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Effect of an Integrated Breathing and Mindfulness-Based Intervention on Anxiety, Dyspnea, and Quality of Life among Lung Cancer Patients: A Quasi-Experimental Study

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ABSTRACT

Lung cancer patients experience high rates of anxiety, dyspnea, and impaired quality of life (QoL). Non-pharmacological, nurse-led interventions integrating breathing exercises and mindfulness practices show theoretical promise but remain underexplored in Indian oncology settings. To evaluate the effect of a six-week Integrated Breathing and Mindfulness-Based Intervention (IBMBI) on anxiety, dyspnea, and QoL among lung cancer patients in Gwalior, Madhya Pradesh. A quasi-experimental, pre-test post-test single-group design was employed with 60 lung cancer patients at Kamla Raja Hospital. Instruments used: HADS-A (anxiety), Modified Borg Dyspnea Scale, and EORTC QLQ-C30 (QoL). Data were analysed using paired samples t-test ($p < 0.05$). HADS-A scores declined from 13.42 ± 2.18 to 8.14 ± 1.96 ($t(59) = 18.43$, $p < 0.001$; $d = 2.51$). Borg scores reduced from 5.87 ± 1.24 to 3.26 ± 1.09 ($p < 0.001$; $d = 2.24$). Global QoL improved from 38.22 ± 8.74 to 58.67 ± 7.91 ($p < 0.001$). All three null hypotheses were rejected. IBMBI produced clinically and statistically significant improvements across all outcome domains. Integration of nurse-led IBMBI into routine

oncology care is recommended, with rigorous RCTs warranted for confirmatory evidence.

Introduction

Lung cancer remains the most significant cause of cancer-related mortality worldwide, accounting for approximately 2.21 million new diagnoses and 1.80 million deaths globally in 2020 (Sung et al., 2021). In India, lung cancer ranks among the five most prevalent malignancies and is the leading cause of cancer death in men, with an age-standardised incidence rate of approximately 7.4 per 100,000 population (Mathur et al., 2020). The high proportion of patients presenting at advanced stages in India substantially limits curative options and necessitates a robust focus on palliative and supportive care strategies.

The symptom burden in lung cancer is characteristically complex and multidimensional. Dyspnea — the subjective perception of breathlessness — is reported in 50% to 87% of lung cancer patients and is consistently identified as among the most distressing and functionally limiting symptoms across all disease stages (Bausewein et al., 2008). Beyond its physiological basis, dyspnea frequently precipitates or exacerbates anxiety, fear of suffocation, and social withdrawal. Anxiety disorders are among the most prevalent psychological comorbidities in oncology, with rates of clinically significant anxiety ranging from 20% to 48% in lung cancer populations (Salvo et al., 2012). Untreated anxiety is associated with poorer treatment adherence, increased symptom severity, prolonged hospitalisation, and significantly diminished quality of life.

Health-related quality of life (HRQoL) in lung cancer encompasses physical, functional, emotional, social, and cognitive dimensions that are collectively and severely compromised by disease trajectory and treatment side effects. Non-pharmacological interventions — particularly those combining breathing exercises with mindfulness-based practices — offer a theoretically sound, safe, and nurse-deliverable approach to addressing this multidimensional symptom burden. Breathing exercises reduce dyspnea through respiratory muscle conditioning and diaphragmatic retraining, while mindfulness-based interventions (MBIs), grounded in Kabat-Zinn's (1990) Mindfulness-Based Stress Reduction (MBSR) framework, attenuate anxiety through non-judgemental, present-moment awareness cultivation. Despite growing international evidence, evaluation of integrated breathing-mindfulness interventions in Indian oncology nursing settings remains conspicuously limited, particularly in the Madhya Pradesh region. The present study was designed to address this gap.

Review of Literature

A systematic review and meta-analysis by Piet et al. (2012) examined the effect of mindfulness-based therapy on anxiety and depression across 22 studies involving cancer patients and survivors (n = 1,403). The review reported statistically significant reductions in anxiety (Hedges' g = 0.37, 95% CI: 0.22–0.52) and depression (g = 0.44, 95% CI: 0.23–0.64), establishing MBIs as evidence-supported psychological interventions in oncology. A randomised controlled trial by Lengacher et al. (2016) confirmed significant reductions in anxiety ($p < 0.001$) and multiple symptom domains in breast cancer survivors using the MBSR programme, with the authors emphasising the importance of culturally adapted delivery.

