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EFFECT OF MUSIC THERAPY INTERVENTION ON LUNG FUNCTION, DYSPNEA AND QUALITY OF LIFE OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS – A RANDOMIZED CONTROL STUDY

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ABSTRACT

Chronic Obstructive Pulmonary Disease (COPD) is a progressive lung condition posing significant challenges to patients' respiratory health and overall well-being. Integrating adjunct therapies such as Music Therapy has gained attention for its potential to enhance COPD management. This study investigates the impact of music therapy interventions in conjunction with standard medical care on hospitalized COPD patients. **Methodology:** A six-month randomized control trial was conducted at a rural tertiary care hospital. Participants aged 40 to 80 were randomly assigned to Group A (Music Therapy + Standard Medical Treatment) or Group B (Standard Medical Treatment). Eight sessions over four days evaluated Peak Expiratory Flow Rate (PEFR), Modified

Borg's Dyspnea Rating Scale (MBS), Mc Gill Quality of Life- Expanded Scale (MQOL-E), accessory muscle usage, and vital signs. **Results:** While vital signs showed no consistent statistically significant changes, Group A exhibited noteworthy reductions in Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), and Respiratory Rate (RR). Compared to Group B, Group A experienced significant improvements in PEFR, MBS, and MQOL-E ($p < 0.05$), highlighting music therapy's positive impact on respiratory health. **Conclusion:** Music therapy interventions, including humming, wind instrument playing, and raga-based music-assisted relaxation, yielded significant positive effects on lung function, dyspnea reduction, and quality of life in hospitalized COPD patients. The cost-effectiveness and patient acceptance of this intervention warrant its recommendation as an adjunct therapy alongside pharmacotherapy. Incorporating music therapy into routine care and pulmonary rehabilitation programs can potentially enhance COPD management strategies, ultimately improving patient outcomes and well-being.

Keywords: Lung, COPD, function, music, life, quality

INTRODUCTION

Chronic Obstructive Pulmonary Disease is defined by Global Initiative for Obstructive Lung Diseases (GOLD) 2023 as a heterogeneous lung condition, having chronic respiratory symptoms (dyspnea, cough, expectoration, and/or exacerbations) brought on by abnormalities of the airways (bronchitis, bronchiolitis), and/or alveoli (emphysema), which result in a persistent, frequently progressive airflow obstruction **[1]**.

According to 2023 report by GOLD, COPD is one of the top 3 causes of mortality worldwide and 90% of the death are attributed to Middle- and Low-Income Countries **[2]**. India accounts for 20% of global deaths caused by COPD indicating high level of prevalence **[3]**. As per recent reports, prevalence of COPD is found to be equal for men and women in developed countries **[4]**. Consistently, poverty and a lower socioeconomic status are linked to airflow obstruction **[5]** and a higher risk of developing COPD **[6]**.

One of the major causes of COPD is tobacco smoking followed by exposure to irritants like industrial fumes, biomass exposure and genetic predisposition **[7]**. Dynamic, cumulative, and recurrent gene (G)-environment (E) interactions throughout the course of a person's lifetime (T) that harm the lungs and/or modify their typical development and ageing processes cause COPD (GE Tomics) **[8]**. Genetic factors, such as

SERPINA1 mutations leading to alpha-1 antitrypsin deficiency, contribute significantly to disease risk **[9]**.

Chronic dyspnea, chronic cough, and sputum production are cardinal symptoms of COPD. These symptoms often manifest years before the onset of airflow obstruction, leading to challenges in early diagnosis **[10]**. COPD patients also experience depression and anxiety symptoms, which are curable but linked to worse health and increased risk of exacerbations **[11, 12]**.

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) classification categorizes COPD severity based on spirometry results, symptoms, exacerbation history, and the presence of comorbidities **[13]**.

The treatment includes managing exacerbations, chronic maintenance medications, pulmonary rehabilitation, oxygen therapy etc. **[14]**. Cost of the treatment of COPD is high and causes substantial economic burden **[15]**. GOLD suggests that, along with pharmacological treatment, it is necessary to improve the quality of life of the COPD patients as part of management of the disease **[16]**. According to a systematic review conducted in 2014, music therapy interventions have been found to improve the quality of life of the patients with COPD **[17]**.

