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RESEARCH ARTICLE

Lung-specific yoga mudras on respiratory function in asthma patients

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ABSTRACT

Background: Asthma is increasingly prevalent worldwide and still could not be effectively controlled with drug therapy alone. Non-pharmacological interventions such as yoga and pranayama were tried with promising results. Mudras are part of yoga tradition and it is said that specific hand postures stimulate cortical areas regulating autonomic nervous system (ANS). The present study aims to find out the role of lung-specific mudras alone in improving respiratory function by modulating the ANS. **Aims and Objectives:** The aims of this study were as follows: (1) To measure the effect of lung-specific yoga mudras on peak expiratory flow rate (PEFR), breath-holding time (BHT), Snider's test (ST), expiratory blast test (EBT), and respiratory endurance test (RET) in the study group after 6 weeks of mudra practice. (2) To measure and compare the PERR, BHT, ST, EBT, and RET values of control group with that of the study group after 6 weeks of mudra practice. **Materials and Methods:** This study was carried out on 50 stable asthma patients in the age group of 20–50 years who were randomly divided into control (n = 25) and study group (n = 25). The study group underwent mudra practice everyday for 30 min and 5 days a week for 6 weeks. Respiratory efficiency tests were measured before and after 6 weeks using peak flow meter and mercury sphygmomanometer. The tests include PEFR, BHT, ST, EBT, and RET.
Results: Statistically significant improvement (<0.001) was observed for all the parameters in the study group when compared with the control group. **Conclusion:** Lung-specific mudras improved the respiratory efficiency in asthmatic patients after 6 weeks of mudra practice.

KEY WORDS: Lung Mudras; Respiration; Asthmatics

INTRODUCTION

The overall prevalence of asthma in India is 2.05% in adults above 15 years.[1] Drug treatments may be useful in the early course of disease, but morbidity and mortality persist. One of 250 deaths is due to asthma worldwide. Hence, alternative non-pharmacological interventions such as yogic pranayama techniques and meditation are tried to prevent and treat asthma along with chemotherapy.[2] These techniques were shown to improve muscular efficiency and respiratory endurance and reduce wheezing episodes.

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Asthma is a chronic inflammatory disorder of the airways involving mast cells, eosinophils, T-lymphocytes, macrophages, neutrophils, and epithelial cells and is associated with bronchial hyperresponsiveness to various stimuli resulting in variable airflow obstruction.[3] It is characterized by recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning.

Autonomic nervous system (ANS) regulates the bronchial smooth muscle tone, bronchial secretions, and permeability.

Asthma is associated with ANS imbalance and characterized by increased bronchial sensitivity to cholinergic constrictors and decreased sensitivity to sympathetic dilators (increased α and decreased β receptor activity).[4] ANS contributes to asthma by acting not only on bronchial musculature but also on bronchial secretions, endothelial permeability, inflammatory mediator release, and pulmonary blood vessels tone. Genetic determinants as well as environmental factors play a role in asthma. Chronic inflammation obstructs the airways by accumulation of secretion, thickening of epithelial basement membrane, and contraction of bronchial smooth muscles. The inflammation results in high concentrations of interleukin 6, tumor necrosis factor alpha, and C-reactive protein in the blood plasma. To combat the excessive parasympathetic activity, there is increased release of Neuropeptide Y (NPY) from sympathetic nerves which, in turn, inhibit the release of acetylcholine. However, in asthmatic patients, NPY nerves are reduced.[5] These evidences suggest that asthma is characterized by abnormalities of both the components of ANS.

