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Effect of Naturopathy thorax massage on spirometric variables among healthy individuals

Nikita Sharma*, Nair Dhiren Ajit & Abhay M Shankaregowda
Maharishi Aurobindo Subharti College & Hospital of Naturopathy & Yogic Sciences, Swami Vivekanand Subharti University, Subhartipuram, NH-58, Delhi-Haridwar Bypass Road, Meerut 250 005, Uttar Pradesh, India
*E-mail: drnikitasharma46@gmail.com

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Massage therapy possesses a lengthy historical background and is extensively practiced on a global scale. Substantial research has illustrated that massage represents a secure, pragmatic, and therapeutic choice. Nevertheless, the precise physiological influence of massage on the thoracic region remains inadequately comprehended. The objective of this investigation was to evaluate the effects of a 35 min thorax massage for six successive days on spirometric variability in healthy volunteers. A total of 150 healthy adult participants, aged between 21 and 25 years and encompassing both genders, were enrolled in this examination. The intervention comprised a 35 min thoracic massage, while the control cohort partook in supine relaxation and deep inhalation for six consecutive days. The primary outcome parameters, encompassing Forced Expiratory Volume in the 1st second (FEV1), Forced Vital Capacity (FVC), and FEV1/FVC ratio (absolute value), were evaluated utilizing Clarity Spirotech (Model No CMSP-01) on the 0th and 6th days of the intervention, with subsequent follow-up assessments on the 12th and 24th days. The investigation encompassed 150 healthy individuals. In contrast to the control set, the intervention group displayed noteworthy overall enhancements in FVC (p value 0.0001), FEV (p value 0.0001), and FEV1/FVC (p value 0.0001) on the 0th, 6th, 12th, and 24th days. This research deduces that a 35 min thorax massage over six successive days amplifies spirometric parameters in healthy volunteers. Nonetheless, further large-scale randomized controlled trials are essential to validate these findings across diverse respiratory disorders.

Keywords: Lung function, Manipulative therapy, Massage therapy, Naturopathy, Spirometry, Thorax massage

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Naturopathy and Yoga encompass primary medical care that integrates traditional healing methods with contemporary knowledge and research. These practices adhere to a distinctive set of principles that prioritize disease prevention, acknowledge the body's inherent ability to heal, and promote personal responsibility in achieving optimal health[1]. The principal naturopathy treatments commonly employed include dietary and fasting therapy, mud therapy, hydrotherapy, manipulative or massage therapy, acupressure, acupuncture, chromotherapy, magneto therapy, and yoga therapy[2]. Massage therapy encompasses a broad spectrum of therapeutic procedures, such as friction, stroking, tapping, and kneading of muscles and soft tissues, which can range from vigorous to gentle, and deep to superficial[3,4].

Prior research indicates that full-body massage therapy can have a positive impact on both psychological and physical well-being[5,6], including reducing anxiety[7-9], alleviating depression[10,11], managing pain[12-15,] mitigating stress[16-18], and enhancing quality of life[19-21] and overall wellness. Moreover, it has been found to enhance various respiratory health indicators, such as average oxygen saturation levels in premature infants, positive airway pressure, decreased heart rate, breathing rate, systolic and diastolic blood pressure, and forced expiratory flow in the first second (FEV1) and FEV1/FVC ratio[21]. Nonetheless, to date, no research has investigated the effects of naturopathy-based thoracic massage techniques on respiratory function.

Methodology

Recruitment & follow-up of participants

Figure 1 illustrates the progression of the participants throughout the course of the trial. A total of 200 individuals were initially evaluated, and after obtaining institutional ethical approval, 150 of them satisfied the necessary inclusion and exclusion criteria. Out of the 50 individuals who were excluded, 20 were