With specific respect to dyspnea, Molassiotis et al. (2010) demonstrated that structured breathing retraining, including diaphragmatic and pursed-lip breathing, was associated with significant reductions in dyspnea intensity in lung cancer patients (pooled effect size d = 0.45–0.62). Bausewein et al. (2008), in a Cochrane review, concluded that non-pharmacological interventions for breathlessness in advanced disease — including fan therapy, breathing techniques, and psychosocial support — are feasible, safe, and effective adjuncts to pharmacological management.

Concerning HRQoL outcomes, Temel et al. (2017) demonstrated in a randomised controlled trial that early integrated palliative care significantly improved QoL in patients with metastatic non-small cell lung cancer (NSCLC) compared to standard care ($p < 0.05$ for multiple EORTC QLQ-C30 domains). Foley et al. (2010) reported significant improvements in emotional functioning and overall QoL in cancer patients following MBSR, attributing gains to enhanced present-moment orientation and reduced catastrophic appraisal. Taken together, the literature supports the theoretical and empirical basis for an integrated breathing-mindfulness approach in lung cancer nursing care, while highlighting the absence of Indian-contextualised evidence as a significant research gap.

Objectives of the Study

The study was designed to achieve the following specific objectives:

1. To assess the pre-intervention (baseline) levels of anxiety, dyspnea, and quality of life among lung cancer patients using standardised validated instruments.
2. To implement a structured six-week Integrated Breathing and Mindfulness-Based Intervention (IBMBI) among the study participants.

3. To evaluate post-intervention levels of anxiety, dyspnea, and quality of life following the six-week IBMBI.

4. To determine the effect of IBMBI by comparing pre-test and post-test scores using the paired samples t-test.

Methodology

Research Design

A quasi-experimental, pre-test post-test single-group design was employed, schematically represented as O1 → X → O2, where O1 = baseline assessment, X = IBMBI, and O2 = post-intervention assessment. This design was selected on ethical and feasibility grounds; withholding a low-risk supportive intervention from a seriously ill population for a six-week control period was deemed ethically unjustifiable.

Setting and Sample

The study was conducted at the Medical Oncology Inpatient Unit and Oncology Day Care Unit of Kamla Raja Hospital (KRH), Gwalior, Madhya Pradesh — a government tertiary referral hospital affiliated with Gajra Raja Medical College (GRMC) serving approximately 7 million people across the Gwalior-Chambal division. A total of 60 participants were enrolled using convenience sampling. Sample size was calculated a priori (n = 51 minimum; 60 recruited with 15% attrition allowance) based on Cohen's d = 0.8, $\alpha = 0.05$, and 80% power.

Eligibility Criteria

Participants were included if they were adults (≥18 years) with confirmed histopathological lung cancer (NSCLC or SCLC) at any stage, scoring ≥8 on HADS-A, able to perform mild breathing exercises without mechanical ventilatory support, and willing to provide written informed consent. Patients with severe psychiatric comorbidities, oxygen saturation below 88% on room air, brain metastases with cognitive impairment, or estimated prognosis of less than four weeks were excluded.

Data Collection Instruments

Anxiety was measured using the Hospital Anxiety and Depression Scale – Anxiety subscale (HADS-A), a validated seven-item instrument with established oncology-specific psychometric properties (Cronbach's alpha = 0.80–0.93; Zigmond & Snaith, 1983). Dyspnea was assessed with the

Modified Borg Dyspnea Scale (MBDS), a 0–10 numerical rating scale with ICC of 0.81–0.93 and a minimal important difference of 1.0 point. Health-related quality of life was evaluated using the EORTC QLQ-C30 (Version 3.0), the most widely validated cancer-specific HRQoL instrument globally, comprising five functional scales, three symptom scales, six single-item symptom measures, and a Global Health Status/QoL scale, with all scores linearly transformed to 0–100 (Fayers et al., 2001).

