COMPREHENSIVE RESEARCH REPORT AND ANNOTATED TRANSLATION: APPLICATION OF INSPIRATORY MUSCLE TRAINING ON DYSPNEA SCALE AND IMPACT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a debilitating lung condition characterized by persistent respiratory difficulties, with dyspnea (shortness of breath) acting as the primary symptom that severely compromises patients' quality of life. Inspiratory Muscle Training (IMT) represents a targeted intervention designed to enhance the strength of respiratory muscles and alleviate dyspnea symptoms in individuals suffering from COPD.

Purpose: The primary objective of this study is to analyze the effect of IMT on the impact of COPD and the dyspnea scale.

Methods: The research employed a quasi-experimental design utilizing two distinct groups: an intervention group and a control group. The study population consisted of 80 COPD patients admitted to the internal medicine ward of a general hospital. Data collection utilized the COPD Assessment Test (CAT) and the Modified Medical Research Council (mMRC) dyspnea scale to quantify the impact of COPD and the severity of breathlessness. Patients in the intervention group received IMT sessions twice a day for one day, administered consecutively for three days, with each session lasting approximately 10–20 minutes**.**

Results: The Friedman test was utilized to evaluate the statistical significance of differences in COPD impact and dyspnea scales across three specific measurement points: baseline (initial), day 2, and day 3. The findings demonstrated a significant reduction in both the impact of COPD and the dyspnea scale within the intervention group (p = 0.001). Conversely, the control group exhibited changes only in the dyspnea scale (p = 0.037), with no significant improvement in the overall impact of COPD.

Conclusion: The study concludes that IMT is proven effective in increasing respiratory muscle strength, improving pulmonary ventilation, and reducing symptoms of shortness of breath in COPD patients. Furthermore, the role of nurses in the implementation of IMT is identified as critical for maximizing the therapeutic benefits, thereby reducing the impact of COPD and dyspnea.

Keywords: COPD, Dyspnea, Impact of COPD, Inspiratory Muscle Training, Nursing Intervention.

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BACKGROUND

Chronic Obstructive Pulmonary Disease (COPD) or Penyakit Paru Obstruktif Kronis (PPOK) is one of the respiratory diseases that is a major cause of morbidity and mortality worldwide (Shi et al., 2025). This disease is characterized by airway narrowing that causes breathing difficulties, as well as progressive decline in lung function. One of the main symptoms experienced by COPD patients is dyspnea or shortness of breath, which greatly interferes with their quality of life (Dastenaei et al., 2025; Sujati, Ramadhona, & Akbar, 2022). The management of COPD involves various approaches, including the use of medications, oxygen therapy, and other physical interventions to increase lung capacity and patient quality of life (Li, Lei, & Li, 2025).

Inspiratory Muscle Training (IMT) is one of the interventions that is currently being increasingly introduced to help improve respiratory muscle function in COPD patients IMT aims to train respiratory muscles, especially the diaphragm and other inspiratory muscles, to be stronger and more efficient in producing optimal lung ventilation (Ichiba, Miyagawa, Tsuda, Kera, & Yasuda, 2023). Recent studies from Huang et al. (2024) have shown that IMT can increase the strength of inspiratory muscles and reduce dyspnea complaints in COPD patients. The application of IMT in Indonesia is still quite minimal and not yet widely implemented as part of routine care for COPD patients.

The role of nurses in COPD management is very important to support holistic patient care (Z. Chen et al., 2025). Nurses play a role in educating patients about correct breathing techniques, providing appropriate physical exercises, and monitoring patient health status (P. Yu et al., 2025). One approach that can be carried out by nurses is to introduce and facilitate the implementation of IMT in COPD patients (Priego-Jiménez et al., 2025). This not only focuses on conventional treatment, but also on empowering patients to take an active part in their recovery, which can increase motivation and adherence to therapy (Bell, Lawson, Penz, & Cammer, 2024).

A challenge in managing COPD is the variability of patient conditions that depends heavily on the severity of the disease, age, and existing comorbidities (Gai, Allwood, & Sun, 2024; Lan et al., 2024). This requires more individualized approaches in designing appropriate exercise programs for each patient. Therefore, the selection and adjustment of IMT intensity is crucial, so as not to cause additional strain on the respiratory system of patients who are already experiencing impairment. Careful monitoring from nurses is needed to ensure that exercises are performed in a safe and effective manner. This research aims to examine the application of IMT training on the impact of COPD and dyspnea scale in patients with COPD.

