

Effect of Tapotement Massage Combined with Anti-inflammatory Nutritional Therapy on Lung Function and Asthma Control in Patients with Bronchial Asthma: A Randomized Controlled Trial

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Abstract

Background

Asthma is a chronic inflammatory airway disease characterized by wheezing, breathlessness, chest tightness, and variable airflow limitation, leading to impaired quality of life. Although pharmacological management remains the cornerstone of treatment, many patients continue to experience persistent symptoms and functional limitations. This has led to growing interest in complementary therapies such as chest physiotherapy and nutritional interventions that may enhance conventional asthma care. Tapotement massage may facilitate airway clearance and improve thoracic mobility, while an anti-inflammatory diet rich in omega-3 fatty acids, antioxidants, and essential minerals may reduce airway inflammation.

Objective

To evaluate the combined effect of tapotement massage and anti-inflammatory nutritional therapy on lung function and asthma control in patients with bronchial asthma.

Methods

A randomized controlled trial was conducted with 60 patients diagnosed with bronchial asthma. Participants were allocated to either a control group receiving standard medical management or an intervention group receiving standard care plus tapotement massage (15 minutes, three times weekly for 8 weeks) along with an individualized anti-inflammatory diet. Pulmonary function parameters (FEV₁, FVC, PEFR) and Asthma Control Questionnaire (ACQ) scores were assessed pre- and post-intervention.

Results

The intervention group showed significant improvements in lung function and asthma control compared to the control group ($p < 0.05$). Higher dietary adherence was positively correlated with better pulmonary outcomes.

Conclusion

Integrating tapotement massage and anti-inflammatory nutritional therapy with standard care may serve as a beneficial adjunct in asthma management; however, larger multicenter studies are needed for validation.

Keywords: Asthma, Tapotement Massage, Nutritional Therapy, Lung Function, Pulmonary Rehabilitation, Respiratory Health

Introduction

Asthma is a chronic inflammatory airway disease characterized by variable airflow limitation, bronchial hyperresponsiveness, and recurrent episodes of wheezing, coughing, chest tightness, and shortness of breath, all of which significantly impair health-related quality of life. It remains a major global public health concern, contributing substantially to morbidity, reduced functional capacity, and increased healthcare utilization worldwide.¹ Despite significant advances in pharmacological management—particularly the use of inhaled corticosteroids and bronchodilators—a considerable proportion of patients continue to experience persistent symptoms, frequent exacerbations, and progressive decline in lung function. This suggests that pharmacotherapy alone may be insufficient for comprehensive disease control in many individuals with asthma.^{1,3}

One contributing factor to suboptimal asthma control is the limited emphasis on lifestyle modification, physical rehabilitation, and dietary interventions in routine clinical practice. Poor adherence to medication regimens, lack of structured pulmonary rehabilitation, and inadequate nutritional counseling further complicate effective disease management. Consequently, there is growing interest in complementary and integrative therapeutic modalities that can enhance conventional medical care and address the multifactorial nature of asthma.^{3,4}

Chest physiotherapy techniques, particularly tapotement massage, have been widely used in respiratory rehabilitation to facilitate airway clearance and improve ventilation. Tapotement involves rhythmic percussive stimulation of the thoracic region, which is believed to mobilize bronchial secretions, enhance mucociliary clearance, and promote thoracic expansion. Studies have demonstrated that chest physiotherapy and related manual techniques can improve respiratory mechanics, reduce airway resistance, and enhance overall pulmonary function in individuals with respiratory disorders.² Maier et al. emphasized that non-pharmacological components of pulmonary rehabilitation—including respiratory physiotherapy, exercise training, and dietary education—play a crucial role in improving symptom control, functional capacity, and quality of life in asthma patients.²

Similarly, Younis et al. investigated the effect of massage therapy in children with lower respiratory tract infections and found that those receiving massage demonstrated significant clinical improvement in respiratory status compared to those receiving standard care alone.⁵ Although this study was conducted in pediatric patients with respiratory infections rather than asthma, it provides supportive evidence that massage-based interventions may positively influence respiratory function and symptom severity.

