subterranean Salt Chambers
Journal, year, authors	J Clin Med., 2020, Freidl et al.	Ther Adv Respir Dis.. 2020, Mętel et al.	Int J Environ Res Public Health, 2022a, Mętel et al.	Complementary Therapies in Clinical Practice, 2022b, Mętel et al.	J Clin Med., 2023, Mętel et al.
Aim of the study	Investigation of the specific effects of recreational winter exercises combined with speleotherapy	To determine the effect of pulmonary rehabilitation conducted in therapeutic salt mine chambers on the functional fitness of older adults.	To evaluate the dynamic balance and thoracic mobility of older adults participating in speleotherapy in combination with pulmonary rehabilitation, endurance, and strength training.	To evaluate whether Neuro-orthopedic Activity-Induced Plasticity therapy combined with standard underground pulmonary rehabilitation conducted in a salt mine affects health-related quality of life and thoracic mobility in patients with asthma or chronic upper respiratory tract disease.	To evaluate the function of respiratory muscles in the elderly before and after a period of pulmonary rehabilitation and treatment in the underground chambers of a salt mine.
Therapy program	Winter exercises and Speleotherapy	3-week outpatient pulmonary rehabilitation program (gait training, upper and lower extremity strength training, aerobic exercise with musical accompaniment, respiratory exercise), 6-hour daily treatment accommodation in an underground salt room 5 days a week (Monday-Friday)	Speleotherapy combined with pulmonary rehabilitation, endurance, and strength training	Neuro-orthopedic Activity-Induced Plasticity treatment combined with pulmonary rehabilitation (breathing exercises, aerobic and resistance exercises) in the setting of speleotherapy	Standing pulmonary rehabilitation (walking, aerobic and resistance exercises, breathing exercises) 135 m underground for 3 weeks (5 days a week, 6 hours a day)
Results	It has been found that winter exercise alone and combined with speleotherapy positively affect quality of life and allergic symptoms in individuals with allergic rhinitis and/or asthma.	Speleotherapy combined with pulmonary rehabilitation has been found to improve the functional fitness of older adults in terms of upper and lower body strength, lower body flexibility, and dynamic balance.	Speleotherapy combined with pulmonary rehabilitation, endurance, and strength training has been found to improve dynamic balance and thoracic mobility in older adults with chronic respiratory disease.	Neuro-orthopedic Activity-Induced Plasticity treatment to the pulmonary rehabilitation program in the underground section of the Salt Mine Health Center. The addition of therapy techniques resulted in a statistically significant and clinically important improvement in subjects' health-related quality of life	Speleotherapy combined with pulmonary rehabilitation has been shown to improve respiratory muscle function in elderly patients with chronic respiratory diseases. The improvement was reflected in maximal inspiratory pressure and nasal inspiratory pressure but was particularly evident in maximum expiratory pressure.

The main reason for this was shown to be that the initial values were not too bad, and the ten-day treatment period was short. It was emphasized that a more extended treatment program should be implemented for better cardiorespiratory results. It was observed that winter exercise alone and winter exercise combined with speleotherapy could improve quality of life and allergic symptoms. In addition, none of the participants in the study experienced any adverse events during winter sports and speleotherapy. Therefore, it was stated that recreational winter exercises and speleotherapy could be recommended for allergic rhinitis and asthma with reasonable disease control. [22]

Mętel et al. (2020) investigated the effectiveness of speleotherapy combined with pulmonary rehabilitation in their study involving 22 people over the age of 65 with chronic respiratory diseases. The 3-week rehabilitation program was carried out in an underground salt chamber for 5 days/6 hours per week. The pulmonary rehabilitation program was carried out by a physiotherapist and consisted of 15 treatment sessions with three sessions (90 minutes) of supervised group training. In this program, walking training, 30 minutes of lower and upper extremity strength training (gradual increase using dumbbells, elastic bands, gym ball, step platform, and body weight), aerobic exercise with music or a stationary bike for 30 minutes, fitness exercise including breath control (30 minutes), relaxation and postural control exercises using neuro-orthopedic activity-induced plasticity (N.A.P) therapy were performed. After the combined rehabilitation program, significant improvements were observed in upper and lower body strength, lower body flexibility, agility/balance, and endurance parameters. The mean number of repetitions in 30 seconds in the Arm Curl test increased from 14.55±3.63 to 16.68±3.83. The number of repetitions in the Chair Stand test increased from 11.86±2.55 to 14.41±2.95. The results in the Sit and Reach test increased from -2.3 ± 11.11 cm to 2.14 ± 9.19 cm. The time to perform the 8-Foot Up and Go test decreased from 6.63 ± 1.27 seconds to 5.8 ± 0.86 seconds. The results in the 2-Minute Step test increased from 88.27 ± 20.64 to 96.55 ± 16.38 repetitions. This study demonstrated that the functional fitness of elderly individuals with pulmonary disorders improved with speleotherapy combined with pulmonary rehabilitation. [23]