The most common precipitating factors for asthma include exercise, cold weather, exposure to air borne allergens, viral infections, and stress. Stress alters the responsiveness of the ANS and hypothalamo–pituitary–adrenal axis, thereby influencing immune system.[6] Stress by increasing the release of pro-inflammatory cytokines precipitates asthma exacerbations. Recent theory suggests that bronchial constriction is due to combination of vagal input plus inflammation.[7]

Respiratory efficiency tests employed in this study are simple bedside tests which help to assess mainly expiratory function of lungs. Peak expiratory flow rate (PEFR) is the maximum expiratory rate in liters/minute with which air is expelled with maximum force after a maximal inspiration. This test is generally used to assess larger airway obstruction and the normal value is 350–600L/m. The best measure for assessing airway obstruction is forced expiratory volume in 1 second (FEV1) which measures both larger and smaller airway obstruction. However, studies had reported that PEFR value correlates well with FEV1.[8] Furthermore, when an asthma attack resolves, larger airway obstruction reverses first than the smaller airway obstruction. Hence, peak flow meter, a tool for ongoing monitoring, is used to measure PEFR, as it is simple and reproducible. Breath-holding time (BHT) is the time taken by an individual to hold his breath as long as he can. The normal duration is around 45–60 s and duration depends on chemical and non-chemical stimuli. It is a measure for assessing the strength of the respiratory muscles and endurance of dyspnea. It could be positively correlated with FEV1 and forced vital capacity in evaluating obstructive diseases.[9]

Mudras were a part of yogic literature along with asanas and breathing exercises. Mudras involve body as a whole, or eyes, tongue, and hands specifically. Hasta mudras indicate delightful hand postures. They were a symbol of communication/expression in dance as well as in religion. The pressure exerted by the interplay of fingers stimulates the peripheral nerve ending which, in turn, sends signals to the central nervous system to bring about the specific response, depending on the type of mudra performed.[10] Few previous studies had depicted the importance of mudras in improving cardiovascular and neurological function.[11,12]

Literature says that lung-specific mudras could improve respiratory efficiency by causing bronchodilatation and reducing mucous congestion.[10] As there was no scientific evidence for this so far, the present study was done to find out the efficacy of yoga mudras in improving the respiratory function in asthma patients.

Aims and Objectives

The aims of this study were as follows:

1. To study the effect of lung-specific yoga mudras on respiratory efficiency in asthma patients.
2. To measure the effect of specific yoga mudras on PEFR, BHT, Snider's test (ST), expiratory blast test (EBT), and respiratory endurance test (RET) in the study group after 6 weeks of mudra practice
3. To measure and compare the PEFR, BHT, ST, EBT, and RET values of control group with that of the study group after 6 weeks of mudra practice.

MATERIALS AND METHODS

The present interventional study was done in the department of physiology of a private medical college and hospital, Madurai, between July 2018 and September 2018 at 4.00 pm everyday, 5 days a week for 6 weeks after obtaining institutional ethical clearance. Stable asthma patients of both the genders, between the age groups of 20 and 50 years, weight and height matched were enrolled for the study. Patients attending outpatient department in July 2018 and hospital workers in the medical college campus who were known asthmatics with disease duration of more than 1 year but not on routine drug treatment were included in the study after obtaining informed consent. Fifty asthma patients were chosen by simple random sampling from the list of all eligible subjects.

The patients were randomly assigned to control group ($n = 25$) and study group ($n = 25$) using a randomization sequence generated in Microsoft Excel. Asthmatics were selected based on adult asthma questionnaire, hospital records and only patients with intermittent and mild persistent asthma were included in the study[5] (WHO global initiative for asthma guidelines 2006).

Patients with acute asthmatic exacerbations and not willing to participate were excluded from the study. Subjects with other

types of lung diseases, mudra trained individuals, smokers, subjects with skeletomuscular disorders, subjects suffering from cardiac diseases, and on medication were also excluded from the study.

The subjects were instructed to refrain from caffeine, nicotine, and alcohol. Subjects on loose clothing were instructed to relax for 10 min initially in the sitting posture on ground except for linga mudra. Then, they were taught to perform all hand mudras by a qualified yoga instructor, along with smooth and deep breathing for 30 min a day.A common instruction was given to not to move their hands and put extra pressure on fingertips while doing hasta mudras.

