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Effect of Surya Bhedana Pranayama on pulmonary functions in urban women of Delhi-NCR

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Abstract

Introduction: Surya Bhedana Pranayama is a yogic breathing practice that stimulates the Pingala Nadi. This activation is associated with the generation of heat and energy and with the arousal of the body's masculine, active processes. Regular practice of this pranayama is believed to strengthen the muscles involved in respiration, since sustained breathing effort conditions the muscles of the lungs and the wider respiratory apparatus.

Aim: The present study set out to assess how Surya Bhedana influences pulmonary function among urban women residing in the Delhi-NCR region.

Material and Methods: Fifty women aged between 30 and 50 years took part in a two-month pranayama training programme, with a mean age of 39.3 ± 2.9 years. Each participant performed Surya Bhedana breathing six days a week across the two months. Tidal volume (TV), vital capacity (VC), inspiratory reserve volume (IRV) and expiratory reserve volume (ERV) were recorded for every participant. A paired (matched) student's t-test was applied, and all analyses were carried out using SPSS.

Results: Following the two-month programme, which involved thirty minutes of daily practice, VC rose from 2825 ± 92.8 to 3208 ± 84.9, TV increased from 472 ± 53.5 to 568 ± 40.5, IRV improved from 1433 ± 51.6 to 1566 ± 47.3, and ERV climbed from 802 ± 49.3 to 998 ± 45.2.

Conclusions: The findings show that TV, VC, IRV and ERV all improved considerably after two months of pranayama training.

Keywords: Tidal Volume, Vital Capacity, Inspiratory Reserve Volume, Expiratory Reserve Volume, Pulmonary Functions, Pranayama

Introduction

The word "prana" carries a range of meanings, including breath, breathing, life, energy and vigour, and it points to the vital force that our breath sustains. "Ayama" conveys the ideas of stretching, extending, expanding, restraining, regulating and prolonging. Taken together, "pranayama" therefore denotes the regulation and extension of the breath (Iyengar, 1981) [1].

Patanjali's Yoga Sutras (Ch. 2, Sutras 49–51) describe pranayama as the deliberate control of inhalation and exhalation while a steady posture is maintained (Madhvacharya & Patañjali, 2008) [2]. The Shiva Samhita refers to this practice as Vayu sadhana, a term that likewise denotes the disciplining of the breath.

In pranayama, the breath is consciously held for prolonged intervals. Drawing in the primal energy is termed inhalation, while retaining the breath in order to assimilate it is called retention. When the lungs are emptied, the practitioner's sense of self, the "I", is offered up to the primal energy, or Atma. With each exhalation, accumulated thoughts and emotions are released from the body. Through such practice, pranayama is said to sharpen decision-making, bring clarity to thought and strengthen the will.

The term "pulmonary function" refers to the physiological evaluation of the respiratory system. It covers measurements such as airway resistance and lung capacity, along with other indices that reveal whether lung impairment is present and how severe it may be.

In resource-poor settings, and particularly where households depend on coal and biomass for cooking and heating, air pollution is a major driver of respiratory illness. Reducing this burden and safeguarding respiratory health calls for coordinated effort among government, industry and the private sector at the local, national and international levels (Kurt *et al.*, 2016) [3].

The Hatha Yoga Pradipika sets out both the definition and the technique of Surya Bhedana Pranayama. Seated comfortably, the practitioner inhales gently through the right nostril, then retains the breath until it is felt to reach the tips of the nails and the roots of the hair, before exhaling slowly through the left nostril (Muktibodhananda Saraswati & Satyānanda, 2011) [4].

Practice of Suryanadi pranayama has been shown to reduce certain ventilatory volumes and capacities while raising PEFR, vital capacity and flow rates, thereby improving respiratory efficiency and possibly guarding against COPD (Keerthi *et al.*, 2013) [5]. Other work reports that adding breathing exercises produces marked gains in spirometric measures and a substantial reduction in dyspnoea, wheeze, night-time symptoms and dependence on rescue medication among asthma patients already receiving optimal treatment (Agarwal *et al.*, 2017) [6].

Material and methods

Fifty healthy women from the Delhi-NCR region were selected at random for a two-month pranayama training programme. Those with any prior pranayama experience, a history of tobacco Use or substance abuse, or chronic conditions such as diabetes, asthma, hypertension, cardiovascular disease or renal disease were excluded. A detailed clinical history was reviewed before a participant was enrolled.

