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A CASE SERIES

Role of *Nadi Shodhana Pranayama* in Lung Function Improvement

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ABSTRACT

Background: Alternate nostril breathing, also known as *Nadi Shodhana Pranayama*, is a traditional yogic breathing method that improves respiratory functioning and balances energy. Although Pranayama has been shown to offer potential therapeutic advantages in several studies, there is little study on how it affects healthy people. The effects of *Nadi Shodhana Pranayama* on pulmonary functions in healthy volunteers are amplified in this case series.

Objectives: Using metrics such as oxygen saturation (SpO_2) level in healthy individuals, forced expiratory volume in 1 s (FEV1), forced vital capacity (FVC), and FEV1/FVC to evaluate the impact of *Nadi Shodhana Pranayama* on pulmonary functions.

Materials and Methods: A total of 20 healthy volunteers were instructed to practice *Nadi Shodhana Pranayama* 30 times daily over 45 days. Spirometry was used to measure pulmonary function both before and after the operation. Subjective sensations with breathing and general sensations were also recorded.

Results: Following the intervention, all individuals' pulmonary function improved. Significant increases in FVC, FEV1, and SpO_2 levels suggested greater air flow, increased oxygen absorption, improved lung capacity, and a more effective respiratory system.

Conclusion: *Nadi Shodhana Pranayama* appears to significantly improve pulmonary function in healthy volunteers, according to the findings. It has the potential to improve health and well-being if it is incorporated into a daily routine. Although the results are encouraging, it is recommended that large-scale studies and randomized controlled trials be conducted to investigate its potential long-term benefits in a variety of populations.

1. INTRODUCTION

The therapeutic value of classical yoga techniques such as *Nadi Shodhan Pranayama* (alternate nostril breathing) is drawing attention in the modern world, where respiratory health has become a major concern, particularly in the wake of COVID-19. A tried-and-true Pranayama method, *Nadi Shodhana* is renowned for its respiratory-supporting, cleansing, and soothing properties.[1] *Nadi* is a tubular organ of the body, such as an artery or vein, through which *Pranic* energy flows. *Shodhana* is a process of purification. By the practice of this Pranayama, the impaired flow of *pranic* energy is set right.[2]

Knowing about *Nadi Shodhana Pranayama,* the practice of "cleansing of the energy channels [*Nadis*]" or "*Nadi Shodhana*" entails breathing mindfully and rhythmically through alternate nostrils. Sitting in a comfortable meditation position is a common practice. Closing the nostrils alternately with the thumb and ring finger. Taking a breath through one nostril, retaining it (if desired), and then letting it out[3] through the other for 5–10 min, repeat the cycle until 30 sets are reached.

This Pranayama has drawn more scientific attention, especially because it may improve oxygen saturation (SpO_2) as determined by a pulse oximeter and lower respiratory rate (RR), two important markers of cardiovascular and respiratory health.

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1.1. Objective

To assess quantitatively the effect of *Nadi Shodhana Pranayama* on pulmonary functions through pulmonary function tests in apparently healthy individuals.

2. MATERIALS AND METHODS

2.1. Sample Size and Source

A total of 20 apparently healthy individuals of either sex who voluntarily gave their consent to perform *Nadi Shodhana Pranayama* were selected from the campus of MJF Ayurved Medical College, Jaipur.

2.2. Inclusion Criteria

- Individuals of the age group 18–65 years, irrespective of sex, were selected
- The individuals who are not suffering from any chronic illness were selected.

2.3. Exclusion Criteria

- Individuals with severe respiratory diseases.

Individuals with diabetes mellitus, cardiovascular disease, and hypertensive patients were excluded.

2.4. Intervention

- The participants were trained in the Outpatient Department for *Nadi Shodhana Pranayama*.
- The Pranayama was practiced 30 times daily for 45 days.

Each session of alternate nostril breathing began with inhalation (*Puraka*), breath holding (*Kumbhaka*), and exhalation (*Rechaka*). The pair of inhalations, breath holding, and exhalation made one round.

Method:[4]

- The candidates have been advised to sit in *padmasana*, *sukhasana*, or *siddhasana*, keeping their hands on the knee in jnana mudra.
- The individuals were suggested to bend the right hand at the elbow, making *Nasagra Mudra* (touch the right nostril with the thumb and the left nostril with the ring and little finger)
- Candidates are advised to inhale through the right nostril and keep the left nostril closed, filling the lungs completely with air by performing *Mulabandha* and *Kumbhaka* (breath holding). After that, exhale through the left nostril.
- Again, candidates are advised to inhale deeply through the left nostril by closing the right nostril.