The following were the mudras practiced in order, using both the hands:[10]

- Atmanjali mudra – Join the palms together in Namaste position (5 min)
- Bronchial mudra – Place the little finger at the base of the thumb, the ring finger on the upper thumb joint, and the middle finger on the pad of the thumb. Extend the index finger (5 min)
- Asthma mudra – Press the fingernails of both the middle fingers with other fingers extended (5 min)
- Bhramara mudra – Place the index finger on the base of the thumb. Place tip of your thumb on the side of your middle fingernail. Extend your ring and little finger (7 min)
- Linga mudra – Place both palms together and clasp your fingers. One thumb should remain upright; encircle it with the thumb and index finger of your other hand (8 min). Mudra was practiced in standing up position coordinating inhalation and exhalation.

Data Collection Method and Tools

The study was explained clearly to the participants and voluntary consent was obtained. Baseline data on all participants were collected using structured questionnaire. On day 1, between 10 am and 12 pm after recording vitals, all the respiratory efficiency tests were done for the control group and the study group. Then, the study group (n = 25) alone was taught yoga mudras by a certified yoga instructor for 30 min. All these yoga mudras were then practiced everyday in the evening under the supervision of the yoga instructor along with slow breathing (8 breaths/min). Values were collected again after 6 weeks of yoga mudra training. At the end of the 6th week, all were instructed to assemble in the department and the parameters were once again measured. The control group too assembled everyday in the department but took rest in the sitting posture, while they were instructed to concentrate on breathing (8 breaths/min).

Respiratory efficiency tests include BHT, EBT, ST, RET, and PEFR. PEFR was measured with the help of mini-Wrights peak flow meter (Ishneel Healthcare Private Limited) and EBT, RET with sphygmomanometer (Diamond agencies). All the parameters were measured in the following method:[13]

BHT

The subject was asked to sit quietly for a few minutes breathing normally. Ask the subject to pinch his nostrils with the thumb and index finger and to hold the breath after a normal inspiration and start the stopwatch. The time duration for which the subject was able to hold the breath was noted. Three such observations at an interval of 5 min were recorded. Similarly, record the BHTs after quiet expiration, deep inspiration, and deep expiration.

EBT

BP apparatus is required for this test. The rubber tube leading from the mercury reservoir to the cuff is disconnected. The subject was asked to take a deep inspiration and blow into the tube to raise the mercury column to the highest level possible. A normal subject can raise the mercury column to 55–100 mmHg or more during a single forceful expiration.

ST

A normal adult should be able to blow out a burning match stick or candle held at a distance of 30 cm in front of his face, with a single forceful expiration.

RET

The subject was instructed to take a deep breath, close his nostrils, and blow into the rubber tubing to raise the mercury column to 40 mmHg level in the manometer. He was instructed to maintain the mercury level at 40 mmHg as long as possible. Normal person can hold it at the same level for 40–70 s or more.

PEFR

The subject was instructed to take a deep breath and then to blow hard into the mouthpiece of the flow meter forcefully with his nostrils closed.

RESULTS

Statistics

The data were entered into MS Excel and analyzed using SPSS v16.0. The readings of PEFR, BHT, EBT, and RET were analyzed using one-way Wilcoxon signed-rank test and ST using McNemar test before and after 6 weeks of mudra practice. $P < 0.05$ will be the cut off to determine statistical significance.

Table 1 shows no statistically significant difference between the pre- and post-intervention values in the control group.

According to Table 2, a statistically significant difference exists between the pre- and post-values for all the parameters.

Table 3 shows a statistically significant difference between the control and the study group for all the respiratory parameters.

According to Tables 4 and 5, no statistically significant difference was observed in the control as well as in the study group

DISCUSSION

In the study group, according to Table 2, there was a significant improvement in all the respiratory parameters after 6 weeks of mudra practice (<0.001). No significant difference was observed in the control group for all the parameters [Table 1]. Table 3 shows no significant difference between the study and the control group. As increase in PEFR from the mean pre-value of 158 L/min to post-value of 240 L/min indicates that decrease in bronchoconstriction had happened after 6 weeks mudra practice, though the mean values were still <350 L/min [Table 2]. An increase in the duration of BHT shows the decreased response of respiratory centers to CO_2. An increase in BH allows air to move fast behind the secretions and also reduces respiratory rate (reduces dyspnea) by desensitizing CO_2 response.[14] The EBT values had increased from 32.52 mmHg to 56.80 mmHg which shows that the strength of the respiratory muscles had improved significantly to promote a strong expiratory effort [Table 2]. The patient's ability to hold the mercury column in sphygmomanometer at 40 mmHg also had increased dramatically from 8.05 s to 28.60 s in RET after 6 weeks, indicating the decrease in bronchial smooth muscle tone and improved respiratory muscle efficiency [Table 2].