Music therapy is the professional use of music and its elements as an intervention in medical, educational, and everyday environments with individuals, groups, families, or communities who seek to optimize their quality of life and improve their physical, social, communicative, emotional, intellectual, and spiritual health and wellbeing. Research, practice, education, and clinical training in music therapy are based on professional standards according to cultural, social, and political contexts. (World Federation of Music Therapy, 2011) **[18]**.

Music Therapy is an evidence based field that employs activities like listening to music, playing instruments or singing either in group or individual session to promote goal oriented therapeutic relationship between the therapist and the patient which aims at achieving positive health outcomes **[19]**. Along with self-management education and physical exercise, music therapy interventions like therapeutic singing and wind instrument playing have been found to be effective in improving respiration, psychological well-being and health related quality of life of patients with COPD **[20]**.

Given that COPD is a progressive disease, there is greater need for devising better management strategies to reduce the impact of

the disease and to improve health and quality of life of the patients **[21]**.

Mouth Organ which is also known as harmonica is a wind instrument with free reed. It means that the reed which is present inside the instrument moves with the help of air pressure provided by the player **[22]**. Mouth organ playing has been proven to improve pulmonary function reflected by improvement in PE Max (Maximum Expiratory Pressure) and PI Max (Maximum Inspiratory Pressure), dyspnea and quality of life of the patients with COPD **[23]**. Another study found music therapy improved pulmonary functions, reduced dyspnea, and reduced stress levels in moderate respiratory disorder patients, demonstrating its potential as a holistic rehabilitation approach **[24]**. A randomized controlled trial examined harmonica playing's impact on COPD patients' clinical, psychosocial, and functional outcomes during pulmonary rehabilitation. Results showed no significant differences, but the combined group (Pulmonary Rehabilitation and Harmonica Playing) improved shortness of breath, quality of life, and walking distance **[25]**. A study of 28 healthy participants examined the impact of heart rate variability on autonomic function, anxiety, and subjective sensation. The intervention with the Indian raga Bhupali reduced HRV spectrum, heart rate, and root mean square of successive differences between normal heartbeats (RMSSD). Post-Indian raga, anxiety levels reduced, while subjective evaluation of emotions improved. There was a decrease in sympathetic activity and boost in vagal modulation **[26]**.

In the study population, presently there is a paucity of literature evidence on music therapy's impact on hospitalized COPD patients. Hence, the current study is designed to evaluate the impact of music therapy intervention (Vocal recreation/ humming, Improvisation and Music Assisted Relaxation) combined with standard medical care on PEFR, dyspnea, quality of life, vital signs (blood pressure, respiratory rate and SpO2) and use of accessory muscle in COPD patients in comparison with standard medical care as a cost effective and motivational disease management strategy for hospitalized COPD patients.

METHODS

Participants:

The study enrolled participants from the inpatient ward of the Department of Pulmonary Medicine at Mahatma Gandhi Medical College and Research Institute. The inclusion criteria comprised COPD patients aged between 40 to 80 years with mild, moderate, or severe airflow limitation as per

GOLD standards. Patients undergoing inpatient treatment with a minimum hospitalization of 4 days were eligible. Patients with hearing impairment, unwillingness for music therapy, and critically ill conditions were excluded.

Study Design:

This study followed an Interventional Block Randomized Control Trial design. Participants were randomly assigned to two groups: Group A (Music Therapy + Standard Medical Treatment) and Group B (Standard Medical Treatment Alone).

Sampling Procedure and randomization:

Randomization was conducted using the online software 'Sealed Envelope' to ensure the allocation of participants to groups was random and unbiased.

Sample Size Determination:

The sample size of 30 participants per group was determined based on literature-derived Dyspnea scores, assuming a significance level (alpha) of 0.05 and a statistical power of 80%.

Intervention Procedure:

The study involved three key music therapy interventions conducted over four consecutive days, twice a day. Each session lasted for 25 minutes and comprised:

1. **Warm Up – Vocal Recreation/Humming (5 minutes)**

Patients were instructed to sit upright in a comfortable position, and the process of humming was explained in a familiar language. They were instructed to breathe out, take a deep breath, and hum comfortably. The principal investigator provided a demonstration, and patients were encouraged to repeat the activity for 5 minutes. Breaks were allowed if needed

2. **Wind Instrument Playing - Mouth Organ Playing (10 minutes)**

The principal investigator provided patients with separate mouth organs set at C scale with 10 holes for playing. Patients were instructed on proper positioning and the purpose of playing. Exercise patterns were explained, and patients repeated the patterns showed by the principal investigator.