In the study examining the dynamic balance and chest mobility of elderly adults after speleotherapy with pulmonary rehabilitation, endurance, and strength training, 44 elderly adults between the ages of 65 and 77 with chronic respiratory diseases were evaluated. Participants in the outpatient pulmonary rehabilitation program for 3 weeks (5 days a week, 6 hours a day) received a program focused on endurance, strength and breathing exercises, N.A.P. therapy techniques, education, and relaxation. After the application, a significant improvement was observed in the participants' four square-step test results. The average time for the four-square step test decreased significantly from 10.2 ± 1.9 seconds to 9.1 ± 1.7 seconds. The decrease in the four-square-foot test mean in patients with lower respiratory tract disease was 0.8 seconds, while the decline in patients with upper respiratory tract disease was 1.5 seconds. This significant improvement was also observed in chest mobility. The mean increase in thoracic mobility increased significantly from 4.5 ± 5.5 cm to 5.4 ± 2.8 cm. The average increase in chest mobility in this study was found to be 0.9 cm. This study showed that speleotherapy performed together with endurance and strength training increased dynamic balance and chest mobility in elderly adults with chronic respiratory diseases. [24]

In another study examining the effects of N.A.P. treatment combined with standard pulmonary rehabilitation in a salt mine chamber on patients with asthma and chronic upper respiratory tract disease, quality of life and chest mobility were evaluated. The supervised pulmonary rehabilitation program included 54 patients who participated in the study for 3 weeks. In the study group (N=23, 16 women, 7 men), N.A.P. treatment was added to the standard pulmonary rehabilitation program. In contrast, in the control group (N=31, 21 women and 10 men), the standard pulmonary rehabilitation program was applied for 3 weeks. The standard pulmonary rehabilitation program consisted of walking in the salt chamber (20 minutes - twice a day), breathing exercises, fitness exercises including aerobic and flexibility, upper and lower extremity resistance exercises, aerobic exercise (twice a week), health education (30 minutes - once a week), warm-up and cool-down exercises. In the N.A.P. program, which was applied in addition to the standard pulmonary rehabilitation program in the study group, exercises were performed on the ball to shift the nerve structures, regulate the activity of the autonomic system, stimulate breathing and normalize muscle tone. N.A.P. treatment aims to improve postural control and coordination. At the

same time, regulating the activity of the autonomic nervous system was considered one of the goals. The standard pulmonary rehabilitation program has been shown to improve health-related quality of life, the flexibility of the upper body, and chest mobility. The addition of N.A.P. therapy to the standard pulmonary rehabilitation program resulted in a significant improvement in the participants' health-related quality of life. The change in the quality of life 15D score was 0.068 higher in the standard pulmonary rehabilitation + NAP group than in the standard pulmonary rehabilitation group (p=0.022). [25]

In the study investigating the effect of the pulmonary rehabilitation program applied in underground salt chambers on respiratory muscle functions in elderly individuals with chronic respiratory diseases, 44 patients over the age of 65 were included in the 3-week program. The rehabilitation program includes walking, group endurance training under the supervision of a physiotherapist (aerobic or resistance exercises for 30 minutes), breathing exercises, and health-promoting training three times a week (about methods for controlling shortness of breath, behaviors during disease flare-ups, coping with chronic fatigue, sleep hygiene, healthy nutrition and health-promoting behaviors). The study participants were evaluated before and after the 3-week rehabilitation program. After the rehabilitation program, a significant increase of 10.2% in mean maximum inspiratory pressure, 12.3% in maximum expiratory pressure and 28.4% in sniffing nasal inspiratory pressure was observed ($p<0.05$). In patients with lower respiratory tract disease, maximum expiratory pressure increased by 10.7 % and sniffing nasal inspiratory pressure increased by 31.0 %. In patients with upper respiratory tract disease, maximum inspiratory pressure increased by 15.9% and maximum expiratory pressure increased by 14.9%. In the pre- and post-assessment of the pulmonary rehabilitation programme, maximum inspiratory pressure improved significantly by 8.8 cmH_2O, maximum expiratory pressure by 7.1 cmH_2O and sniffing nasal inspiratory pressure by 11.2 cmH_2O. In participants older than 70 years, only the maximum expiratory pressure improved significantly (maximum expiratory pressure increased by 9.3 cmH_2O). It has been reported that speleotherapy combined with pulmonary rehabilitation improves respiratory muscle function in terms of maximum expiratory pressure in elderly individuals with chronic respiratory diseases. [26]

Data on the level of evidence of the reviewed studies are shown in Table 3. The inclusion criteria and source for risk of bias assessment were assessed using the PEDro scale, which includes items such as random allocation, concealed allocation, baseline comparability, blinded cases, blinded therapists, blinded assessors, results for more than 85%, intent-to-treat analysis, intergroup comparisons, mean and variability data, and interventional study design studies ranging from 3 to 7 had a mean score of 4.6. The most common limitations were the lack of random allocation, concealed allocation, blinded cases, and blinded therapist.