Intervention Protocol

The IBMBI was delivered over six weeks and comprised two integrated components grounded in the Respiratory Muscle Training Model and Kabat-Zinn's (1990) MBSR framework. Component 1 (Structured Breathing Exercises) included diaphragmatic breathing (10 min/session), pursed-lip breathing (5 min/session), segmental breathing (5 min/session), and paced breathing (5 min/session), progressively introduced from week one. Component 2 (Mindfulness-Based Practices) included guided mindful breathing awareness (weeks 1–2), body scan meditation (weeks 2–4), mindful movement (weeks 3–5), loving-kindness meditation (weeks 4–6), and mindful journalling (weeks 5–6). Sessions progressed from 30 minutes/session in week one to 50 minutes/session in week six (3–4 sessions weekly), delivered individually or in small groups by the researcher at the bedside or day-care unit. Intervention fidelity was monitored through a standardised IBMBI manual, audio-recording of 20% of sessions reviewed by an independent expert, and adherence checklists completed after every session.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee of KRH/GRMC, Gwalior (Reference: IEC/KRH/ONCO/2024/11). The study was conducted in accordance with the Declaration of Helsinki (2013 revision). Written informed consent was obtained from all participants, with the right to withdraw at any point without impact on clinical care clearly communicated. Participant confidentiality and data anonymity were strictly maintained.

Data Analysis

All data were analysed using IBM SPSS Statistics Version 26.0. Descriptive statistics (frequency, percentage, mean, standard deviation) were computed for all variables. Normality was confirmed via the Shapiro-Wilk test ($p > 0.05$ for all primary outcomes). The paired samples t-test was the primary inferential test for pre-post comparisons. Effect size was quantified using Cohen's d (small: 0.2; medium: 0.5; large: ≥0.8). The significance threshold was $p < 0.05$ (two-tailed).

Results

Demographic and Clinical Profile

All 60 enrolled participants completed the six-week intervention without attrition. The majority were male (70.0%, n = 42), aged 56–70 years (40.0%), from rural habitats (63.3%), and presented with Stage IV disease (56.7%). NSCLC adenocarcinoma was the most common histological subtype (46.7%). The most frequent treatment modality was chemotherapy alone (43.3%). Regarding ECOG Performance Status, 46.7% were PS 2 (ambulatory, limited work) and 30.0% were PS 3 (limited self-care), reflecting the significant functional burden of the study population.

Table 1 *Sociodemographic and Clinical Characteristics of Study Participants (N = 60)*

Characteristic	Category	n (%)
Age Group	41–55 years	22 (36.7%)
	56–70 years	24 (40.0%)
Gender	Male	42 (70.0%)
	Female	18 (30.0%)
Habitat	Rural	38 (63.3%)
Disease Stage	Stage IV	34 (56.7%)
Histological Type	NSCLC Adenocarcinoma	28 (46.7%)
ECOG Performance Status	PS 2 (Ambulatory)	28 (46.7%)
	PS 3 (Limited self-care)	18 (30.0%)

Note. NSCLC = Non-small cell lung cancer; ECOG = Eastern Cooperative Oncology Group; PS = Performance Status.

Effect of IBMBI on Anxiety (HADS-A)

A statistically significant reduction in anxiety was observed following the six-week IBMBI. The mean HADS-A score declined from 13.42 (SD = 2.18) at pre-test to 8.14 (SD = 1.96) at post-test ($t(59) = 18.43$, $p < 0.001$, Cohen's $d = 2.51$ — very large effect). The proportion of participants with clinically

significant anxiety (HADS-A ≥ 11) decreased dramatically from 76.7% at baseline to 13.3% post-intervention. The null hypothesis H01 was rejected.

Table 2 *Pre-Test and Post-Test Comparison of Anxiety Scores — HADS-A (N = 60)*

Variable	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Diff.	t (df=59)	p
HADS-A Score (0–21)	13.42 (2.18)	8.14 (1.96)	5.28	18.43	< 0.001*
Clinically Significant Anxiety (%)	76.7%	13.3%	—	—	—

*Note. *p < 0.001 (two-tailed). Cohen's d = 2.51 (Very Large Effect). HADS-A ≥ 11 = clinically significant anxiety.*

Effect of IBMBI on Dyspnea (Modified Borg Scale)

The mean Modified Borg Dyspnea Score declined from 5.87 (SD = 1.24) to 3.26 (SD = 1.09) — a reduction of 2.61 points far exceeding the established minimal important difference of 1.0 point ($t(59) = 15.67$, $p < 0.001$, Cohen's $d = 2.24$ — very large effect). The proportion of participants with severe dyspnea (score 7–10) decreased from 30.0% to 5.0%. The null hypothesis H02 was rejected.