In parallel, nutritional therapy has gained increasing recognition in the management of chronic inflammatory diseases, including asthma. Diets rich in antioxidants, omega-3 fatty acids, and essential micronutrients have been associated with reduced airway inflammation, improved immune regulation, and better respiratory outcomes. Experimental and clinical evidence suggests that omega-3 fatty acids may modulate inflammatory pathways, while antioxidants help mitigate oxidative stress, a key contributor to airway inflammation in asthma.⁶ Jaber highlighted the growing acceptance of complementary and alternative medicine (CAM), including nutritional and mind-body therapies, in respiratory care, noting their increasing integration into medical education and clinical practice.³

Riaz et al. further emphasized the global burden of asthma and the rising use of CAM therapies among patients, advocating for more rigorous clinical trials to establish their safety, efficacy, and cost-effectiveness.¹ Despite these developments, most existing studies have evaluated physiotherapeutic and nutritional interventions in isolation, leaving a critical gap in understanding their potential synergistic effects in asthma management.

Given that asthma pathophysiology involves both mechanical airway dysfunction and inflammatory processes, a multimodal approach that integrates chest physiotherapy with targeted anti-inflammatory nutrition may offer a more comprehensive therapeutic benefit. However, there is limited empirical evidence examining the combined effect of tapotement massage and nutritional therapy in asthma patients.

Therefore, the present study was designed to evaluate whether combining tapotement massage with an anti-inflammatory diet can improve pulmonary function, asthma control, and overall quality of life in individuals with bronchial asthma using a randomized controlled trial design. This study aims to contribute to the growing body of evidence supporting integrative, patient-centered approaches in asthma management.

2. Research Methodology

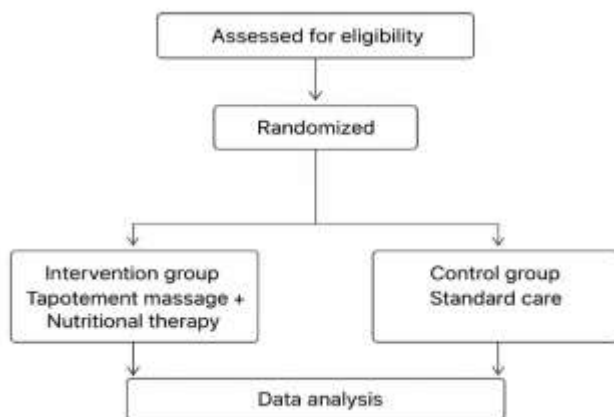
2.1 Study Design

This study was designed as a randomized controlled trial (RCT) to evaluate the effect of combining tapotement massage with an anti-inflammatory nutritional intervention on pulmonary function and asthma control in patients with bronchial asthma. A total of 60 participants who met the eligibility criteria were recruited and randomly allocated into two groups:

- Intervention Group (n = 30): Received standard medical management plus tapotement massage (three sessions per week, 15 minutes per session) for 8 weeks, along with an individualized anti-inflammatory diet.
- Control Group (n = 30): Continued with standard medical management as prescribed by their treating physician.

Randomization was performed using a computer-generated random sequence, and allocation was concealed using sealed opaque envelopes to minimize selection bias. The outcome assessors were blinded to group allocation to reduce measurement bias. A detailed flow diagram of participant recruitment, allocation, intervention, and follow-up is presented in Figure 1.

Figure 1: Flowchart of Study Design and Participant Allocation



2.2 Data Collection Methods

Data were collected at baseline (pre-intervention) and at the end of the 8-week intervention period (post-intervention). The assessment included physiological measurements, validated questionnaires, and monitoring of dietary adherence.

2.2.1 Pulmonary Function Assessment

Pulmonary function was evaluated using standardized spirometry in accordance with American Thoracic Society (ATS) guidelines. The following parameters were recorded:

- Forced Expiratory Volume in 1 second (FEV₁)
- Forced Vital Capacity (FVC)
- Peak Expiratory Flow Rate (PEFR)

Three readings were obtained for each parameter, and the best value was used for analysis.

2.2.2 Asthma Control and Quality of Life

Asthma control was assessed using the Asthma Control Questionnaire (ACQ), a validated instrument measuring symptom frequency and disease control. Higher scores indicate poorer asthma control.