Under the supervision of a trained yoga instructor, participants practised pranayama for thirty minutes each day. Vital Capacity (VC), Tidal Volume (TV), Inspiratory Reserve Volume (IRV) and Expiratory Reserve Volume (ERV) were measured both before and after the two-month programme. A respirometer was used to record these parameters, and the results were analysed with the student's paired t-test. All statistical work was performed in SPSS.

The Surya Bhedana pranayama used in the programme is described as follows. Seated in a comfortable posture, the practitioner inhales gently through the right nostril and then holds the breath until it is felt to spread to the roots of the hair and the tips of the nails, after which the breath is released slowly through the left nostril (H.Y.P. 2.48–50).

The training session was structured as follows:

1. Prayer
2. Surya Bhedana Pranayama: 15 minutes
3. Rest: 3 minutes
4. Surya Bhedana Pranayama again: 15 minutes
5. Closing prayer: Shanti Mantra

Results are reported as mean and standard deviation. The paired t-test was used to test the significance of the study parameters in SPSS version 15.0, and a p-value below 0.05 was taken to indicate statistical significance.

Results

The study showed that pranayama had a favourable effect on lung function. After the training period, the post-intervention readings for vital capacity (VC), tidal volume (TV), inspiratory reserve volume (IRV) and expiratory reserve volume (ERV) were all significantly higher (p<0.05). In Surya Bhedana pranayama, the breath is drawn in through the right nostril and released through the left. The practice warms the body, raises energy levels and may benefit the lungs by allowing greater intake of oxygen.

Table 1: Effects of pranayama on the pulmonary health of urban women of Delhi-NCR

Parameters	Pre-yoga	Post-yoga	p-value
Tidal Volume (TV)	472 ± 53.5	568 ± 40.5	p<0.05
Vital Capacity (VC)	2825 ± 92.8	3208 ± 84.9	p<0.05
Inspiratory Reserve Volume (IRV)	1433 ± 51.6	1566 ± 47.3	p<0.05
Expiratory Reserve Volume (ERV)	802 ± 49.3	998 ± 45.2	p<0.05

As the table shows, VC, TV, IRV and ERV all rose substantially, with a p-value below 0.05 treated as statistically significant. The overall pattern points to improved pulmonary function, since each of the four principal lung volumes advanced. Such changes suggest that the respiratory system moves air through the lungs more effectively. Higher VC, TV, IRV and ERV values indicate a greater capacity to hold air and a stronger ability to breathe deeply. Several mechanisms may account for these gains, among them improved lung compliance, stronger respiratory muscles, better alveolar function or the effectiveness of the intervention itself. The shifts in standard deviation suggest that the measurements grew more precise and consistent, with the occasional between-participant variation set against a broadly uniform improvement. Increases of this kind in lung volume are commonly seen with therapy or exercise designed to enhance breathing.

Discussion

Breathing practices such as Surya Bhedana help to clear toxins, debris and secretions from the bronchial tree and the alveoli, cleansing the respiratory passages and the air within them. The name "Surya Bhedana" combines two elements: "Surya", meaning sun, and "Bhedana", meaning piercing or penetrating. In its simplest form, the technique consists of inhaling through the right nostril, holding the breath and exhaling through the left.

The Pingala Nadi is an energy channel that runs from the Muladhara chakra to the right nostril, joining the two. By opening this channel, Surya Bhedana Pranayama is thought to govern our capacity for physical activity and to express the masculine, solar quality of energy. Practitioners hold that the technique supplies the body with vitality and solar warmth, which may counter excessive cooling in the system, especially during the cooler Vata or Kapha seasons.

Some evidence complicates a straightforward reading of nostril-specific effects. One study found no meaningful difference between right-nostril breathing (RNB) and left-nostril breathing (LNB) after either acute exposure of fifteen minutes or eight weeks of training, with both techniques eliciting a predominantly parasympathetic response (Jain *et al*., 2005) [7]. Telles and colleagues, by contrast, reported that right-nostril breathing produced a marked rise in oxygen consumption (Telles *et al*., 1996) [8]. Sankar and Das concluded that yoga, pranayama and breathing techniques may help children with uncontrolled, mild-to-moderate chronic asthma, though not those in an acute, severe phase (Sankar & Das, 2018) [9]. Among people with COPD, pranayama may improve perceived health, disease severity and functional status, yet without any significant gain in FEV1, since airflow limitation is largely irreversible and tends to worsen over time (Gupta *et al*., 2014) [10]. Inspiratory muscle training and hypoventilation training have proved effective in reducing medication use, notably the reliance on beta-adrenergic inhalers (Ritz & Roth, 2003) [12].