*Corresponding author

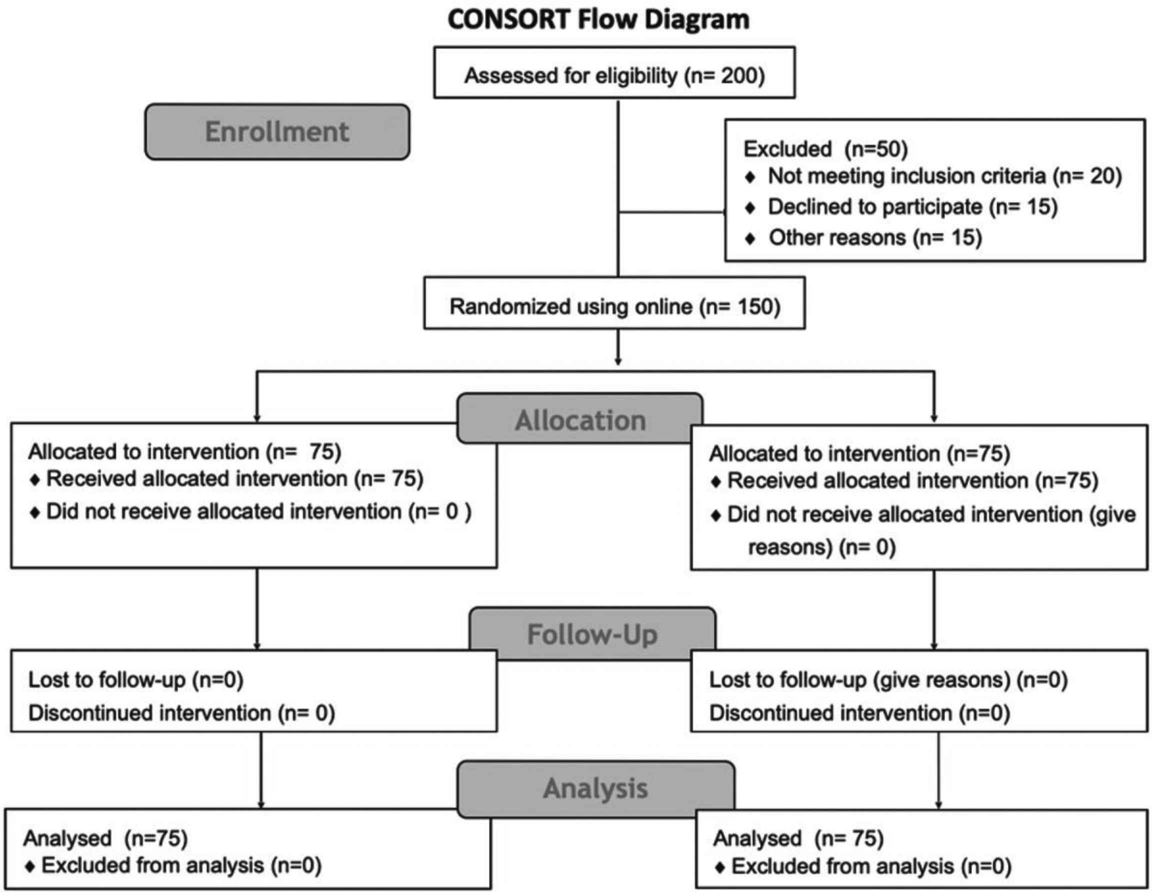

Fig. 1 — Flowchart of participants through trial

disqualified due to pre-existing medical conditions, 15 declined to participate in the trial, and 15 were unable to allocate the necessary time for their involvement.

Subsequently, the remaining 150 participants were randomly allocated to either the control or intervention groups, and a baseline analysis was performed to initiate the intervention among them.

Setting

Maharishi Aurobindo Subharti College & Hospital of Naturopathy & Yogic Sciences, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India.

Informed consent

After detailing the study's duration, nature, and protocol in both written and verbal form, informed consent was gained.

Baseline characteristics

The randomization method was carried out using an online randomizer that could be accessed at https://www.randomizer.org. It is significant to notice that both groups showed similar characteristics, including certain preliminary measurements. Table 1 provides a brief summary of the essential characteristics of the study participants at the baseline.

Table 1 — Demographic Table describing age and gender distribution

	Case	Control
No of patients (N)	75	75
Avg age	23.64±2.1	23.57±2.1
Gender (M:F)	31:44	43:32
Gender-Male %	31 (41.33%)	43 (57.33%)
Female %	44 (58.67%)	32 (42.67%)

Subjects

150 individuals who were in good health and satisfied the criteria for inclusion in this randomized controlled trial were arbitrarily allocated to either the intervention or control groups using an online tool called randomiser (www.randomiser.org).