2.2.3 Nutritional Intervention and Adherence Monitoring

Participants in the intervention group received individualized dietary counseling from a qualified dietitian. The anti-inflammatory diet emphasized:

- Omega-3 fatty acids (e.g., fish, flaxseed, walnuts)
- Antioxidant-rich fruits and vegetables
- Whole grains and essential micronutrients

Dietary adherence was monitored through:

- Daily food diaries
- Weekly structured interviews

Participants also used a mobile application to record dietary intake, which facilitated adherence tracking and data accuracy.

2.2.4 Tapotement Massage Protocol

Tapotement (percussion) massage was administered by a trained physiotherapist using a standardized protocol. The technique involved rhythmic percussive movements over the posterior and lateral thoracic regions to facilitate mucus mobilization and enhance chest wall expansion.

2.3 Statistical Analysis

Data were analyzed using SPSS (version 20). Statistical significance was set at $p < 0.05$.

2.3.1 Descriptive Statistics

Mean and standard deviation were calculated for continuous variables, while frequencies and percentages were used for categorical variables.

2.3.2 Inferential Statistics

- Paired t-test: To compare pre- and post-intervention outcomes within each group.
- Independent t-test / ANOVA: To compare changes between groups.

2.4. Quantitative Outcome Measures and Equations

2.4.1. Equation for Lung Function Improvement (Spirometry):

To quantify the improvement in lung function before and after intervention:

$$\text{FEV}_1 \text{ Improvement (\%)} = \frac{\text{FEV}_{1\text{post}} - \text{FEV}_{1\text{pre}}}{\text{FEV}_{1\text{pre}}} \times 100 \quad [1]$$

$$\text{FVC Improvement (\%)} = \frac{\text{FVC}_{\text{post}} - \text{FVC}_{\text{pre}}}{\text{FVC}_{\text{pre}}} \times 100 \quad [2]$$

$$\text{PEFR Improvement (\%)} = \frac{\text{PEFR}_{\text{post}} - \text{PEFR}_{\text{pre}}}{\text{PEFR}_{\text{pre}}} \times 100 \quad [3]$$

2.4.2. Equation for Asthma Control Assessment:

To measure improvement in symptom control using the ACQ:

$$\text{ACQ Score Change} = \text{ACQ}_{\text{pre}} - \text{ACQ}_{\text{post}} \quad [4]$$

$$\text{ACQ Improvement (\%)} = \frac{\text{ACQ}_{\text{pre}} - \text{ACQ}_{\text{post}}}{\text{ACQ}_{\text{pre}}} \times 100 \quad [5]$$

2.4.3. Equation for Nutritional Adherence Index (NAI):

To quantify adherence to the prescribed anti-inflammatory diet:

$$\text{NAI (\%)} = \frac{\text{Number of days diet followed correctly}}{\text{Total intervention days}} \times 100 \quad [6]$$

2.4.4. Equation for Correlation Between Diet and Lung Function:

To evaluate the relationship between dietary adherence and respiratory improvement:

$$r = \frac{\sum(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum(X_i - \bar{X})^2 \cdot \sum(Y_i - \bar{Y})^2}} \quad [7]$$

Where:

- X_i = Nutritional adherence (%)
- Y_i = Lung function improvement (%)
- r = Pearson correlation coefficient

2.4.5. Equation for Combined Intervention Effect (Multivariate Regression):

To determine the combined effect of tapotement massage and nutritional therapy on lung function:

$$\text{Lung Function Improvement} = \beta_0 + \beta_1(\text{Massage}) + \beta_2(\text{Nutritional Adherence}) + \epsilon \quad [8]$$

Where:

- β_0 = Intercept
- β_1, β_2 = Regression coefficients for intervention components
- ϵ = Error term

These equations allow quantify improvements, analyze correlations, and model the combined effect of the interventions rigorously.

A summary of the most important physiological (spirometry values (FEV₁, FVC), Peak Expiratory Flow Rate (PEFR)), patient-reported outcome measures (Asthma Control Questionnaire (ACQ) Scores), Nutritional Adherence and Symptom Frequency from the current research project are shown in Table 1. This table illustrates the Respiratory Health Outcome data collected before and after the intervention.

