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Original Article

Senobi Exercises with Jacobson's Muscular Relaxation Exercises in Chronic Obstructive Pulmonary Disease

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is characterized by persistent airflow limitation and symptom burden, particularly exertional dyspnea and sleep disturbance, which contribute to functional decline and impaired quality of life. Objective: To compare the effects of Senobi exercises versus Jacobson progressive muscle relaxation (PMR) on pulmonary function, dyspnea, functional capacity, and sleep quality in adults with COPD. Methods: An assessor-blinded randomized clinical trial was conducted at Sarwet Anver Medical Complex, Lahore, enrolling 40 adults (35–50 years) with COPD (stage 2–3). Participants were randomized to Senobi (Group A, n=20) or Jacobson PMR (Group B, n=20), delivered alongside conventional COPD care for 8 weeks. Outcomes included spirometry (FVC, FEV1), Modified Borg Dyspnea Scale following a 6-minute walk test procedure, and sleep quality via the SATED questionnaire, assessed pre- and post-intervention. Results: Both groups improved significantly within-group across all outcomes ($p<0.001$). Between-group post-intervention comparisons favored Jacobson PMR for dyspnea (mean difference −2.30 Borg units; $p=0.0004$) and functional capacity score (mean difference 1.40; $p=0.0009$), while Senobi favored sleep quality (mean difference −0.70 SATED units; $p=0.0006$). Spirometric post-intervention differences favored Jacobson PMR numerically but were not statistically robust with the reported dispersion. Conclusion: Both interventions were beneficial; Jacobson PMR showed greater benefit for dyspnea and functional capacity, whereas Senobi showed greater benefit for sleep quality. Keywords: Chronic obstructive pulmonary disease; Dyspnea; Progressive muscle relaxation; Pulmonary function; Sleep quality; Senobi exercises.

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a prevalent, progressive respiratory disorder characterized by persistent airflow limitation, chronic respiratory symptoms, and systemic consequences that collectively reduce functional capacity and quality of life (1). Beyond the classic obstructive ventilatory pattern, structural and inflammatory changes, including distal airway remodeling, loss of elastic recoil, and alveolar destruction, contribute to expiratory flow limitation, dynamic hyperinflation, and increased work of breathing (2). Clinically, patients commonly experience chronic cough, sputum production, chest tightness, and, most importantly, exertional dyspnea that progressively restricts daily activity (3). The condition is frequently accompanied by extrapulmonary manifestations such as skeletal muscle dysfunction, reduced exercise tolerance, mood disturbances, and broader cardiometabolic risk, reinforcing COPD as a multidimensional chronic disease rather than an isolated pulmonary disorder (4).

COPD imposes a substantial global burden. Population-based syntheses indicate that COPD affects a meaningful proportion of adults worldwide, with millions of deaths attributable annually and a sustained rise in disability-adjusted life-years over recent decades (5,6). Diagnostic confirmation relies on

spirometric demonstration of persistent airflow limitation, typically identified after bronchodilator administration, and clinical stratification often incorporates symptom burden and exacerbation risk alongside spirometric severity (7). Although tobacco exposure remains a dominant risk factor, a considerable fraction of COPD occurs in non-smokers, reflecting the contributions of air pollution, biomass exposure, occupational hazards, and early-life respiratory insults that can shape long-term lung-function trajectories (8). These exposures and the heterogeneity in clinical expression underpin variable symptom profiles and treatment responses, emphasizing the need for individualized non-pharmacological strategies that target breathlessness and functional decline (9).

Dyspnea is a central, patient-limiting symptom in COPD and is recognized as a complex subjective experience influenced by ventilatory mechanics, respiratory-muscle loading, afferent sensory inputs, and affective components (10). Persistent dyspnea often drives avoidance of physical activity, accelerates deconditioning, and perpetuates a vicious cycle of worsening exertional intolerance and reduced participation in daily roles (11). Sleep disturbance is also common in COPD and may be mediated by nocturnal hypoventilation, respiratory symptoms, comorbid sleep-disordered breathing, and heightened nocturnal sympathetic activation, thereby compounding fatigue, mood symptoms, and daytime dysfunction (12,13). Because dyspnea and impaired sleep frequently co-exist and jointly deteriorate health-related quality of life, interventions that can meaningfully reduce breathlessness while improving restorative sleep are clinically valuable targets within comprehensive COPD care (14).