3. **Music Assisted Relaxation - Instrumental Music based on Mohanam Raga (10 minutes)**

Patients were instructed to lie down on the bed in supine position and relax both the hands by the side of the body, palms facing down. Later, the patients were instructed to close their eyes. Live instrumental music based on Bhupali Raaga (Mohanam) was played by the music therapist for 10 minutes on guitar. Post 10 minutes the patients were instructed to slowly rub their palms and place the palms on the closed eye lids. Finally they were

instructed to open their eyes gently

Outcome Measures:

Baseline assessments were conducted for Peak Expiratory Flow Rate (PEFR), Modified Borg's Dyspnea Rating Scale (MBS), Use of Accessory Muscle, and Quality of Life using the McGill Quality of Life – Expanded (MQOL-E) scale. Vital signs, including respiratory rate, blood pressure, and SpO2, were measured before and after each session.

Data Analysis:

The collected data were analyzed using appropriate statistical methods, comparing the intervention group (Group A) with the control group (Group B). The significance of changes in PEFR, MBS, MQOL-E scores, and vital signs within and between groups was determined using statistical tests.

Ethical Considerations:

The study adhered to ethical guidelines and obtained informed consent from all participants. Confidentiality and privacy of participants' data were ensured throughout the study.

Statistical Methods Used

Peak Expiratory Flow Rate (PEFR), McGill Quality of Life (MQOL-E), blood pressure, respiratory rate, and SpO2 will be analyzed quantitatively using mean and standard deviation, with independent t-tests comparing intervention and control groups. The Modified Borg's Dyspnea Rating Scale will be explored qualitatively through frequency and percentages. Additionally, the use of accessory muscles will be quantified in terms of frequency and percentages. Statistical analysis was carried out using SPSS version 19.0 (IBM SPSS, US) software with Regression Modules installed. Descriptive analyses were reported as mean and standard deviation of continuous variables.

RESULTS AND DISCUSSION

The current study evaluated the impact of music therapy intervention like humming, wind instrument playing and raga based music assisted relaxation on Peak Expiratory Flow Rate (PEFR), perceived dyspnea and quality of life of hospitalized COPD patients. The findings were as follows. Age distribution in control and experimental groups was uneven due to block randomization, with the maximum number of participants being 71-80 years old. In the current study, there were more number of male participants in both control and experimental group as compared with the female participants. In Indian context the prevalence of COPD was 11.4% (95% CI: 6.0%-16.9%) for men and 7.4% (95% CI: 5.2%-9.6%) for women, respectively **[27]**.

Table 1: Between group comparison for PEFR and MBS

Variables	Group	N	Mean	Std. Deviation	p-value
PEFR_PRE	1	24	182.25	79.33	0.189
	2	24	154.97	61.25	
PEFR_POST	1	24	216.50	87.29	0.008
	2	24	155.36	62.37	
MBS_PRE	1	24	9.42	0.830	0.471
	2	24	9.17	1.465	
MBS_POST	1	24	1.45	0.943	0.001
	2	24	3.542	1.47	

Table 1 shows between group comparison for PEFR and MBS for both experimental and control group.

The intervention significantly increased PEFR and MBS in Group 1 (Music Therapy with standard treatment) compared to Group 2(standard treatment alone), with a significant difference (p-value = 0.008). The mean PEFR increased from 182.25 to 216.50, while MBS decreased from 9.17 to 1.45, with a significant difference (p-value = 0.471). The music therapy intervention had a positive effect on the improving lung function and reducing dyspnea as indicated by PEFR MBS scores respectively. Findings of the current study are consistent with a study which found that using music as distractive auditory stimuli (DAS) in pulmonary rehabilitation programs can promote walking adherence and maintain gains in patients with moderate-to-severe COPD. The DAS group experienced a significant decrease in perceived dyspnea during ADL and increased 6MW distance over time **[28]**.

Table 2: Between group comparison for McGill Quality of Life –Expanded Total

	Group	N	Mean	SD	P value
MQOLET_PRE	1	24	4.35	0.89	0.913
	2	24	4.37	0.74	
MQOLET_POST	1	24	8.21	0.76	0.001
	2	24	6.46	0.54	

Table 2 shows between group comparisons for McGill Quality of Life –Expanded Total.