Inclusion

- Both male & female participants
- Participants without any previous exposure to massage therapy were included.
- Willing to participate

Exclusion

- Subjects with acute infections
- Skin allergy or disease
- Smokers
- Alcoholic
- Recently underwent surgery or hospitalisations
- Diagnosed with any respiratory disease

Materials and Methods

Before the intervention, participants were instructed to refrain from consuming meals and caffeine or wait for a minimum of 4 h after eating in order to facilitate complete movement of the diaphragm and minimize any discomfort. The participants were positioned in a supine posture on a massage table measuring 73 inches in length and 30 inches in width, ensuring comfort by flexing the hips. Lukewarm sesame oil was applied to the chest region, and the subsequent procedures were executed in a sequential manner. Initially, the participants were directed to attain a state of relaxation by taking a few deep breaths. The participant's arms should be in a relaxed state, maintaining a distance from the sides to allow for the elongation of the pectoralis muscle. The operator was positioned facing the participant’s feet to facilitate effective manual manipulation. Movements were initiated from the sternum and directed laterally toward the axilla, encompassing the region from the clavicle to the inferior borders of the last ribs. Centripetal friction was applied using the thumbs and palms, aligning with the venous blood flow to promote circulatory return.

To stimulate glandular activity and achieve targeted mechanical effects, the skin was rhythmically grasped and compressed between both hands in an alternating pattern. Care was taken throughout to avoid excessive pressure and prevent bruising. This was followed by an additional round of centripetal friction to reinforce the circulatory response. Subsequently, palmer kneading was performed using the full surface of the operator’s palms. This technique aimed to enhance mechanical stimulation of the underlying tissues. Finally, percussion techniques were applied, involving controlled, rhythmical blows delivered through flexion and extension of the wrist joints. These percussive movements were intended to increase tissue elasticity and stimulate neuromuscular responses across various modes.

- Tapping – beating with finger tips
- Hacking – Using a relaxed but slightly spaced ulnar border of the hand, the technique produces controlled vibratory stimulation.
- Spatting – palmar surface with rigidly extended fingers is employed to induce hyperthermic effects.
- Beating – movement performed using loose fist where dorsal or palmar surface of the hand facing body region which has excitatory effect which gives rise to vasodilation.
- Clapping- movement in which the palmar surface of the hand is shaped to entrap air while coming in contact with the body surface producing a loud sound.

The massage was completed by the stroking of thorax and the entire procedure was done for 35 min (Table 2)[22].

Outcomes

The dataset of the case and control groups encompasses the baseline measurements as well as the post and two follow-up evaluations of FVC, FEV1, and FEV1/FVC ratios for a total of 150 individuals. Additionally, two post-week follow-ups were conducted. In order to assess the normality of the data, the Kolmogorov-Smirnov tests were employed, indicating that the data is homogeneous. For the within-group analysis, paired sample t-tests were utilized, while for the between-group analysis, independent sample t-tests were applied to analyze the data across different evaluation times. The baseline characteristics of the study population (demographic profile, including age and gender) are summarized in Table 1.

A comparison of baseline or pre respiratory function between the intervention and control groups is shown in Table 3. Following six sessions of

Table 2 — Movement employed during intervention in order

Movement in Order	Duration
Centripetal friction	5 min
Fulling or superficial kneading	5 min
Centripetal friction	5 min
Palmer kneading	5 min
Percussion inclusive of tapping, hacking, spatting, beating, clapping	5 min
Assistive respiration	5 min
Resistive respiration	5 min

Table 3 — Pre respiratory function comparison in between intervention and control group at baseline

	Case	Control	P - value
FVC	2.5±0.54 (1.6-3.47)	2.5±0.55 (1.6-3.8)	0.2
FEV1	2.5±0.54 (1.48-3.43)	2.5±0.54 (1.6-3.47)	0.4
FEV1/FVC	95.9±2.2 (91.01-99.47)	96±2.2 (91.01-99.47)	0.5

thorax massage, a significant improvement in FVC was observed. Furthermore, during the first and second follow-ups, only FEV1 exhibited a highly significant change.

Assessment

The evaluation was conducted on the 1st day, the 6th day, and follow up assessments were performed on the 12th and 24th day of the intervention.