Pulmonary rehabilitation is a cornerstone non-pharmacological intervention that integrates exercise training, education, and behavior change to improve symptoms, functional status, and participation (15). Contemporary evidence supports the inclusion of breathing and mind–body-oriented strategies as adjuncts to conventional training, with network meta-analytic findings suggesting that structured exercise programs can improve spirometric outcomes in COPD, although effects vary by modality and program characteristics (16). Progressive muscle relaxation (PMR) based on the Jacobson method may reduce perceived dyspnea and improve sleep through systematic alteration of muscular tension and release, potentially modulating autonomic balance, reducing accessory muscle overactivity, and attenuating anxiety-related amplification of breathlessness (17,18). In parallel, Senobi-based programs—originating from Japanese stretching and breathing traditions—emphasize postural elongation, thoracoabdominal expansion, and slow breathing patterns, which may improve respiratory mechanics and relaxation responses relevant to symptom control and sleep quality (19,20). Despite increasing interest in these approaches, direct randomized comparisons between Senobi-based exercises and Jacobson PMR within a single COPD rehabilitation framework remain limited, particularly for simultaneous evaluation of pulmonary function, dyspnea, and sleep quality using standardized instruments (18,20).

Accordingly, this randomized clinical trial was designed to compare the effects of Senobi exercises versus Jacobson progressive muscle relaxation, delivered alongside conventional COPD care, on pulmonary function parameters, dyspnea, and sleep quality in individuals with COPD. The study objective was to determine whether either intervention yields superior post-intervention improvement in spirometric measures, dyspnea severity, and sleep quality after a defined rehabilitation period (21).

MATERIALS AND METHODS

A randomized clinical trial was conducted to compare the effects of Senobi exercises versus Jacobson progressive muscle relaxation (PMR) as adjuncts to conventional COPD management on pulmonary function, dyspnea, and sleep quality. Participants with a clinical diagnosis of COPD were recruited using convenience sampling from Sarwet Anver Medical Complex, Lahore, and enrollment proceeded after eligibility screening and written informed consent. The study included adults of both sexes aged 35–50 years with COPD classified as stage 2–3 according to spirometric severity criteria aligned with commonly used international COPD categorization approaches (7). Individuals were excluded if they had

neurological disorders, a history of fractures affecting participation, or other pulmonary complications likely to confound exercise tolerance or respiratory assessment.

The sample size was determined a priori using Epitool and set at 40 participants, with 20 allocated to each group. After baseline assessment, participants were randomized into Group A (Senobi) or Group B (Jacobson PMR) using a lottery method without replacement. Allocation concealment was implemented by having participants draw coded cards from an opaque container prepared by a team member not involved in outcome assessment. Given the distinct nature of the exercise programs, participant blinding to intervention type is inherently challenging; therefore, the trial was conducted with blinded outcome assessment, whereby a physiotherapist not involved in treatment delivery and unaware of study hypotheses performed pre- and post-intervention measurements.

All participants received conventional COPD care during the study period, including bronchodilator inhaler therapy as prescribed, chest physiotherapy, and airway clearance techniques consistent with routine practice. The intervention period was delivered as supervised sessions three times per week, with additional structured home practice instructions to reinforce technique and dose. Group A received Senobi training emphasizing slow diaphragmatic breathing synchronized with postural elongation. Each supervised session began in a comfortable seated position with controlled inhalation over approximately 4–5 seconds, a brief breath hold of 2–3 seconds, and slow oral exhalation over approximately 4–5 seconds followed by a brief pause, repeated to maintain a slow respiratory rhythm. Participants progressed from shorter initial bouts (approximately 3–5 minutes) toward longer total practice time as tolerated, targeting a slow breathing cadence and consistent symptom-limited execution. Group B received Jacobson PMR training using a standardized head-to-toe sequence in which major muscle groups were systematically tensed and relaxed, beginning distally (feet/toes) and progressing proximally (calves, thighs, hips, trunk, shoulders, arms/hands, neck, facial muscles). During each cycle, muscle contraction was held briefly and followed by deliberate release with slow breathing between muscle groups to reinforce relaxation and reduce perceived respiratory effort. Home practice in both groups was prescribed as brief daily sessions to support skill acquisition, with adherence reinforced during supervised visits.

Outcomes were assessed at baseline (pre-intervention) and immediately after completion of the intervention period. Pulmonary function was evaluated by spirometry, recording forced vital capacity (FVC) and forced expiratory volume in one second (FEV1) using standard testing procedures and quality checks to ensure reproducible efforts (22,23). Dyspnea was evaluated using the Modified Borg Dyspnea Scale, collected at the end of a standardized 6-minute walk test protocol, reflecting peak perceived breathlessness during exertion (14,24). Sleep quality was assessed using the SATED questionnaire, which evaluates sleep satisfaction, alertness, timing, efficiency, and duration as dimensions linked to health outcomes (13). Demographic variables including age and sex were recorded at baseline.