Pranayama may enhance oxygenation and delay the emergence of COPD-related symptoms. Together with Om chanting, it has been shown to build respiratory muscle endurance and to improve use of the alveolo-bronchial tree (Chaudhary *et al*., 2024) [13]. Kaminsky observed that symptomatic COPD patients may gain considerable benefit from pranayama, though this needs confirmation in larger clinical trials (Kaminsky *et al*., 2017) [14]. In healthy individuals, yogic breathing improved lung function within six weeks, with gains in both peak expiratory flow rate and forced expiratory volume (Kupershmidt & Barnable, 2019) [15]. Right-nostril breathing shortens arterial and ventilatory reaction times while raising blood pressure, heart rate, vital capacity and peak expiratory flow rate, though further research in people with cardiac and pulmonary conditions is required to establish its clinical value (Bargal *et al*., 2024) [16]. Yogic breathing has also been found to enhance respiratory endurance in competitive swimmers (Hakked *et al*., 2017) [17]. Another study suggests that uninostril and alternate-nostril techniques initiated through the right nostril induce a state of alertness by activating the sympathetic nervous system, boosting ascending reticular activity and producing central effects at the primary thalamo-cortical level (Bhavanani *et al*., 2014) [18].

In a related programme, structured techniques classified as heating pranayama (Suryanadi, Bhastrika and Kapalabhati) were practised three times a week for twelve weeks. Afterwards, patients with bronchial asthma showed improvements in pulmonary function test parameters and a shift in autonomic tone from sympathetic towards parasympathetic dominance, although these results did not reach statistical significance (Saha *et al*., 2024) [19]. Pranayama practice over ten to thirty days has been reported to improve measures such as FVC, FEV1, FEV1/FVC and MVV, which suggests that it may serve as a sound lifestyle measure for preventing lung disorders and improving lung function (Manaspure & Fadia, n.d.).

Overall, the present findings indicate that this form of controlled nostril breathing may be recommended to improve cardiorespiratory efficiency, since the data point to enhanced respiration.

Conclusion

The results indicate a marked improvement in lung function, evident in the rise across all four measured volumes: VC (Vital Capacity), TV (Tidal Volume), IRV (Inspiratory Reserve Volume) and ERV (Expiratory Reserve Volume).

1. Tidal Volume (TV)

Starting value: 472 ± 53.5; final value: 568 ± 40.5; change: an increase of 96 mL.

Tidal volume is the amount of air moved in or out during ordinary breathing, so a higher figure reflects a larger average exchange per breath. The rise from 472 mL to 568 mL indicates that participants could take somewhat deeper breaths, plausibly because of greater lung flexibility, stronger respiratory muscles or other factors that ease breathing. The fall in standard deviation from 53.5 to 40.5 suggests that this improvement in tidal volume was fairly uniform across the group.

2. Vital Capacity (VC)

Starting value: 2825 ± 92.8; final value: 3208 ± 84.9; change: an increase of 383 mL.

Vital capacity is the largest volume of air a person can exhale after the deepest possible inhalation, so a higher value reflects a better ability to hold and expel air. The increase from 2825 mL to 3208 mL, together with the drop in standard deviation from 92.8 to 84.9, points to improved lung capacity and more consistent results across participants. This may reflect better lung performance or the outcome of effective conditioning that has expanded functional capacity.

3. Inspiratory Reserve Volume (IRV)

Starting value: 1433 ± 51.6; final value: 1566 ± 47.3; change: an increase of 133 mL.

Inspiratory reserve volume is the maximum amount of air that can be drawn in after a normal breath. The rise from 1433 mL to 1566 mL shows that participants could inhale more deeply, which may indicate stronger respiratory muscles, greater lung flexibility or improved alveolar function. The reduction in standard deviation from 51.6 to 47.3 suggests that the gain was broadly similar across the group.

4. Expiratory Reserve Volume (ERV)

Starting value: 802 ± 49.3; final value: 998 ± 45.2; change: an increase of 196 mL.

Expiratory reserve volume is the amount of air that can still be forced out after a normal exhalation. The rise from 802 mL to 998 mL indicates that participants could exhale more fully during quiet breathing, possibly because of better lung performance or more efficient respiratory muscles. The narrowing of the standard deviation from 49.3 to 45.2 points to more consistent data and reinforces the general trend of improvement.

Taken together, these findings indicate improved pulmonary function, most likely arising from better lung compliance, greater respiratory muscle strength or the effect of the intervention. The results consistently reflect positive change in lung volumes, which may be linked to improved respiratory health or to the efficacy of the practice under study.

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