Spirometry

Spirometry tests were conducted utilizing the Clarity Spirotech apparatus, specifically the CMSP-01 model. Each participant was administered the FVC maneuver while maintaining a stationary seated position and securing their nostrils with a nose clip. Prior to the commencement of the tests, a thorough explanation and demonstration were provided, elucidating the proper execution of the FVC maneuver, which encompassed a deep inhalation, a forceful and complete expiration lasting six seconds, and subsequent inhalation until reaching the initial starting point. In order to fulfill the requirements for the conclusion of the testing (EOT), all participants were allotted a maximum of six attempts and a five-minute period of rest. Each subject successfully completed a minimum of three trials that adhered to the EOT criteria, with the most favorable result among those three being selected for the final analysis and interpretation. The subsequent parameters of the spirometer, namely Forced Vital Capacity (FVC), Forced Expired Volume in 1 second (FEV1), and the ratio of FEV1 to FVC (FEV1/FVC), were quantified. The testing procedures were executed by a certified pulmonology technician who maintained no involvement in the research study.

Statistical analysis

The SPSS software (version 16.0) was utilized to execute all of the analyses in a blinded manner. The data at baseline and on the post- or sixth day were summarized by employing the mean and standard deviation. The Kolmogorov-Smirnov test was employed to ascertain whether the data distribution adhered to a normal distribution. For each group, the treatment impact was compared to the baseline on day six, and this was evaluated via a paired t-test. The discrepancy in effect between the intervention and control groups was assessed through the use of an independent t-test. The significance level was set as p=0.05.

Results

The case and control group dataset has pre and post data values for the FVC, FEV1 and FEV1/FVC of 75 patients taken on 0th, 6th day along with 12th day & 24th day follow-up. The datasets are organized and separated into Pre-Post dataset names, to assess the data normalization test and data analysis. Kolmogorov-Smirnov Test (p>0.05) found non-significant for each variable. A paired sample t-test was used for within-group analysis, while an independent t-test was applied for between-group comparisons. A p-value of <0.05 was considered statistically significant.

Values are expressed as Mean ± SD (Min-Max). ** is significant o-values i.e,* < 0.05.

The examination of individual spirometry parameters in participants from the case and control cohorts was carried out. This involved the assessment of pulmonary function through Spirometry. More specifically, the evaluation included the measurement of FEV1 (forced expiratory volume in one second), which signifies the volume exhaled within the initial second following maximal inhalation, and is a fundamental parameter for appraising the mechanical attributes of the lungs. Furthermore, the FVC (forced vital capacity) was gauged, indicating the volume of air forcefully exhaled commencing from the peak of inhalation, and is typically diminished in various respiratory ailments. By computing the FEV1/FVC ratio, it becomes possible to categorize the pattern as obstructive, restrictive, or normal, thereby yielding valuable insights into the respiratory well-being of the individual.

The initial data demonstrates uniformity in both the groups prior to any interventions. Subsequent data post-intervention discloses noteworthy FVC values in the inter-group comparison on the 6th day (Table 4). Analysis of the data between the groups exhibited a substantial enhancement in FEV1 on the 6th and 12th days or during subsequent assessments. The first follow-up on the 12th day and the second on the 24th

Table 4 — Post respiratory function comparison in between intervention and control group at 6th day

	Case	Control	P - value
FVC	2.5±0.54 (1.62-3.49)	2.5±0.55 (1.6-3.8)	0.001*
FEV1	2.5±0.54 (1.62-3.5)	2.5±0.54 (1.62-3.5)	0.3
FEV1/FVC	96.3±2.2 (91.67-99.51)	96.3±2.2 (91.67-99.51)	0.5

day showed a significant improvement in FEV1. (Table 5,6) A comprehensive examination of the data via ANOVA revealed significant alterations in both the groups, with particularly notable changes observed in the intervention group across all three spirometry parameters. The control group displayed an escalating trend in FVC (2.6±0.55), FEV1 (2.6±0.54), and FEV1/FVC (97±2.2) values from the baseline values of 2.5±0.54, 2.5±0.54, and 95.9±2.2, respectively, with p-values of 0.04, 0.0001, and 0.0001, respectively. (Table 7)

Conversely, in the case group (Thorax Massage), the initial FVC (2.5±0.54), FEV1 (2.5±0.54), and FEV1/FVC (95.9±2.2) values exhibited significant enhancement by the 24th day to 2.6±0.55, 2.8±0.55, and 97±2.2, respectively, with a p-value of 0.0001 in all the three parameters of spirometry. (Table 6,7)

Adverse events

No adverse reactions observed & reported according to the intervention group.