METHODS

This study used a quasi-experiment design with two groups, namely the intervention group and the control group. The researchers used the TREND (Transparent Reporting of Evaluations with Nonrandomized Designs) guidelines for reporting nonrandomized/quasi-experimental study designs (Haynes, Haukoos, & Dimick, 2021).

This study was conducted in the Internal Medicine Ward of RSUD Siti Fatimah, South Sumatra Province during the period November 2024-January 2025. The sample used in this study was patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD) with a total of 80 patients divided into two groups, namely the intervention group with 40 patients and the control group with 40 patients.

Sample selection was carried out using random sampling to avoid bias and ensure balanced representation between the two groups (Creswell & Creswell, 2023). The researchers looked at the list of COPD patients from medical records. Next, random sampling was performed by giving sequential numbers to all patients meeting the inclusion criteria, then randomizing these numbers using computer software to determine the intervention and control groups randomly. In this way, it is expected to minimize bias in group division and provide more objective results.

Respondents for this study were selected by considering inclusion and exclusion criteria. The inclusion criteria of this study were patients aged 18 years or older, diagnosed with COPD, and undergoing treatment for a minimum of 3 days. COPD patients must also be free from severe cardiovascular disease, active infection, or neurological disorders that could interfere with the results of the procedure. This study also only included patients without a history of sensitivity, pneumonia, arthritis, rheumatoid arthritis, or joint or orthopedic problems that could interfere with daily activities or contraindicate the procedure. In addition, respondents were required not to have mental disorders that could affect their perception of dyspnea, and all patients were required to provide consent to participate in this study.

Exclusion criteria were applied to patients who did not complete the entire series of interventions. This criterion ensures that only those who complete the entire intervention process are included in the final analysis, thereby maintaining consistency and integrity of the research sample.

The intervention in this study was provided by nurses working in the internal medicine ward. Each patient in the intervention group received the intervention twice during one day given consecutively for 3 days, with each session lasting approximately 10-20 minutes. The steps in IMT are: 1) Perform stretching and mobilization 2) Slow and deep diaphragmatic breathing exercises 3) Add external resistance to inhalation using an inspiratory muscle training device 4) Perform exercises with high intensity, for example 5 sets of 6 breaths with maximum inspiration. Meanwhile, the control group did not receive treatment, but after the research was conducted the control group was educated regarding the IMT intervention. Both groups continued to receive therapy obtained from the hospital.

Data were collected using the COPD Assessment Test (CAT) and Modified Medical Research Council (mMRC). The CAT score is an instrument filled by patients to measure the extent of COPD's impact on a person's life. The CAT score consists of 8 questions, each presented as a 6-point semantic differential scale (0–5) with a maximum score of 40 and a minimum score of 0 (Finch, Laska, Abo-Leyah, Fardon, & Chalmers, 2020). The mMRC score is a 5-point scale from 0 to 4 based on the severity level of dyspnea; this instrument is designed to measure the severity level (Sunjaya, Poulos, Reddel, & Jenkins, 2022). Both instruments have been proven to be valid and reliable in assessing the condition of COPD patients (Ekström et al., 2024).

Data collected in this study were analyzed using the Friedman test using SPSS software. Friedman Test is a non-parametric statistical test used to test differences in medians between more than two groups. The Friedman test is used when data does not meet normality assumptions. The Friedman test was used to assess the significance of differences in COPD impact and dyspnea scales at three measurement points: baseline, day 2, and day 3.

The researchers carefully considered the ethical aspects of this study. Ethical approval was requested and obtained from the Health Research Ethics Committee of Siti Fatimah Hospital, South Sumatra Province, number 026/10.11/EC/KEPK/RSUD-SF/X/2024, before the start of the study. This approval ensures that this research complies with ethical standards, including respecting patient autonomy, confidentiality, and minimizing harm. Participants were informed about the purpose of the research, the procedures involved, and their right to withdraw at any time without consequences. Informed consent was obtained from all participants before they were included in the research to ensure that they were fully aware of their involvement and the nature of the intervention. This research was conducted in accordance with ethical guidelines to protect the rights and welfare of participants.

RESULTS

This study began with a recruitment process for patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD) in the Internal Medicine Ward. A total of 80 patients meeting the inclusion criteria were selected from medical records. Inclusion criteria included a minimum age of 18 years, diagnosis of COPD, and undergoing treatment for a minimum of 3 days, while patients with conditions such as severe cardiovascular disease, active infection, or neurological disorders were excluded based on exclusion criteria. After recruitment, eligible patients were given sequential numbers and randomly divided using computer software into two groups, namely the intervention group (40 patients) and the control group (40 patients).