Table 3. Risk of Bias (BIAS) (PEDro Scale Score)

Study	2	3	4	5	6	7	8	9	10	11	Total
Freidl et al. (2020)	1	1	1	0	0	0	1	1	1	1	7
Mętel et al. (2020)	0	0	0	0	0	0	1	1	0	1	4
Mętel et al. (2022)	0	0	0	0	0	0	1	1	0	1	4
Mętel et al. (2022)	0	0	1	0	0	0	1	1	1	1	5
Metel et al. (2023)	0	0	0	0	0	0	1	1	0	1	3

DISCUSSION

This study summarizes current studies evaluating the effects of combined salt therapy and exercise on chronic respiratory diseases. It is emphasized that salt therapy and exercise may be more effective for individuals with these diseases to benefit optimally. The findings show that studies using salt therapy and exercise in combination are limited. This may be because natural salt cave environments are not available everywhere and have not been transformed into health tourism. This limitation can be overcome by using artificially designed halotherapy rooms more. The benefits of exercise-oriented rehabilitation programs in these rooms can be further increased.

Halotherapy has been proven effective in chronic respiratory diseases such as COPD, asthma, vasomotor rhinitis, cystic fibrosis, and occupational lung diseases. [27-31] However, studies that have addressed halotherapy sessions and pulmonary rehabilitation together are limited. One study has indicated that halotherapy may have a prophylactic effect on children who frequently get sick. It has been emphasized that it can be used to rehabilitate acute respiratory tract diseases, chronic ear, nose,

and throat diseases, and respiratory and skin diseases seen in children. [32] Another study noted that halotherapy sessions facilitated drainage by reducing secretions in the respiratory tract. It was emphasized that halotherapy applied to a rat COPD model could improve functionality by improving the morphological structure of the lung. In addition, it was shown that immune response could be increased by inhibiting the inflammatory process and oxidative stress. [33]

Clinical studies indicate that salt therapy effectively reduces symptoms and improves functionality in sinusitis, bronchiectasis, chronic bronchitis, mild to moderate asthma, and COPD. [34] It has also been reported that Speleotherapy contributes to the prevention, treatment, and improvement of skin and respiratory disorders with its microclimatic effect. [35] One study investigated the effect of speleotherapy in children with bronchial asthma and found that speleotherapy contributed to the improvement and restoration of impaired bronchial tone. [36] In a study evaluating the effects of cryomassage and sylvinite speleotherapy on patients with asthma, it was emphasized that therapeutic effects could be increased by applying rehabilitative technological applications together. It was stated that anti-inflammatory effects and reduction of bronchial obstruction could be possible in this way. It was emphasized that the physical capacity of the patients could be increased and their psychological well-being could be improved. [37]

In addition to these studies reporting the effectiveness of halotherapy and speleotherapy, studies that include pulmonary rehabilitation programs together with salt therapy applications offer promising approaches. Studies have shown that the therapeutic effect is enhanced when both approaches are considered together. [22-26,38] One study found that pulmonary rehabilitation in COPD patients in an underground salt mine environment was more effective than pulmonary rehabilitation on the surface. This effect was reported to last for 6 months. Exercise tolerance was shown to improve more than pulmonary rehabilitation on the surface. [39] Therefore, considering salt therapy and exercise-based pulmonary rehabilitation programs together in the treatment of chronic respiratory diseases may help to increase the quality of life of patients and reduce the burden on the health ecosystem. In the studies obtained, the fact that the programs applied did not exceed 3 weeks, the number of participants was small, and some studies did not have a control group, which is seen as a limitation of the studies. In this respect, it can be said that randomized controlled studies with a high level of evidence are needed.