Discussion

This experimental study was done to evaluate the differences in the respiratory health status of healthy volunteers after 6 sessions of thorax massage. To our knowledge this study is the first of its kind that has explored the lung function changes by naturopathy thorax massage among healthy volunteers. Our findings show that there is significant improvement in the spirometry parameters after taking thorax massage among male and female participants. This may be due to the following mechanisms as depicted in Figure 2.

The therapeutic properties of sesame oil, derived from the perennial herb plant *Sesamum indicum* L. in the *Pedaliaceae* family, have been widely recognized[23]. This edible oil is commonly used in the Mediterranean region, India, Nepal, and various parts of Asia to enhance the preparation of cuisine. The chemical composition of sesame oil primarily consists of eicosanoic, linoleic, linolenic, oleic, palmitic, palmitoleic, and stearic acids, as well as lignans and antioxidants such as α-tocopherol[24,25]. These constituents contribute significantly to the medicinal properties of sesame oil. It has been proposed that the high consumption of omega-3 and omega-6 fatty acids in the diet of Eskimos, which are abundantly found in sesame oil, may explain their low incidence of lung ailments. These fatty acids have been shown to inhibit the production of bronchoconstriction leukotrienes by diverting the synthesis of eicosanoids from the arachidonic acid pathway. Animal experiments have demonstrated that supplementation with eicosapentaenoic acid or γ-linolenic acid can reduce the effects of thromboxane and pulmonary resistance in mice exposed to endotoxins. Moreover, small-scale human studies have indicated that eicosapentaenoic acid supplementation can lead to the incorporation of eicosapentaenoic acids into phospholipids and reduce neutrophil leukotriene production. Therefore, it is plausible that these fatty acids possess preventive properties against lung illnesses. However, studies investigating the respiratory outcomes of human intervention have yielded conflicting results, suggesting a potential distinction based on the duration of usage[26]. Furthermore, sesame oil has been found to be a favorable choice for infant massage, as it has been reported to improve blood flow and promote post-massage sleep in infants. Agarwal *et al.*[26] concluded that sesame oil massage is a superior option for

Table 5 — Comparison of spirometric variables between intervention and control group at 12th day

	Case	Control	P - value
FVC	2.6±0.54 (1.66-3.56)	2.6±0.55 (1.63-3.47)	0.4
FEV1	2.7±0.55 (1.78-3.85)	2.6±0.53 (1.66-3.56)	0.07*
FEV1/FVC	96.6±2.2 (91.92-99.68)	96.6±2.2 (91.62-99.68)	0.5

Table 6 — Comparison of spirometric variables between intervention and control group at 24th day

	Case	Control	P - value
FVC	2.6±0.55 (1.69-3.59)	2.6±0.55 (1.6-3.81)	0.3
FEV1	2.8±0.55 (1.92-3.93)	2.6±0.54 (1.69-3.59)	0.007*
FEV1/FVC	97±2.2 (92.32-99.96)	97±2.2 (92.32-99.96)	0.5

Table 7 — Overall comparison of spirometric variables between intervention and control group at 0th, 6th, 12th, 24th day

	Case (N=75)					Control (N=75)				
	0th day	6th	12th day	24th day	P value	0th day	6th	12th day	24th day	P value
FVC	2.5±0.54	2.5±0.54	2.6±0.54	2.6±0.55	0.0001*	2.5±0.55	2.5±0.55	2.6±0.55	2.6±0.55	0.04
FEV1	2.5±0.54	2.5±0.54	2.7±0.55	2.8±0.55	0.0001*	2.5±0.54	2.5±0.54	2.6±0.53	2.6±0.54	0.0001*
FEV1/FVC	95.9±2.2	96.3±2.2	96.6±2.2	97±2.2	0.0001*	96±2.2	96.3±2.2	96.6±2.2	97±2.2	0.0001*