Area for hand movements has a larger representation in the contralateral cerebral cortex. Pressing two palms together in Namaste position during Atmanjali mudra stimulates nerve endings in both the palms which have abundant sensory receptors. Pressure in both the palms will stimulate opposite cerebral hemispheres. Equivocal stimulation of both the cerebral hemispheres balances the activity of sympathetic and parasympathetic components of the ANS as the left hemisphere predominantly controls parasympathetic function and the right hemisphere sympathetic function. Hence, the different finger movements depending on the type of mudra performed bring the particular response. In the present study, the decrease in bronchoconstriction and inflammation could be due to lung-specific hand mudras which would have modulated the autonomic function. The connection between asthma and emotion was recorded in few functional magnetic resonance imaging studies. Along with increased inflammatory signals in the lung and airways with respect to asthma-specific stimuli, not only there is increase in inflammatory mediators but also there is activation of emotional area of the brain, i.e. anterior insular cortex.[5] As ½ h of mudra practice regularly calms down the individual, this relaxation could have reduced the stress, thereby reducing airway inflammation and improving asthma. Slow and deep breathing exercises were known to influence the autonomic activity.[15,16] As breathing is also regulated during mudra practice, this also could have contributed to modulation of ANS. This is supported by the fact that there is a decrease in heart rate, systolic blood pressure, diastolic blood pressure, and blood viscosity in a previous study after 15 min of mudra practice.[12] In the present study, mudra practice was carried over for a period of 6 weeks as well as for a minimum duration of 30 min, as in a previous study using electrophotonic imaging, a statistically significant change in the Electro photonoic imaging (EPI) parameter was observed only after practicing

Table 1: Comparison of pre- and post-intervention (after 6 weeks) values in the control group

Parameters	Duration	Mean	*n*	Standard deviation	Standard error mean	*P*
Pair 1 (PEFR)	Pre-value	202.40	25	71.664	14.333	0.100
	After 6 weeks	196.80	25	72.095	14.419	
Pair 2 (BHT-QI)	Pre-value	19.36	25	9.322	1.864	0.638
	After 6 weeks	19.84	25	8.260	1.652	
Pair 3 (BHT-QE)	Pre-value	14.76	25	6.851	1.370	0.618
	After 6 weeks	15.24	25	6.833	1.367	
Pair 4 (DI)	Pre-value	30.36	25	18.708	3.742	0.908
	After 6 weeks	30.60	25	14.329	2.866	
Pair 5 (BHT-DE)	Pre-value	17.04	25	5.070	1.014	0.696
	After 6 weeks	17.40	25	6.671	1.334	
Pair 6 (EBT)	Pre-value	37.76	25	16.179	3.236	0.717
	After 6 weeks	37.36	25	15.903	3.181	
Pair 7 (RET)	Pre-value	9.96	25	9.235	1.847	0.854
	After 6 weeks	9.76	25	7.524	1.505	

PEFR: Peak expiratory flow rate in L/min, BHT: Breath-holding time in seconds, EBT: Expiratory blast test in mmHg, RET: Respiratory endurance test in seconds

Table 2: Comparison of pre- and post-intervention (after 6 weeks) values in the study group