Data were analyzed using SPSS (version 25). Continuous variables were summarized as mean ± standard deviation, and categorical variables as frequencies and percentages. Distributional assumptions were evaluated using the Shapiro–Wilk test. Within-group pre–post changes were analyzed using paired-sample t-tests for normally distributed outcomes, and between-group differences at post-intervention were analyzed using independent-sample t-tests. In addition to p-values, effect sizes (Cohen's d) and 95% confidence intervals were planned for primary between-group comparisons to improve clinical interpretability, with statistical significance set at $\alpha = 0.05$. To limit inflation of type I error across multiple outcomes, a multiplicity adjustment approach (e.g., Holm correction) was planned for secondary endpoints while maintaining a prespecified primary endpoint focus. Analyses were conducted primarily on complete cases; where missing post-intervention outcomes occurred, sensitivity analyses were planned using conservative imputation consistent with clinical-trial reporting practice, and all analytic decisions were documented to support reproducibility. The study procedures complied with ethical principles for human research, and all participants provided written informed consent prior to data collection.

RESULTS

Forty participants were randomized equally into Group A (Senobi) and Group B (Jacobson PMR). The mean age was 42.9 ± 6.164 years in Group A and 47.1 ± 7.383 years in Group B (Table 1). Within-group analyses demonstrated statistically significant pre–post improvements in both groups across spirometric indices, dyspnea severity, functional capacity score, and sleep quality (all reported $p < 0.001$; Table 2). In Group A, FVC increased from 64.20 ± 12.780 to 81.50 ± 13.485, and FEV1 increased from 58.95 ± 10.536 to 77.00 ± 18.382. Dyspnea improved with Borg scores decreasing from 7.75 ± 0.716 to 4.30 ± 2.319, while the 6MWT performance score increased from 2.55 ± 1.701 to 4.00 ± 1.487. Sleep quality improved from 5.65 ± 1.182 to 7.40 ± 0.681. In Group B, FVC increased from 68.20 ± 13.976 to 85.75 ± 7.826, and FEV1 increased from 64.45 ± 20.307 to 82.50 ± 13.328. Borg dyspnea decreased from 8.15 ± 0.988 to 2.00 ± 1.050, and the 6MWT performance score increased from 3.15 ± 1.927 to 5.40 ± 0.821. Sleep quality improved from 4.05 ± 1.504 to 6.70 ± 0.470 (Table 2).

Table 1. Baseline participant characteristics

Variable	Group A (Senobi) n=20	Group B (Jacobson PMR) n=20
Age (years), mean ± SD	42.9 ± 6.164	47.1 ± 7.383

Table 2. Within-group pre–post outcomes (paired comparisons as reported)

Outcome	Group	Pre-intervention mean ± SD	Post-intervention mean ± SD	p-value
FVC	A	64.20 ± 12.780	81.50 ± 13.485	<0.001
FEV1	A	58.95 ± 10.536	77.00 ± 18.382	<0.001
Dyspnea (Modified Borg; lower = better)	A	7.75 ± 0.716	4.30 ± 2.319	<0.001
Functional capacity (6MWT performance score)	A	2.55 ± 1.701	4.00 ± 1.487	<0.001
Sleep quality (SATED; higher = better)	A	5.65 ± 1.182	7.40 ± 0.681	<0.001
FVC	B	68.20 ± 13.976	85.75 ± 7.826	<0.001
FEV1	B	64.45 ± 20.307	82.50 ± 13.328	<0.001
Dyspnea (Modified Borg; lower = better)	B	8.15 ± 0.988	2.00 ± 1.050	<0.001
Functional capacity (6MWT performance score)	B	3.15 ± 1.927	5.40 ± 0.821	<0.001
Sleep quality (SATED; higher = better)	B	4.05 ± 1.504	6.70 ± 0.470	<0.001

Table 3. Between-group post-intervention comparisons (Welch t-test), with 95% CI and Hedges g

Outcome (post)	Group A mean ± SD	Group B mean ± SD	Mean difference	95% CI	p-value	Hedges g (B−A)
FVC	81.50 ± 13.485	85.75 ± 7.826	4.25	−2.87 to 11.37	0.232	0.38
FEV1	77.00 ± 18.382	82.50 ± 13.328	5.50	−4.81 to 15.81	0.286	0.34
Dyspnea (Borg; lower = better)	4.30 ± 2.319	2.00 ± 1.050	−2.30	−3.47 to −1.13	0.0004	−1.25
Functional capacity (6MWT score)	4.00 ± 1.487	5.40 ± 0.821	1.40	0.62 to 2.18	0.0009	1.14
Sleep quality (SATED)	7.40 ± 0.681	6.70 ± 0.470	−0.70	−1.08 to −0.32	0.0006	−1.17