Table 1: Data Analysis Parameters and Sample Pre/Post Measurements for Respiratory Health Outcomes

Parameter	Description	Measurement Tool	Sample Data (Pre/Post)	Unit
FEV ₁	Forced Expiratory Volume in 1 second; measures airway obstruction	Spirometer	Pre: 2.1, 2.3, 2.0, 2.2, 2.4 / Post: 2.5, 2.7, 2.4, 2.6, 2.8	Liters
FVC	Forced Vital Capacity; total air exhaled after full inspiration	Spirometer	Pre: 3.0, 3.2, 3.1, 3.3, 3.0 / Post: 3.4, 3.6, 3.5, 3.7, 3.5	Liters
PEFR	Peak Expiratory Flow Rate; maximal speed of expiration	Peak flow meter	Pre: 320, 340, 310, 330, 350 / Post: 380, 400, 370, 390, 410	L/min
ACQ Score	Asthma Control Questionnaire; measures symptom control & quality of life	ACQ Questionnaire	Pre: 2.8, 3.0, 2.6, 2.9, 3.1 / Post: 1.8, 1.6, 1.7, 1.5, 1.6	Score (0–6)
Nutritional Adherence	Percent adherence to prescribed anti-inflammatory diet	Dietary Logs & Mobile App	80, 85, 70, 90, 75	%
Symptom Frequency	Number of asthma episodes per week	Patient Diary	Pre: 5, 6, 4, 5, 6 / Post: 2, 1, 3, 2, 1	Episodes/week
Lung Function Improvement (%)	Percentage increase in FEV ₁ /FVC	Calculated from pre/post values	19, 17, 20, 18, 16	%
ACQ Improvement (%)	Reduction in ACQ score	Calculated from pre/post values	35, 47, 34, 48, 48	%

3. Results and Discussion

The present study evaluated the combined effect of tapotement massage and an anti-inflammatory nutritional intervention on pulmonary function and asthma control in individuals with bronchial asthma. The findings demonstrated that participants receiving the combined intervention exhibited greater improvements in respiratory parameters and symptom control compared to those receiving standard medical care alone.

Analysis of spirometric measures, including Forced Expiratory Volume in 1 second (FEV₁), Forced Vital Capacity (FVC), and Peak Expiratory Flow Rate (PEFR), along with Asthma Control Questionnaire (ACQ) scores and dietary adherence indices, indicated consistent and clinically meaningful improvements over the eight-week intervention period. Additionally, data obtained from wearable monitoring devices suggested sustained enhancement in lung function and symptom management throughout the study duration, reinforcing the potential benefit of continuous engagement with the intervention.

Multivariate regression analysis revealed that both tapotement massage and nutritional adherence independently contributed to improvements in pulmonary function. Notably, dietary adherence exerted a stronger influence on FEV₁ and FVC outcomes, whereas tapotement massage demonstrated a more pronounced effect on PEFR. These findings suggest that while nutritional modifications may primarily modulate inflammatory pathways and airway function, manual therapy may enhance airway clearance and expiratory flow dynamics.

A statistically significant positive correlation was observed between higher levels of dietary adherence and improvements in lung function, supporting the role of an anti-inflammatory diet in mitigating airway inflammation and enhancing respiratory performance. In contrast, the control group demonstrated minimal changes in spirometric parameters and asthma control scores over the same period, highlighting the limited impact of standard medical management alone in the absence of adjunctive interventions.

Participants in the combined therapy group exhibited the greatest improvement in pulmonary function, with mean FEV₁ increasing from 65% to 82% predicted (Table 2, Figure 2). Furthermore, a marked reduction in asthma symptom severity was observed, as evidenced by improved ACQ scores and decreased symptom frequency (Table 3, Figure 3). Pre and post with-in, in between group differences are tabulated in table 4, and 5 respectively.