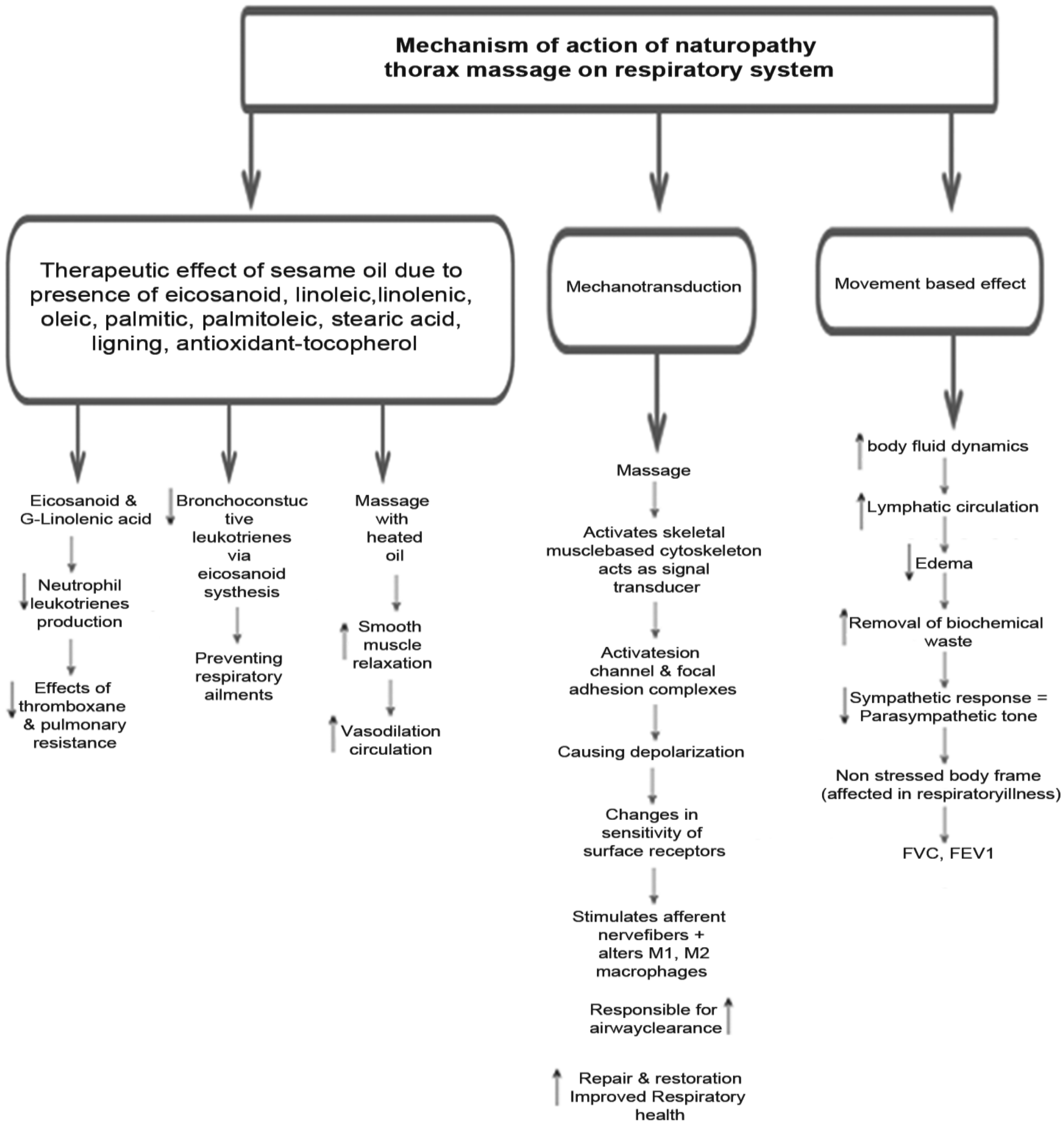

Fig. 2 — Possible mechanism of action for naturopathy thorax massage

newborns. While therapeutic compounds derived from natural sources may pose unexpected side effects, such as allergic reactions, the external application of sesame oil has been deemed safe and well-tolerated. In this trial, participants who received thorax massage with sesame oil did not experience any notable adverse effects. To ensure the safety, feasibility, and long-term usage of sesame oil, it is imperative to conduct extensive research in this field.

Heart Rate Variability (HRV), levels of serum cortisol and norepinephrine, as well as Sympathetic Skin Response (SSR) suggestive of parasympathetic dominance, all experience a decrease as a result of heat-assisted massage therapy[27,28]. The effects of similar manipulation treatment on the thorax involve an increase in blood flow, a reduction in pain perception, and/or changes in tissue[29]. The therapy stimulates autonomic activity, leading to vasodilation, relaxation of smooth muscles, and an increase in blood flow[30]. The application of manual therapy to the thoracic region can potentially regulate the autonomic nerve supply to the respiratory muscles[31]. A number of studies have shown that improving mobility of the thoracic joints temporarily enhances lung function in healthy individuals[32,33].