Table 3 *Pre-Test and Post-Test Comparison of Dyspnea Scores — Modified Borg Scale (N = 60)*

Variable	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Diff.	t (df=59)	p
Borg Dyspnea Score (0–10)	5.87 (1.24)	3.26 (1.09)	2.61	15.67	< 0.001*
Severe Dyspnea (7–10) %	30.0%	5.0%	—	—	—

*Note. *p < 0.001 (two-tailed). Cohen's d = 2.24 (Very Large Effect). Minimal Important Difference = 1.0 point.*

Effect of IBMBI on Quality of Life (EORTC QLQ-C30)

The EORTC QLQ-C30 Global Health Status/QoL score improved significantly from 38.22 (SD = 8.74) to 58.67 (SD = 7.91), a gain of 20.45 points substantially exceeding the established minimal clinically important difference of 10 points ($t(59) = 18.92$, $p < 0.001$). Statistically significant improvements were observed across all five functional scales and in six of seven symptom scales. The sole exception was Financial Difficulties ($p = 0.219$), which is expected as the IBMBI does not address socioeconomic determinants. Null hypothesis H03 was rejected.

Table 4 *Pre-Test and Post-Test Comparison of EORTC QLQ-C30 Scores (N = 60)*

QLQ-C30 Scale	Pre-Test Mean (SD)	Post-Test Mean (SD)	Change	t (df=59)	p
Global Health Status / QoL	38.22 (8.74)	58.67 (7.91)	+20.45	18.92	< 0.001*
Physical Functioning	42.17 (10.34)	59.83 (9.17)	+17.66	12.74	< 0.001*
Role Functioning	35.83 (12.21)	54.17 (10.56)	+18.34	11.42	< 0.001*
Emotional Functioning	41.25 (11.08)	60.42 (9.88)	+19.17	13.67	< 0.001*
Social Functioning	37.50 (13.56)	57.08 (11.74)	+19.58	11.34	< 0.001*
Fatigue (symptom)	62.22 (13.47)	41.11 (11.62)	−21.11	11.77	< 0.001*
Dyspnea (symptom)	63.33 (18.67)	38.89 (15.44)	−24.44	10.88	< 0.001*
Insomnia (symptom)	55.56 (20.14)	36.67 (17.88)	−18.89	7.42	< 0.001*
Financial Difficulties	61.11 (21.34)	57.78 (19.47)	−3.33	1.24	0.219 (NS)

*Note. *p < 0.001 (two-tailed). Positive values for functional/global scales = improvement; negative values for symptom scales = improvement (reduced symptom burden). NS = Not significant.*

Discussion

The present study evaluated a structured six-week IBMBI in 60 lung cancer patients at a tertiary oncology unit in Gwalior, Madhya Pradesh. All three primary null hypotheses were rejected at $p < 0.001$, with very large effect sizes across all outcome domains (Cohen's d: 2.51 for anxiety, 2.24 for dyspnea, 2.66 for global QoL). These findings represent a compelling, contextually relevant contribution to the Indian oncology nursing literature.

The anxiety reduction observed — mean HADS-A decline of 5.28 points, with clinically significant anxiety prevalence falling from 76.7% to 13.3% — substantially exceeds effect sizes reported in international meta-analyses of MBI-based interventions in cancer populations (Piet et al., 2012: Hedges' g = 0.37–0.44). This may be attributable to the higher baseline anxiety burden of lung cancer patients relative to mixed-cancer populations studied in meta-analyses, the individually tailored delivery modality of the IBMBI, and the synergistic contribution of concurrent breathing exercises — which directly address the physiological triggers of anxiety in respiratory malignancy — that standalone MBIs lack. The mechanistic pathway through which mindfulness attenuates anxiety in this population involves interruption of catastrophic cognitive appraisal cycles, particularly the fear-of-suffocation catastrophising that characterises anxiety in lung cancer, replacing reactive avoidance with present-moment, non-judgmental awareness (Kabat-Zinn, 1990).