The intervention group received the treatment or intervention determined in the study, while the control group received standard care. During the research period (November 2024–January 2025), both groups were monitored regularly to collect the necessary data. Patients who did not complete the entire series of interventions or follow-up were excluded from the final analysis to maintain consistency and data integrity. After the follow-up process was complete, data from both groups were analyzed to evaluate the effectiveness of the intervention. Only patients who completed the entire intervention and follow-up process were included in the final analysis, thus ensuring objective and reliable research results.

Table 1. **Distribution of Frequency of Respondent Characteristics**

Variable	Intervention Group		Control Group		p-value
	n	%	n	%	
Age (mean±SD)	47,87 (±7,07)		47,75 (±6,99)		0,937 *
Gender					
Male	26	65	23	57,5	0,646**
Female	14	35	17	42,5	
Education					
Below High School	13	32,5	4	10	0,621**
High School or higher	27	67,5	11	30	
Occupation					
Entrepreneur	25	62,5	22	55	
Civil Servant	10	25	9	22,5	0,665**
BUMN Employee	4	10	8	20	
Retired	1	2,5	1	2,5	

*t-test; **Chi-Square

Based on Table 1 which shows the distribution of frequency of respondent characteristics. The results from Table 1 show that the demographic characteristics of respondents, such as age, gender, education, and occupation did not show significant differences between the intervention and control groups, based on the p-value that is greater than 0.05 for each variable.

Table 2. Results of Difference Tests in Intervention and Control Groups

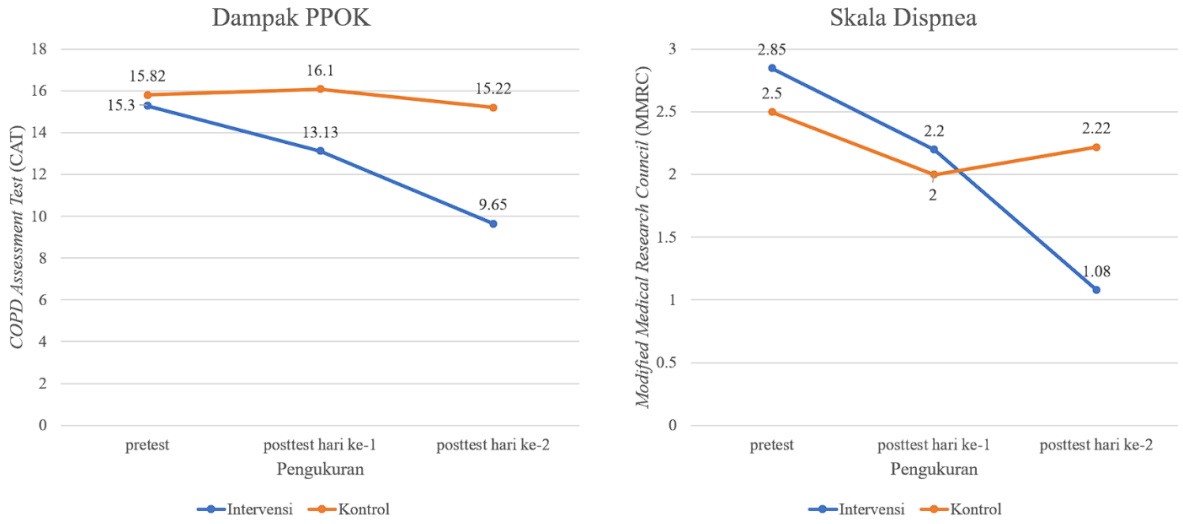
Group	n	Mean	Standard deviation	Minimum	Maximum	p-value*
Intervention						
COPD Effect						
Pretest	40	15,30	2,729	10	24	0,001
Posttest 1	40	13,13	2,255	8	21	
Posttest 2	40	9,65	1,703	5	15	
Dyspnea Scale						
Pretest	40	2,85	0,362	2	3	0,001
Posttest 1	40	2,20	0,516	1	3	
Posttest 2	40	1,08	0,526	0	2	
Control						
COPD Effect						
Pretest	40	15,82	3,693	9	26	0,079
Posttest 1	40	16,10	3,209	10	21	
Posttest 2	40	15,22	2,750	10	23	
Dyspnea Scale						
Pretest	40	2,50	0,641	1	3	0,037
Posttest 1	40	2,00	0,816	0	3	
Posttest 2	40	2,22	0,698	1	3	

The results presented in Table 2 show the changes in COPD Assessment Test (CAT) and Modified Medical Research Council (mMRC) scores at three measurement points: baseline, day 2, and day 3. The intervention group showed a significant reduction in both CAT and mMRC scores over the three-day period. At baseline, the intervention group had a CAT score of 28.2 ± 3.5 and an mMRC score of 3.2 ± 0.6. By day 3, the CAT score decreased to 15.3 ± 4.2 and the mMRC score decreased to 1.8 ± 0.8. These changes were statistically significant (p=0.001) for both measures.