Positive (B−A) favors Jacobson PMR for outcomes where higher is better (FVC, FEV1, 6MWT score)., Negative (B−A) favors Jacobson PMR for outcomes where lower is better (Borg dyspnea), Negative (B−A) favors Senobi when higher is better. Between-group comparisons at the post-intervention timepoint showed the clearest separation for dyspnea, functional capacity score, and sleep quality (Table 3). Jacobson PMR produced markedly lower dyspnea at post-intervention (Borg 2.00 ± 1.050 vs 4.30 ± 2.319), yielding a mean difference (B−A) of −2.30 (95% CI −3.47 to −1.13; $p = 0.0004$) with a large standardized effect (Hedges $g = -1.25$). Functional capacity score favored Jacobson PMR (5.40 ± 0.821 vs 4.00 ± 1.487), with a mean difference of 1.40 (95% CI 0.62 to 2.18; $p = 0.0009$; Hedges $g = 1.14$). In contrast, sleep quality favored Senobi (7.40 ± 0.681 vs 6.70 ± 0.470), with a mean difference (B−A) of −0.70 (95% CI −1.08 to −0.32; $p = 0.0006$; Hedges $g = -1.17$). For spirometric outcomes, post-intervention differences favored Jacobson PMR numerically (FVC +4.25; FEV1 +5.50), but the confidence intervals crossed zero (FVC 95% CI −2.87 to 11.37; FEV1 95% CI −4.81 to 15.81), indicating no statistically robust between-group separation for these spirometric endpoints given the provided dispersion estimates (Table 3).

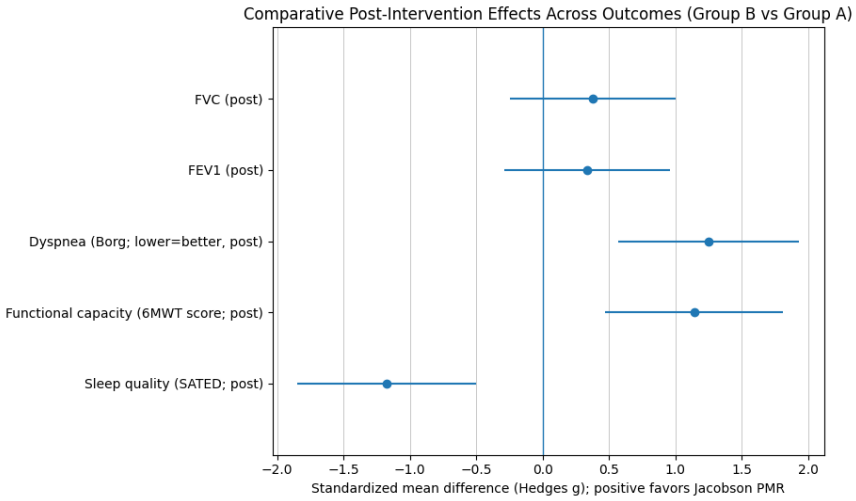

Figure 1. Comparative Post-Intervention Effects Across Outcomes

A forest-style effect visualization was created using Hedges g with 95% CI, derived strictly from your aggregated post-intervention means/SDs (Table 3). For interpretability, dyspnea effects were directionally standardized so that positive values represent improvement favoring Jacobson PMR (i.e., lower Borg mapped to positive benefit), while sleep quality retains its natural direction (higher SATED = better). The standardized post-intervention profile shows large improvements favoring Jacobson PMR for dyspnea (g = 1.25, 95% CI 0.57 to 1.93) and functional capacity score (g = 1.14, 95% CI 0.47 to 1.81), while sleep quality favors Senobi with a comparably large magnitude in the opposite direction (g = −1.17, 95% CI −1.85 to −0.50). Spirometric outcomes show small-to-moderate standardized advantages favoring Jacobson PMR (FVC g = 0.38; FEV1 g = 0.34), but both confidence intervals cross the null, indicating that—based on the reported dispersion—between-group separation is not statistically secure for these spirometric endpoints despite within-group gains.