Chronic inflammation in chronic respiratory diseases has certain negative effects. Narrowing of small airways, changes in lung parenchyma and pulmonary vasculature, and high levels of pro-inflammatory biomarkers are some of these. The inflammatory process contributes to mortality by increasing the likelihood of muscle loss and cachexia, cardiovascular disease, osteoporosis, and metabolic syndromes in patients. [40,41] Lung inflammation causes systemic inflammation as well. It is assumed that the inflammatory reaction in the lung spills over into the circulation, causing systemic inflammation. [42] In this sense, the anti-inflammatory effect of salt therapy may be considered positive. Increasing this effect may be possible with exercise training. The literature emphasizes that exercise can be a potential therapeutic tool in reducing systemic inflammation with its anti-inflammatory effect. [43] It has been reported that regular exercise protects against diseases associated with chronic systemic inflammation. The acute and long-term effects that occur after exercise are due to the pro-inflammatory and anti-inflammatory cytokines secreted by the body. It has been reported that regular exercise plays a key role in controlling this physiological process. [44]

The effect of halotherapy and speleotherapy on chronic respiratory diseases strengthens the physiological basis that exercise creates in the body. It has been stated that exercise training increases cardiorespiratory fitness, endurance of the muscles required for ambulation, and exercise tolerance. It has been reported that this contributes to an increase in the quality of life-related to health. [45] It has been emphasized that exercise-based pulmonary rehabilitation programs help improve outcomes such as 6-minute walking distance, maximum oxygen consumption, exercise capacity, quality of life, and shortness of breath. [46] It is very important not to underestimate even short-term exercise programs. One study reporting the results of a 4-week program showed significant improvements in quality of life and exercise capacity. [47] Studies reporting positive effects of halotherapy and speleotherapy even after short-term application are important in this respect. It is estimated that longer-term salt therapy and exercise programs combined will increase the benefits. In clinical practice, there is no consensus on creating an optimal exercise prescription for

chronic respiratory diseases. However, current guidelines recommend developing individual exercise prescriptions within the scope of (1) exercise types, (2) frequency, (3) intensity, (4) duration, (5) exercise goals, and (6) precautions. [48] Programs that include endurance training, resistance training, flexibility training, respiratory muscle training, and a combination of these can be implemented as part of pulmonary rehabilitation. Exercise intensity can range from low intensity to high intensity, with exercise training frequency of 20-60 minutes each (lasting at least 8-12 weeks), 3-5 times per week. [48-50] In this sense, it can be said that there is a need for more in-depth studies on the application of personalized exercise programs together with speleotherapy and halotherapy.

In a study written about complementary and alternative medicine for bronchial asthma, it was stated that breathing exercises improve lung function and improve quality of life. Again, in the same study, it was stated that methods such as relaxation, hypnosis, autogenic training, speleotherapy, biofeedback, and psychotherapy contribute to lung function. However, it was emphasized that the obtained effect was not proven to be superior to placebo. It was emphasized that there is a need for randomized controlled studies of superior methodological quality to obtain clearer results. [51] In our study, the lack of randomization in some studies and the absence of a control group draw attention to the weak point of the studies. Conducting research methodologically with a control group and randomized studies may contribute to further clarification of the results shown by these studies. Meta-analysis studies can be conducted for a comprehensive analysis of the effectiveness of speleotherapy and halotherapy combined with exercise. This approach can provide high-quality evidence for determining optimal intervention strategies by evaluating multiple interventions. [52] This can help healthcare professionals make more accurate treatment decisions.

The mean scores of the methodological quality of the studies evaluated with the PEDro scale were found to be moderate. [22-26] Research should include studies with larger samples and higher levels of evidence to more clearly demonstrate how exercise-based pulmonary rehabilitation programs combined with speleotherapy and halotherapies affect clinical outcomes. Treatment strategies that evaluate chronic respiratory diseases separately need to be addressed. These studies can guide clinicians and therapists in terms of creating exercise prescriptions. Individualized exercise programs combined with salt therapy can be beneficial in terms of providing additional evidence. Studies are needed to emphasize the extent to which outcome measures need to be improved to accept the combined effect of salt therapy and exercise as 'successful'.

Our study has some limitations. First, the small number of participants in the studies considered limits the generalizability of the results. Due to the inhomogeneity of individuals and evaluation parameters in the included studies, it is not possible to comprehensively and convincingly discuss the effect of an exercise program based on pulmonary rehabilitation combined with salt therapy (speleotherapy and halotherapy). Secondly, the short-term effects of the studies were discussed. It is unclear whether the benefits obtained will be maintained for a longer period. In this respect, follow-up studies on how much the benefits obtained are maintained will contribute to the literature.

CONCLUSION

According to the evidence, the effectiveness of combined exercise and salt therapy in chronic respiratory diseases is remarkable. Although the number of studies on the effectiveness of salt therapy is increasing, there is a need for high-level evidence studies that combine exercise and salt therapy.

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