Before and after intervention, the measured values of forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1), and FEV1/FVC were recorded from a digital spirometer monitor, and SpO_2 levels were measured with the help of a pulse oximeter. Three repeated readings were taken, and the best value was noted down. Then the participants practiced *Nadi Shodhana Pranayama* for 30 repetitions for 45 days. After 45 days, the objective parameters to be assessed were again measured. Volunteer information, such as age, sex, address, occupation, height, weight, and food habits, was recorded. The normal value was calculated based on these parameters. Then the subject was asked to sit in an upright straight position and was suggested to take a deep breath as per strength, then quickly place the mouthpiece into the mouth and discharge out the air as hard and as fast as possible. The entire procedure was repeated 3 times, taking the best value. The highest amount of air that is forcibly exhaled after inhaling as deeply as possible is measured as FVC, and the amount of air exhaled in 1 s after a deep inhalation is measured as FEV1. The anticipated value and the test score were then compared.

2.5. Statistical Analysis

All the values obtained before and after carrying out *Nadi Shodhana Pranayama* were expressed as mean ± standard deviation. For statistical analysis, the Student's paired *t*-test was used. In the result section $P < 0.05$ indicates a significant difference.

3. RESULTS

1. SpO_2
   - Increased from 95.8% to 96.85%
   - $t = 5.688$, $P < 0.0001$

This increase is highly statistically significant, indicating that *Nadi Shodhan Pranayama* significantly improves SpO_2 levels.

2. FEV1
   - Increased from 73.6 to 76.05
   - $t = 6.563$, $P < 0.0001$

Again, this is extremely significant, showing that *Nadi Shodhana* strengthens respiratory muscle tone, improves lung elasticity, and airway patency.

3. FVC
   - Increased from 76.6 to 79.75
   - $t = 5.294$, $P < 0.0001$

Significantly improved lung capacity shows that regular *Nadi Shodhana* enhances lung expansion and expiratory function.

4. FEV1/FVC ratio
   - Slight decrease from 0.9623 to 0.9543
   - $t = 0.9193$, $P = 0.1847 \rightarrow$ Not significant

The ratio change is negligible and not statistically significant, which is good because this ratio is usually used to detect obstructive or restrictive lung diseases; a stable ratio indicates balanced lung function, and no obstruction has developed.

The study shows that *Nadi Shodhana Pranayama* practiced for 45 days led to statistically and clinically significant improvements in: SpO_2, expiratory volume (FEV1), and lung capacity (FVC). There was no negative impact on the FEV1/FVC ratio, indicating that the practice enhances respiratory efficiency without altering lung mechanics pathologically.

Therefore, *Nadi Shodhana Pranayama* proves to be an effective, low-cost, non-pharmacological intervention to improve lung function and lung oxygenation.

4. DISCUSSION

4.1. Improvement in SpO_2

The increase in SpO_2 from 95.8% to 96.85% ($t = 5.688$, $P < 0.0001$) demonstrates a highly significant enhancement in blood oxygenation. This suggests improved alveolar gas exchange and enhanced oxygen uptake by the lungs. *Nadi Shodhana*, through its slow, controlled breathing pattern, increases parasympathetic tone, improves alveolar ventilation, and facilitates optimal oxygen-carbon dioxide exchange.

4.2. Enhancement in FEV1

FEV1 showed a statistically highly significant improvement from 73.6 to 76.05 (t = 6.563, P < 0.0001), indicating better airflow and strengthening of respiratory muscles. *Nadi Shodhana Pranayama's* balanced inhalation and exhalation rhythm tones the intercostal muscles and diaphragm, improving expiratory flow and reducing airway resistance. This may also reflect enhanced bronchial hygiene and reduced airway inflammation due to the calming effect of breath regulation.

4.3. Increase in FVC

FVC also increased significantly from 76.6 to 79.75 (t = 5.294, P < 0.0001), reflecting enhanced lung capacity and improved expansion of the thoracic cavity. The Pranayama practice allows for better recruitment of lung units, especially in the lower lobes, promoting full use of lung potential and improving lung compliance.

4.4. Stability of FEV1/FVC Ratio

The FEV1/FVC ratio showed a slight, non-significant decrease from 0.9623 to 0.9543 (t = 0.9193, P = 0.1847). This stability is clinically important, as it indicates that although both FEV1 and FVC increased, their proportional relationship remained balanced, suggesting that there was no development of obstructive or restrictive pathology. This reinforces the safety and non-invasive nature of *Nadi Shodhana* on lung mechanics.