The intervention significantly improved quality of life in both Group 1 and Group 2, with a mean MQOLET score of 8.21 in Group 1 and 6.46 in Group 2. However, the improvement in Group 1 was significantly greater than in Group 2, as evidenced by higher mean MQOLET scores in Group 1. As per the information available, McGill Quality of Life-Expanded (MQOLET) questionnaire has not been used in music therapy or COPD studies, highlighting the potential for this study to address this knowledge gap.

The study evaluated the impact of the intervention on various dimensions of quality

of life in two groups before and after the intervention. Before the intervention, there were no statistically significant differences in overall quality of life, physical well-being, feelings and thoughts, social well-being, surroundings, thinking, and health care scores between the two groups. After the intervention, a statistically significant improvement was observed in overall quality of life scores in Group 1 (mean: 7.92, SD: 1.018) compared to Group 2 (mean: 7.13, SD: 0.850), with a p-value of 0.001. Similarly, the intervention led to statistically significant improvements in physical well-being, feelings and thoughts, social well-being, surroundings, and thinking scores in Group 1 compared to Group 2, with p-values of 0.001, 0.001, 0.002, 0.001, and 0.001, respectively. However, the improvement in health care scores after the intervention was not statistically significant between the two groups (p-value = 0.731).

A few other studies employing music therapy intervention with COPD patients have shown similar findings.

MT employs music on purpose to treat physical and mental illnesses, enhance functioning, raise quality of life, and change behavior. Whistle performance as active MT, vocal therapy through singing, vocalization for respiratory control, and pursed-mouth and abdominal breathing are all forms of MT for COPD **[29]**.

Seven publications on music therapies were included in the final analysis, with 40% from the US and 70% from randomized control trials conducted in hospitals. While physiological outcomes like FEV, FVC, and respiratory control showed mixed results, music improved psychological outcomes including quality of life, dyspnea, and anxiety **[30]**.

The experimental group exhibited consistent improvement in systolic blood pressure after the intervention, yet no statistically significant disparity was noted in systolic blood pressure between the experimental and control groups before or after the intervention in the present study. This lack of significance might be linked to a prior study illustrating heightened blood pressure during exercise among COPD patients, possibly influencing the post-intervention systolic blood pressure results in the experimental group **[31]**. This observation aligns with the known abnormal hemodynamic response to exercise seen in many COPD patients. Despite this, the study emphasizes that systolic blood pressure exhibited comparable patterns between the two groups, highlighting potential underlying factors warranting further exploration beyond the scope of the study **[32]**.

Additionally, the experimental group displayed considerable diastolic blood pressure improvement post-intervention compared to the pre-intervention condition, yet no statistically significant diastolic blood pressure differences were evident between the experimental and control groups before or after the intervention. In summary, the study's data analysis indicates a lack of consistent and significant distinctions in diastolic blood pressure between the groups over the study's duration. Notably, some specific time points post-intervention exhibited statistically significant differences.

These findings are partly aligned with a past systematic review wherein the music therapy group demonstrated significant improvement in diastolic blood pressure compared to the control group. This suggests that while the present study did not yield consistent significant diastolic blood pressure differences, the broader body of research indicates a potential positive impact of music therapy on this parameter.

At specific time points (RR3_POST, RR5_POST, RR6_POST, and RR7_POST), the p-values were found to be less than .05 (p-values = .007, .001, .000, and .002, respectively). This indicates that there were statistically significant differences in respiratory rates between the two groups at those particular time points.

Due to its calming effects, passive music therapy (i.e., listening to music) is useful in reducing dyspnea and anxiety, which leads to increased exercise tolerance in COPD patients **[33]**.

Experimental group generally exhibited slightly higher mean oxygen saturation compared to control group, but the differences were not deemed significant. At some specific time points (SpO23_PRE, SpO25_PRE, and SpO28_POST), the p-values were found to be less than .05 (p-values = .157, .376, and .222, respectively). This indicates that there were statistically significant differences in oxygen saturation between the two groups at those particular time points indicating positive impact of music therapy intervention. Peripheral oxygen saturation was found to be improved post music therapy intervention as per a recent study **[34]**. These findings are consistent with the partial observations made during the current study.