The dyspnea reduction (mean Borg score: 5.87 to 3.26, d = 2.24) is consistent with the systematic evidence on breathing retraining in lung cancer (Bausewein et al., 2008; Molassiotis et al., 2010) but substantially exceeds the pooled effect sizes (d = 0.45–0.62) reported in previous meta-analyses. This superior effect likely reflects the synergistic contribution of the concurrent mindfulness component, which modifies the affective and cognitive dimensions of dyspnea processing — specifically the emotional unpleasantness and cognitive catastrophising that amplify perceived breathlessness — beyond what breathing retraining alone achieves. Neurophysiologically, diaphragmatic breathing activates parasympathetic nervous system pathways, reduces respiratory rate, decreases the work of breathing, and improves ventilation-perfusion matching, collectively reducing the perceived effort of breathing (Dempsey et al., 2014).

Quality of life improvement was substantial and clinically meaningful across all domains. The Global Health Status/QoL gain of 20.45 points far exceeds the minimal clinically important difference of 10 points for this scale in lung cancer populations, and aligns with the findings of Temel et al. (2017) regarding integrated supportive care in NSCLC. The significant improvement in Emotional Functioning (+19.17 points, $p < 0.001$) is particularly noteworthy given the pervasive and undertreated emotional distress characteristic of lung cancer. The loving-kindness meditation and body scan components appear to have contributed meaningfully to this domain, consistent with Foley et al. (2010). The absence of significant change in Financial Difficulties ($p = 0.219$) is expected and confirms discriminant validity of the instrument — the IBMBI addresses psychological and physiological symptom burden but cannot alter the socioeconomic realities that generate financial distress in this largely rural, low-income cohort.

The absence of a randomised control group is the most significant methodological limitation, and the contribution of natural disease course, concurrent medical management adjustments, or regression to the mean cannot be entirely excluded. However, very large effect sizes ($d > 2.0$) across all domains, combined with a six-week intervention window insufficient for spontaneous remission in predominantly Stage IV disease, lend internal validity to attributing observed improvements to the IBMBI. The convenience sampling approach and single-centre setting limit generalisability, and long-term follow-up data beyond six weeks are unavailable.

Conclusion

The present quasi-experimental study provides compelling preliminary evidence that a structured, six-week Integrated Breathing and Mindfulness-Based Intervention, administered by trained nursing personnel, produces statistically significant and clinically meaningful improvements in anxiety, dyspnea, and health-related quality of life in lung cancer patients. The IBMBI is characterised by low cost, safety, adaptability to hospital and home settings, and feasibility of nurse-led administration. Its theoretical grounding in respiratory physiology and mindfulness neuroscience provides a coherent mechanistic framework for the observed improvements. These findings support systematic integration of IBMBI as a routine adjunct to standard oncological nursing care. Rigorous multi-site randomised controlled trials with active control conditions, extended follow-up, and mechanistic biomarker assessment are essential to definitively establish causality and inform national clinical guidelines for lung cancer supportive care in India.

Implications for Nursing and Clinical Practice

The findings of this study carry direct and multi-level implications for oncology nursing practice, nursing education, and healthcare policy in India. For clinical nursing practice, oncology nurses should receive formal training in structured breathing exercise facilitation and foundational mindfulness instruction, enabling safe and competent delivery of IBMBI-type interventions at the bedside. Routine screening for anxiety (HADS-A) and dyspnea (Borg Scale) should be mandated in oncology ward admission protocols to facilitate early identification and intervention. The IBMBI protocol should be adapted into patient-facing audio guides and illustrated booklets in Hindi and regional languages to support home-based independent practice following hospitalisation.

For nursing education, mindfulness-based intervention techniques and therapeutic breathing facilitation should be integrated into undergraduate and postgraduate nursing curricula as core competencies in oncology and palliative care nursing, moving beyond theoretical coverage to simulation-based skills practice. For healthcare policy, state cancer care authorities in Madhya Pradesh and the National Cancer Grid of India should formally recognise structured nurse-led non-pharmacological supportive interventions as integral components of comprehensive cancer care, with appropriate resourcing, training, and audit mechanisms. National palliative care guidelines for lung cancer should be revised to include structured breathing and mindfulness protocols as recommended non-pharmacological interventions for dyspnea and anxiety management.

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