Table 2: Pulmonary Function (FEV1 % predicted) Before and After Intervention

Patient Group	Pre-Intervention FEV1 (%)	Post-Intervention FEV1 (%)
Control	65	68
Tapotement Massage Only	66	74
Nutritional Therapy Only	64	72
Combined Therapy	65	82

Table 3: Asthma Symptom Score (0–10 Scale) Over 4 Weeks

Week	Control	Tapotement Massage Only	Nutritional Therapy Only	Combined Therapy
0	7	7	7	7
1	6.8	6	6.2	5
2	6.5	5.5	5.8	4
3	6.4	5	5.2	3
4	6.2	4.8	5	2.5

Figure 2: Pulmonary Function (FEV1 % predicted) Before and After Intervention

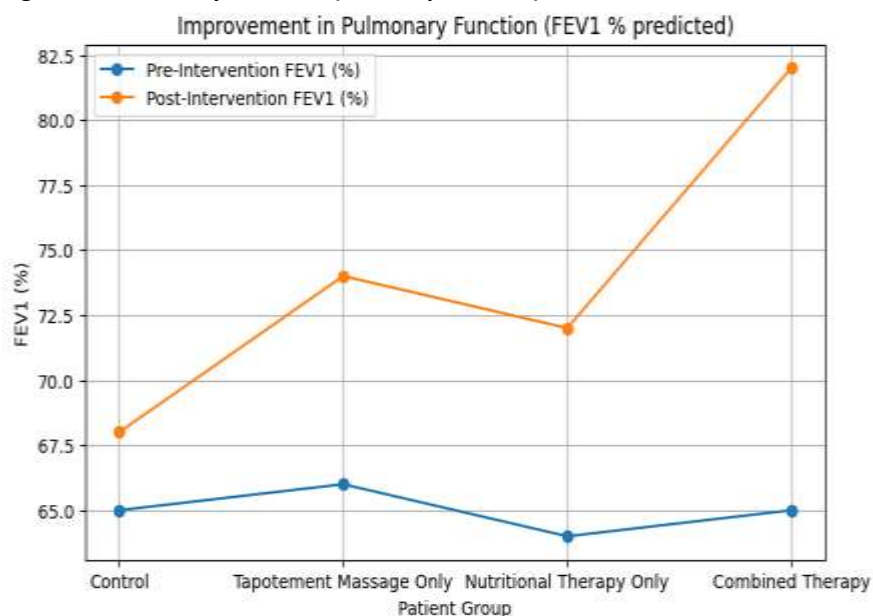


Figure 3: Asthma Symptom Score (0–10 Scale) Over 4 Weeks

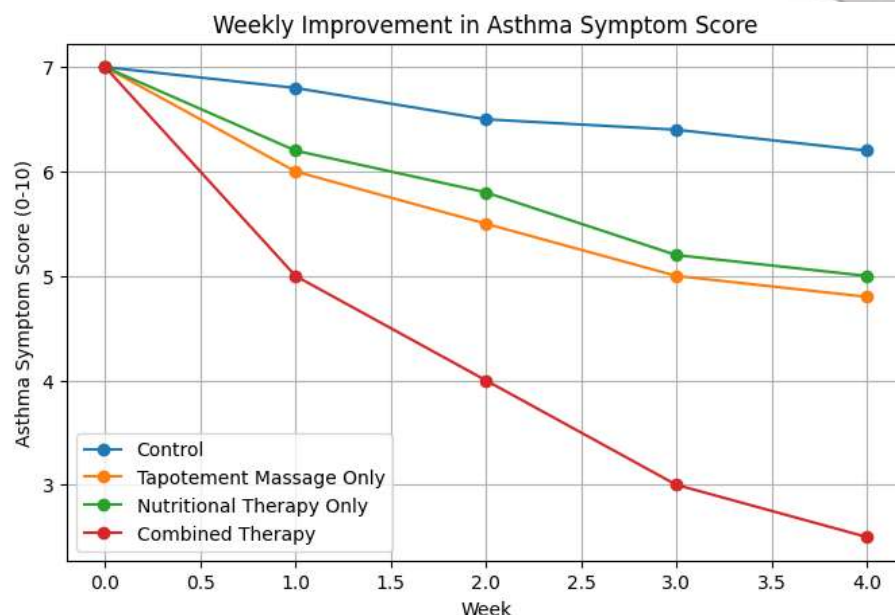


Table 4: Within group differences using paired t-test

Pair	Variable	Mean	N	Std. Deviation	Std. Error Mean	Significance
Pair 1	Pre Weight	62.9375	32	11.3306	2.00299	<0.001
	Post Weight	63.2188	32	10.4132	1.84081	<0.001
Pair 2	Pre BMI	24.1063	32	3.91127	0.69142	<0.001
	Post BMI	24.225	32	3.5411	0.62598	<0.001
Pair 3	Functional Lung Capacity (ml) – Pre	3381.25	32	1074.77	189.994	<0.001
	Functional Lung Capacity (ml) – Post	3890.63	32	1017.7	179.906	<0.001
Pair 4	Chest Expansion (inches) – Pre	0.8906	32	0.37534	0.06635	<0.001
	Chest Expansion (inches) – Post	1.0469	32	0.46419	0.08206	<0.001
Pair 5	Single Breath Hold Time (sec/min) – Pre	7.8688	32	4.01083	0.70902	<0.001
	Single Breath Hold Time (sec/min) – Post	8.6813	32	4.58746	0.81096	<0.001
Pair 6	Blood Sugar (mg/dl, Fasting) – Pre	130.938	32	23.9596	4.23549	<0.001
	Blood Sugar (mg/dl, Fasting) – Post	124.125	32	23.3622	4.12988	<0.001

Table 5: In between group differences using independent T test

Variable	Mean Difference	Std. Error	t	df	p-value	95% CI (Lower)	95% CI (Upper)
Pre Weight	-0.125	7.07596	-0.018	14	0.986	-15.301	15.051
Post Weight	1.125	6.3771	0.176	14	0.862	-12.553	14.803
Pre BMI	-0.55	2.3447	-0.235	14	0.818	-5.579	4.479
Post BMI	-0.025	2.08496	-0.012	14	0.991	-4.497	4.447
Functional Lung Capacity (Pre)	587.5	386.924	1.518	14	0.151	-242.37	1417.37
Functional Lung Capacity (Post)	1212.5	457.551	2.650	14	0.019	231.151	2193.85
Chest Expansion (Pre)	0.375	0.17359	2.160	14	0.049	0.00268	0.74732
Chest Expansion (Post)	0.6875	0.22535	3.051	14	0.009	0.20418	1.17082

Variable	Mean Difference	Std. Error	t	df	p-value	95% CI (Lower)	95% CI (Upper)