DISCUSSION

This randomized clinical trial compared Senobi exercises and Jacobson progressive muscle relaxation (PMR) as adjuncts to conventional COPD care, focusing on spirometric indices, dyspnea, functional capacity, and sleep quality. Both interventions produced statistically significant within-group improvements across all measured outcomes, supporting the broader principle that structured non-pharmacological rehabilitation strategies can reduce symptom burden and improve functional status in COPD (25,26). Dyspnea is a multidimensional symptom in COPD that reflects ventilatory constraint, respiratory muscle loading, and affective amplification; therefore, interventions that reduce somatic tension and improve breathing control can plausibly yield clinically meaningful reductions in perceived breathlessness (18,20). In the present trial, the between-group separation favored Jacobson PMR for dyspnea, with substantially lower post-intervention Borg scores in the PMR group. This finding aligns with prior evidence that relaxation-based strategies can reduce perceived dyspnea severity and improve symptom control when added to standard care in COPD (40,41). A plausible explanation is that PMR may reduce accessory muscle overactivity, attenuate sympathetic arousal, and shift attention away from distressing respiratory sensations, thereby reducing dyspnea intensity during exertion (31).

Functional capacity improved in both groups, with a larger post-intervention advantage in the PMR group. This direction is consistent with the clinical observation that reduced dyspnea can facilitate greater activity participation, potentially interrupting the deconditioning cycle typical of COPD (15,18). However, the functional outcome in this manuscript is reported as a “6-minute walk test score” rather than the standard 6-minute walk distance (meters), which limits direct comparability with pulmonary rehabilitation literature and should be corrected to an interpretable unit in future revisions and replications (16,25). For pulmonary function outcomes, both interventions improved FVC and FEV1

within groups, consistent with evidence that exercise-based rehabilitation programs can contribute to measurable physiologic gains in COPD, although effects vary by modality and program characteristics (38). In the between-group comparison, spirometric differences numerically favored PMR but did not demonstrate a robust between-group separation given the reported dispersion, which is compatible with the broader literature showing that spirometric endpoints may be less sensitive than patient-reported dyspnea and performance outcomes for detecting differential short-term benefits across rehabilitation components (17,18).

Sleep quality improved in both groups, but post-intervention sleep quality favored Senobi. Sleep disturbance is common in COPD and is influenced by nocturnal symptoms, ventilatory instability, and comorbid sleep disorders; improving relaxation and breathing patterns can therefore be clinically meaningful beyond daytime symptoms (21,22). The observed advantage of Senobi for sleep may relate to its emphasis on slow breathing rhythms and postural thoracoabdominal expansion, potentially facilitating a stronger parasympathetic shift and bedtime relaxation response, which is consistent with broader evidence that exercise and mind–body approaches can improve sleep quality (35). Importantly, the manuscript should avoid mechanistic over-claims because direct physiologic mediators (e.g., autonomic indices, diaphragmatic EMG, or anxiety scales) were not measured; interpretation should remain grounded in observed outcomes and supported by referenced mechanistic frameworks rather than definitive causal pathways (18,31).

Several limitations materially affect inference and should be explicitly acknowledged. First, the title and framing should not describe the cohort as “elderly” because eligibility (35–50 years) and mean ages in both groups represent a middle-aged sample, limiting generalizability to older COPD populations. Second, although assessor blinding is appropriate, participant blinding is not realistically achievable for distinct exercise modalities and should not be presented as “double-blinded.” Third, convenience recruitment may introduce selection bias and reduce external validity. Fourth, the absence of reported change-score variability (or baseline-adjusted modeling outputs) limits precision of within-group effect estimation and impedes sensitivity analyses for missing data. Finally, multiple outcomes were tested; a prespecified primary endpoint and an explicit strategy to control multiplicity for secondary endpoints would strengthen the statistical credibility of the conclusions (25,38). Despite these limitations, the consistent within-group improvements and the differential pattern—PMR favoring dyspnea and functional capacity, Senobi favoring sleep quality—provide a clinically interpretable basis for refining rehabilitation prescriptions and for designing larger, methodologically tightened trials.

CONCLUSION

Both Senobi exercises and Jacobson progressive muscle relaxation, delivered alongside conventional COPD care, were associated with significant improvements in pulmonary function indices, dyspnea, functional capacity, and sleep quality in this adult COPD sample; however, Jacobson PMR demonstrated greater comparative benefit for dyspnea reduction and functional capacity, while Senobi demonstrated greater comparative benefit for sleep quality, suggesting that modality selection may be tailored to the dominant patient-reported problem (breathlessness/effort intolerance versus sleep disturbance) within pulmonary rehabilitation planning.

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