4.5. Role of *Nadi Shodhana Pranayama*

Nadi Shodhana, or alternate nostril breathing, is deeply rooted in yogic traditions and is scientifically proven to balance the autonomic nervous system. Its rhythmic practice facilitates:

- Improved respiratory mechanics by promoting diaphragmatic breathing
- Enhanced alveolar recruitment, thereby improving oxygen diffusion
- Reduced sympathetic overactivity, which may help in airway relaxation and reduction of inflammation
- Increased parasympathetic tone aids better recovery and respiratory endurance.
- Detoxification at the cellular level through enhanced CO_2 elimination
- Furthermore, *Nadi Shodhana* contributes to mind–body harmony, reducing stress-induced bronchospasm, and creating a calm internal physiological environment that supports healing and resilience.

4.6. Physiological Mechanisms Involved

4.6.1. Increased vagal activity

Activation of the vagus nerve reduces heart rate and RR.[5]

4.6.2. Improved lung compliance

Regular expansion of the lungs improves elasticity and tidal volume during Pranayama.

4.6.3. Reduced sympathetic overactivity

By reducing stress chemicals that influence breathing patterns, breathing regulation lessens the fight-or-flight response.[6]

4.6.4. Alkalizing effect

By lowering CO_2 accumulation, deep breathing aids in preserving acid-base equilibrium.[7]

4.6.5. Pulse oximeter and observational benefits

Within 5–10 min of *Nadi Shodhana*, pulse oximeter readings frequently indicate a 1–2% increase in SpO_2. Significant subjective relief was experienced by individuals with mild dyspnea or post-viral exhaustion in clinical observations. In addition, pulse rate tends to decrease, indicating improved parasympathetic regulation.

4.6.6. Research-based evidence

According to a 2017 study in the International Journal of Yoga, healthy volunteers who practiced *Nadi Shodhana* for 10 min saw an increase in SpO_2 and a decrease in RR.

Another trial involving post-COVID patients showed improved SpO_2 and lowered respiratory distress when *Nadi Shodhana* was included as an adjunct to conventional therapy.[8]

4.6.7. Recommended practice

- Frequency: Twice daily
- Duration: 30 sets of *Nadi Shodhana Pranayama* daily.
- Precautions: For patients with serious respiratory illnesses, it should be performed under supervision, on an empty stomach, and in a well-ventilated area.

5. CONCLUSION

Modern instruments such as the pulse oximeter are now confirming the physiological benefits of *Nadi Shodhana Pranayama*, a straightforward yet effective yoga technique. It is a useful, non-pharmacological supplement to respiratory health regimens because of its capacity to increase SpO_2, decrease RR, and lessen stress. *Nadi Shodhana* has enormous potential to improve the body's inherent healing ability, whether it is applied in integrated care, daily wellness practices, or rehabilitation settings.

In the current study, healthy people' respiratory metrics, including FVC, FEV1, FEV1/FVC, and SpO_2 level, significantly improved after 45 days of *Nadi Shodhana Pranayama*. These improvements imply that even in those without a history of respiratory disorders, *Nadi Shodhana Pranayama* can maximize lung capacity, strengthen the respiratory muscles, and boost air flow. It can be incorporated into a daily routine as a preventive measure to enhance health and well-being because it is a non-invasive and economical technique.

This pilot study successfully demonstrates that 45 days of *Nadi Shodhana Pranayama* practice leads to clinically and statistically significant improvements in SpO_2, FEV1, and FVC, without any adverse changes in the FEV1/FVC ratio. These improvements point to enhanced pulmonary function, respiratory efficiency, and overall oxygenation status, highlighting the Pranayama's potential as an accessible, low-cost, and side-effect-free intervention in both healthy individuals and those with subclinical respiratory insufficiency. The findings encourage the inclusion of *Nadi Shodhana* in daily lifestyle routines, respiratory rehabilitation programs, and even preventive public health strategies aimed at building pulmonary resilience in the post-pandemic era.

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7. AUTHORS' CONTRIBUTIONS

All the authors contributed equally to the design and execution of the article.

7. FUNDING

Nil.

8. ETHICAL APPROVALS

This study does not require ethical clearance as it is a case series.

9. CONFLICT OF INTEREST

Nil.

10. DATA AVAILABILITY

This is an original manuscript, and all data are available for only review purposes from the principal investigators.

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Parameters	Mean		Mean diff.	% relief	SD±	SE±	*t*-value	*P*-value	S
	BT	AT							
SpO_2 level	95.8	96.85	−1.05	1.0960334	0.8256	0.1846	5.688	<0.0001	ES
FEVI	73.6	76.05	−2.45	3.3288043	1.669	0.3733	6.563	<0.0001	ES
FVC	76.6	79.75	−3.15	4.1122715	2.661	0.595	5.294	<0.0001	ES
FEV1/FVC	0.9623	0.9543	0.00775	0.80536215	0.0377	0.00843	0.9193	0.1847	NS

SD: Standard deviation, SE: Standard error, SpO_2: Oxygen saturation, FEV1: Forced expiratory volume in 1 s, FVC: Forced vital capacity