Parameters	Duration	Mean	*n*	Standard deviation	Standard error mean	*P*
Pair 1 (PEFR)	Pre-value	158.00	25	60.415	12.083	0.000
	After 6 weeks	240.40	25	72.599	14.520	
Pair 2 (BHT-QI)	Pre-value	14.34	25	8.315	1.663	0.000
	After 6 weeks	30.96	25	9.039	1.808	
Pair 3 (BHT-QE)	Pre-value	13.77	25	7.620	1.524	0.000
	After 6 weeks	27.52	25	8.598	1.720	
Pair 4 (DI)	Pre-value	15.39	25	8.663	1.733	0.000
	After 6 weeks	39.40	25	7.555	1.511	
Pair 5 (BHT-DE)	Pre-value	14.16	25	7.776	1.555	0.000
	After 6 weeks	32.24	25	8.378	1.676	
Pair 6 (EBT)	Pre-value	32.52	25	17.328	3.466	0.000
	After 6 weeks	56.80	25	13.304	2.661	
Pair 7 (RET)	Pre-value	8.05	25	8.354	1.671	0.000
	After 6 weeks	28.60	25	11.339	2.268	

PEFR: Peak expiratory flow rate in L/min, BHT: Breath-holding time in seconds, EBT: Expiratory blast test in mmHg, RET: Respiratory endurance test in seconds

Table 3: Comparison of values between the control and study group

Group statistics

Parameters	Control	*n*	Mean	Standard deviation	Standard error mean	*P*
PEFR 6 weeks	1	25	−5.6000	16.35033	3.27007	<0.001
	2	25	82.4000	61.93276	12.38655	
BHT-QI 6 weeks	1	25	0.4800	5.03422	1.00684	<0.001
	2	25	16.6200	7.52950	1.50590	
BHT-QE 6 weeks	1	25	0.4800	4.75324	0.95065	<0.001
	2	25	13.7468	8.59725	1.71945	
BHT-DI 6 weeks	1	25	0.2400	10.23181	2.04636	<0.001
	2	25	24.0100	8.46699	1.69340	
BHT-DE 6 weeks	1	25	0.3600	4.55412	0.91082	<0.001
	2	25	18.0800	8.23569	1.64714	
EBT 6 weeks	1	25	−0.4000	5.44671	1.08934	<0.001
	2	25	24.2800	10.48618	2.09724	
RET 6 weeks	1	25	−0.2000	5.36190	1.07238	<0.001
	2	25	20.5500	9.54921	1.90984	

PEFR: Peak expiratory flow rate in L/min, BHT: Breath-holding time in seconds, EBT: Expiratory blast test in mmHg, RET: Respiratory endurance test in seconds

mudras for more than 20 min.[17] In a 6-month duration study on 50 middle-aged women who practiced mudras, maximum changes were observed in autonomic variables and breathe rate. There was an increase in skin resistance and decrease in stress parameters.[18] Circadian rhythm exists for bronchial muscle tone. Hence, PEFR values vary significantly both in normal and asthmatic individuals due to biological rhythm.[19] To eliminate bias, all the tests were performed only between 10 am and 12 pm everyday. Asthma severity is directly related to autonomic dysfunction even when the patient is not in a period of exacerbation. Hence, the patients chosen for this study were not under acute exacerbation and not on routine drug therapy.[20]

Strength

This study is the first of its kind to measure the airway changes in asthma patients using mudras alone. The cooperation was very good from the patient's side, as many showed interest in learning theses simple techniques eagerly which were easy to perform.

Limitation

PEFR and other respiratory parameters could have been measured using computerized spirometer and a larger sample size could be used. The specific effect of each lung-specific mudra on respiratory function could have been noted.

Table 4: Snider's test value after 6 weeks in the control group

Test		Not able		Able	
		Count (no)	Row *n* (%)	Count	Row *n* (%)
Snider pre	Not able	15	93.8	1	6.2
	Able	1	14.3	6	85.7

Table 5: Snider's test values after 6 weeks in the study group

Test		Not able		Able	
		Count	Row *n* (%)	Count	Row *n* (%)
Snider pre	Not able	9	40.9	13	59.1
	Able	0	0.0	3	100.0

CONCLUSION

Lung-specific hasta mudras significantly increased all the parameters of respiratory efficiency after 6 weeks of mudra practice. No significant change was observed in the control group in all the parameters after 6 weeks. A significant difference existed between the control and study group. This simple, cost-effective, non-pharmacological technique if practiced regularly could improve lung function and reduce the need for drug dosage.

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