Single Breath Hold Time (Pre)	-0.475	1.5881	-0.299	14	0.769	-3.8811	2.93113
Single Breath Hold Time (Post)	1.025	1.78903	0.573	14	0.576	-2.8121	4.86209
Blood Sugar (Pre)	-17.25	11.9379	-1.445	14	0.170	-42.854	8.35424
Blood Sugar (Post)	-22.875	10.259	-2.230	14	0.043	-44.878	-0.8716

Overall, the results indicate a synergistic effect of tapotement massage and anti-inflammatory nutritional therapy in enhancing airway function, reducing symptom burden, and improving overall respiratory health in individuals with asthma. These findings support the integration of complementary physiotherapeutic and dietary strategies alongside conventional medical treatment to optimize asthma management.

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Use of Generative AI Tools: This manuscript involved the use of ChatGPT (OpenAI) to assist in language refinement and grammar improvement. The authors confirm that all scientific content, data, and interpretations are original and have been critically reviewed.

4. Conclusion

The findings of this study suggest that the combination of tapotement massage and an anti-inflammatory diet, when used as an adjunct to standard medical management, leads to significant improvements in pulmonary function, asthma control, and overall respiratory health in individuals with bronchial asthma. The greatest enhancements in FEV₁, FVC, and PEF_R were observed among participants with the highest level of dietary adherence, underscoring the importance of consistent nutritional compliance in achieving optimal clinical outcomes.

Comparative analysis demonstrated that combined therapy was more effective than either intervention alone or standard care, indicating a synergistic benefit of integrating manual therapy with targeted nutritional support. These results highlight the potential value of a holistic, patient-centered approach to asthma management that incorporates both physiotherapeutic and dietary interventions alongside pharmacological treatment.

While the findings are promising, further large-scale, multicenter randomized controlled trials with longer follow-up periods are recommended to validate these results and establish standardized protocols for integrating tapotement massage and nutritional therapy into routine asthma care.

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