The current study did not find statistically significant differences in the use of accessory muscles between experimental and control group at both the PRE and POST time points. One of the major issues in a wide variety of medical conditions, from respiratory disorders like COPD to cardiovascular diseases, is the

management of bronchial secretions.[35, 36] The term "airway clearance techniques" (ACTs) refers to various methods for removing excess secretions. Their goals include expanding collapsed lung areas to improve gas exchanges, reducing inflammatory response, and reducing airway obstruction brought on by secretions obstructing the airway lumen, which helps to prevent respiratory tract infections **[35-37]**.

From the patient's perspective, a single technique is rarely used for a specific pathological condition. The goal is to achieve the best airway clearance with minimal side effects and adverse events **[38]**. The effectiveness of any technique is influenced by patient factors, such as satisfaction, motivation, and perceived effectiveness. It is crucial to consider the patient's preferences and adapt the technique to their lifestyle **[39]**. Some of the techniques used in ACT include Active Cycle of Breathing Techniques (ACBT), Manual Techniques, Pursed Lip Breathing (PLB), Positive Expiratory Pressure (PEP) **[40]**.

In PEP, the oscillation causes vibrations within the bronchial walls to move the secretions into the lumen, the PEP component promotes airflow behind the secretions, and the repeated accelerations of the expiratory flow facilitate the secretions' movement from the peripheral airways to the central ones which helps with airway clearance **[41]**.

In comparison with mouth organ the cost incurred for the OPEP devices is high. Music therapy techniques used in the current study were humming/monotone chanting, wind instrument playing and raga based music assisted relaxation. First two which tend to resemble few aspects of the ACT mentioned above. Mouth Organ which is also known as harmonica is a wind instrument with free reed. It means that the reed which is present inside the instrument moves with the help of air pressure provided by the player **[42]**. It was observed that when the patients were playing lower frequency notes on the mouth organ as a sustained note, likeliness of cough and expectoration was greater. A more systematic design would provide a clear understanding about the role of music therapy intervention such as the ones used in this study, to facilitate airway clearance.

In the current study, the patients in the experimental group initially complaining about chest congestion were observed to bring up sputum and expectorate during humming as well as mouth organ playing. After listening to live instrumental raga music, some patients reported feeling relaxed whereas some fell asleep post 10 minutes of music listening indicating deep relaxation.

Limitations

The current study employed unique method of intervention to assess its effectiveness on PEFR, MBS and QOL of COPD patients. However, there are a few limitations to the current study.

- The study was conducted for a small sample size making the generalizability of the outcome limited.
- The mouth organs used in the current study were of medium quality with the provision of funds better quality instruments with good resistance could have been used for the study.
- The study could have been conducted in rainy or winter season as more number of COPD admissions are witnessed during these seasons.
- Due to lack of appropriate infrastructure, the relaxation sessions post exercise had to be conducted by the bedside. This resulted into diverted attention due to external noises present in the ward.

Future Implications:

As lower frequencies travel to the smaller airways, instruments generating lower frequency sounds could be employed in the future to assess its effect on airway clearance and resulting impact pulmonary function.

Relaxation post exercise should be conducted in a quiet and peaceful environment to assess its absolute impact on the patients' physiological as well as parameters.

The same study design should be replicated with diverse and larger sample size to increase generalizability of the results.

A comparative study between an OPEP device and mouth organ should be conducted to assess the efficacy of these interventions on airway clearance.

CONCLUSION

The current study aimed to evaluate the effect of music therapy intervention on lung function, dyspnea and quality of life of hospitalized COPD patients. Results indicated a statistically significant difference in Peak Expiratory Flow Rate (PEFR), Modified Borg's Dyspnea Rating Scale (MBS) and McGill Quality of Life- Expanded scale post intervention in the experimental group in comparison with the Control group. However, there was no consistently significant change in vitals measured; Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Respiratory Rate (RR), Saturation of Peripheral Oxygen (SpO_2) and use of accessory muscles in both the experimental as well as control group. To conclude music therapy interventions such as humming, wind instrument playing and raga based music

assisted relaxation have potential as an adjunct therapy to pharmacotherapy to improve peak expiratory flow rate, reduce dyspnea and improve quality of life of COPD patients over a period of 4 days. As it is cost effective in comparison with other methods currently available and well received by the patients, it is recommended to the practitioners to incorporate music therapy interventions in routine care as well pulmonary rehabilitation.

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SJ – design, JCR- manuscript preparation and communication PR- supervision, RS- data collection

Ethical issues – YES approved

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