In naturopathy, thorax massage is performed in a way that is quite similar to the procedures of manual lymphatic drainage, which are commonly used by medical professionals and allied health care providers for various illnesses[34]. The rationale behind these manipulations is based on several suggestions: they enhance the dynamics of body fluids, facilitating the reduction of edema; they stimulate the lymphatic system by increasing lymph circulation; they expedite the removal of biochemical waste from body tissues; and they decrease sympathetic nervous system responses while increasing parasympathetic nervous tone, resulting in a non-stressed state of the body-frame that is primarily affected in respiratory conditions[35]. Furthermore, studies on infants have demonstrated that massage improves Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second (FEV1) by increasing the tonicity of the airways and reducing their sensitivity[36].

The process of mechanotransduction involves the conversion of an external mechanical deformation of tissue into a chemical signal or subsequent cellular signalling cascade. This mechanism serves as a mediator of signals within and between cells, leading to changes in protein expression. In skeletal muscles, mechano sensitization is brought about by the presence of stretch-activated ion channels and focal adhesion complexes, resulting in depolarization and alterations in the sensitivity of surface receptors to their substrates[37]. Moreover, mechanotransduction also plays a role in immunomodulation, particularly in macrophages and neutrophils, with a specific focus on respiratory health. However, research has primarily concentrated on macrophage-based mechanisms instead of neutrophils due to limitations such as respiratory bursts and edema. A study conducted by Segar *et al*.[38] suggests that massage therapy influences the behavior of M1 and M2 macrophages, as well as afferent nerve fibers, creating an environment conducive to repair and regeneration for accelerated recovery. Additionally, macrophages play a critical role in maintaining airway function by eliminating inhaled particles, cellular debris, and infectious agents through the induction of innate and acquired immunity. They are also involved in signal transduction, which is vital for respiratory health. Earlier investigations on the efficacy of massage therapy have yielded highly inconsistent and inconclusive results due to a lack of randomized control trials[37].

Conclusion

The research demonstrates that following a six-day period of thorax massage, significant alterations in lung volumes were observed. Considering that these findings can be utilized as a safe and beneficial treatment for various respiratory ailments, the modifications endured for a duration of two weeks.

The study has following limitations:

1. The sample size is relatively smaller. Hence, generalising the study outcome to a larger population would not be definitely conclusive.
2. Other variables such as body temperature, respiratory rate, heart rate variations have not been included in the study
3. A key limitation is that the study involved only healthy volunteers due to the COVID 19 pandemic, which may limit the generalizability of the results to clinical populations with underlying health conditions. The physiological responses in healthy individuals may not accurately reflect those in patients for whom the intervention is ultimately intended.

Directions for future research

1. Further clinical trials with larger sample size including respiratory disease subjects can be done
2. Implementations of the therapy can be compared with postural drainage, lymphatic drainage practices for further clinical interpretations.
3. Different types of oil can be compared
4. Recent research in massage has revealed that current practice is not fully explicit about what occurs in a massage. Not all articles mention strokes, stroke speed, pressure, stroke length, and body area applicable. The proposed specification includes stroke types, rhythm/rate, stroke frequency/speed, stroke number, pressure/depth, sequence/mix, direction of stroke, stroke length, body area applicable, massage purpose, body areas, frequency of massage, number of massages, duration per massage, location, qualifications/experience, and style of massage. The patient's age, gender, occupation/former occupation, and clinical condition/health status are also considered. A standardised vocabulary for pressure, such as light/gentle, moderate, firm/strong/deep, and heavy/rough, could be a useful first step in standardizing this mercurial measure.

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Conflict of Interest

No conflict of interest.

Ethical Approval

The University Ethics Committee (Medical) with reference number SMC/UECM/2021/270/155 has approved the study.

Author Contribution

NS, AMS, and NDA collaboratively conceptualized the study. The study design was formulated by NS and NDA. Data collection was exclusively conducted by NS, with data analysis performed jointly by NS and NDA. NS took the lead on manuscript drafting, while critical review and editing were undertaken by AMS and NDA. The study was supervised by AMS and NDA. Funding acquisition was secured by AMS. All authors have reviewed and approved the final manuscript.

Data Availability

The data supporting the findings of this study are available within the manuscript and also can be obtained from the corresponding author upon reasonable request.

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