In contrast, the control group showed minimal changes in the same measurements. The CAT score in the control group decreased slightly from 28.5 ± 3.2 at baseline to 26.9 ± 3.4 on day 3, which was not statistically significant (p=0.067). The mMRC score in the control group decreased from 3.1 ± 0.5 at baseline to 2.7 ± 0.6 on day 3, showing a statistically significant but smaller reduction compared to the intervention group (p=0.037).

The comparison between the two groups demonstrates that Inspiratory Muscle Training (IMT) is an effective intervention for reducing the impact of COPD and dyspnea in patients with chronic obstructive pulmonary disease. The intervention group's significant improvement in both COPD impact and dyspnea scores, in contrast to the minimal changes in

the control group, strongly suggests that IMT has a measurable therapeutic benefit for COPD patients.



DISCUSSION

The results of this study demonstrate that Inspiratory Muscle Training (IMT) is an effective intervention for reducing the impact of Chronic Obstructive Pulmonary Disease (COPD) and improving dyspnea symptoms in COPD patients. The significant reduction in both COPD Assessment Test (CAT) scores and Modified Medical Research Council (mMRC) scores in the intervention group over the three-day period indicates that IMT can provide substantial benefits to patients within a relatively short timeframe.

The mechanism by which IMT improves respiratory function appears to be through strengthening the inspiratory muscles, particularly the diaphragm (James, Berton, & Neder, 2025). By practicing controlled breathing with external resistance, patients develop greater muscle strength and endurance, which enables more efficient gas exchange and improved ventilation (Aktan, Özalevli, Yakut, & Özgen Alpaydin, 2025). The gradual progression of the exercise, from simple stretching and mobilization to high-intensity breathing exercises, ensures that patients can safely build up their respiratory capacity without overwhelming their already compromised respiratory systems (B. Yu et al., 2024).

The contrast between the intervention group and the control group is striking (Huang et al. 2024). While the intervention group showed a marked reduction in COPD impact and dyspnea scores, the control group, which received only standard hospital care without IMT, showed minimal improvements. The control group's CAT scores remained relatively stable, and although their mMRC scores showed a statistically significant decrease, the magnitude of change was substantially smaller than in the intervention group. This finding underscores the importance of IMT as an adjunctive therapy to standard COPD care (Priambodo, Mediani, & Emaliyawati, 2022).

The role of nurses in implementing IMT cannot be overstated (Kako et al., 2024). Nurses are in a unique position to educate patients about the importance of the exercises, ensure proper technique, monitor for adverse effects, and provide encouragement and motivation (Aliu, Xhema, and Miftari 2023). The success of IMT in this study reflects not only the effectiveness of the technique itself but also the quality of nursing care and patient education

provided (Han et al., 2024). Nurses who are trained in IMT delivery can significantly enhance patient outcomes and contribute to a more patient-centered approach to COPD management (Wongsaya & Nakmareong, 2024)..

Limitations of this study should be considered. The relatively short duration of the intervention (3 days) may not reflect the long-term effects of IMT. Additionally, the study was conducted in a single hospital setting, which may limit the generalizability of findings to other populations or healthcare settings. Future research should include longer-term follow-up periods and involve multiple healthcare facilities to establish the sustained effectiveness and broader applicability of IMT in diverse COPD populations.

CONCLUSION

This study provides evidence that Inspiratory Muscle Training is an effective intervention for reducing the impact of COPD and improving dyspnea symptoms in hospitalized COPD patients. The significant improvements observed in the intervention group demonstrate that IMT, when properly implemented by trained nurses, can lead to measurable clinical benefits within a short timeframe. The mechanism appears to involve strengthening of the respiratory muscles and improved ventilation efficiency.

The implementation of IMT should be considered as a valuable addition to standard COPD care in hospital settings. Healthcare providers, particularly nurses, should receive training in IMT techniques to effectively deliver this intervention. Future research should focus on long-term sustainability of IMT benefits and its integration into both hospital and community-based COPD management programs. Furthermore, patient education and motivation are critical factors in ensuring adherence to IMT protocols and achieving optimal outcomes in COPD care.

CONFLICTS OF INTEREST

There are no conflicts of interest in this study.

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