

Effect of Bhastrika Pranayama on Pulmonary Function and Body Mass Index of Banaras Hindu University Students.

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ABSTRACT

Background: -Bhastrika Pranayama is a rapid, forceful breathing technique traditionally held to improve lung function and stimulate metabolic activity. University students, owing to sedentary schedules and exposure to urban pollution, are particularly prone to declining respiratory efficiency.

Aim: - To study the effect of Bhastrika Pranayama on pulmonary function and Body Mass Index (BMI) of Banaras Hindu University students.

Materials and Methods: - Thirty students aged 18–25 years were randomly assigned to two equal groups: an experimental group that practised Bhastrika Pranayama daily for six weeks, and a control group that received no intervention. We measured Forced Vital Capacity (FVC), Vital Capacity (VC), and BMI before and after the six weeks and analysed them using a paired t-test.

Results: - The experimental group showed a significant rise in FVC, from 2.9915 ± 0.8803 L to 3.2280 ± 0.8391 L ($p < 0.001$). VC dropped from 3877.87 ± 5434.34 mL to 3199.95 ± 868.26 mL, though this change was not statistically significant ($p = 0.419$). BMI stayed unchanged at 22.7798 ± 1.9149 kg/m² across both assessments. No change was observed in the control group for any parameter.

Conclusion: Six weeks of Bhastrika Pranayama practice significantly improved FVC among university students, while VC and BMI showed no meaningful change. The findings support Bhastrika Pranayama as a simple, accessible method for improving lung function, though longer-duration studies are warranted to evaluate its impact on VC and body composition more conclusively.

Keywords: - Bhastrika Pranayama, Pulmonary function, FVC, VC, BMI, University students

INTRODUCTION

Yoga has occupied a central place within Indian philosophical tradition for centuries, and its relevance to health and self-regulation continues to draw scholarly attention. Pranayama, one of its core components, refers to the conscious control of breathing and is recognized for the influence it exerts on both respiratory mechanics and broader physiological processes (Chanavirut et al., 2006). Among the various pranayama techniques, Bhastrika, often described in English as "bellows breath," involves rapid and forceful cycles of inhalation followed immediately by equally forceful exhalation. Where many pranayama practices emphasize a slow, restful rhythm, Bhastrika instead calls upon the diaphragm and the accessory muscles of respiration to work vigorously, and is traditionally understood to clear the respiratory passages, expand lung capacity, and encourage metabolic activity (Shyam Karthik et al., 2014).

Lung health is typically evaluated through indicators such as Forced Vital Capacity (FVC), Vital Capacity (VC), and Peak Expiratory Flow Rate (PEFR). A number of controlled investigations have recorded favorable shifts in

these measures after a period of Bhastrika practice. In one such study, a six-week programme combining Bhastrika with Nadishodhana pranayama produced a statistically significant rise in FVC and PEFr among young, healthy participants (Shankarappa et al., 2012). Elsewhere, a randomized trial comparing one month of Bhastrika practice against an equal period of running found the Bhastrika group achieved significantly greater gains in FVC, FEV₁, PEFr, and MVV (Kuppusamy et al., 2019). A broader analysis combining data from several yogic breathing techniques, including Bhastrika, similarly reported a consistent, moderate improvement in FVC, FEV₁, the FEV₁/FVC ratio, and PEFr among healthy adults (Bash et al., 2023). University students, by virtue of largely sedentary academic schedules, inconsistent physical activity, and, in many settings, ongoing exposure to urban air pollution, form a group that is particularly susceptible to a decline in respiratory efficiency. Alongside this, Body Mass Index (BMI), a widely applied measure of body composition, offers useful insight into the nutritional and metabolic standing of this population — a concern given the rising incidence of overweight and lifestyle-related conditions reported among Indian university students in recent years.

The demands that Bhastrika Pranayama places on the respiratory system, combined with its claimed metabolic benefits, position it as a low-cost, easily accessible, and non-invasive intervention with potential to affect both lung function and body composition. While pranayama as a broader practice has received growing attention within exercise physiology and yoga-therapy research, few studies have looked specifically at how Bhastrika alone affects pulmonary function together with BMI, particularly among a defined student group such as that of Banaras Hindu University. Much of the available literature either folds Bhastrika into a wider composite yoga protocol, making it difficult to separate its individual contribution (Shyam Karthik et al., 2014), or is centred on older adults, clinical patients, or occupational groups rather than young, apparently healthy university-going individuals (Bamne, 2017).

This gap in the existing body of research provides the basis for the present study. By examining the effect of a structured Bhastrika Pranayama programme on selected pulmonary function parameters (FVC, VC) and BMI among students of Banaras Hindu University, this work seeks to add population-specific, empirically grounded findings to an area of study that has so far depended largely on traditional claims and limited controlled evidence. The outcomes of this study are intended to contribute to a clearer understanding of the physiological effects of pranayama, while also supporting its practical adoption as a preventive health measure within university settings.

Aim and Objectives

The present study aims to examine the effect of Bhastrika Pranayama on the pulmonary function, and Body Mass Index (BMI) of Banaras Hindu University students. It seeks to record pre-test and post-test values of selected pulmonary function variables (FVC, VC and BMI, administer a structured Bhastrika Pranayama training programme, and statistically compare the pre and post intervention data to determine the significance of change.

MATERIALS AND METHODS

Thirty students of Banaras Hindu University, Varanasi, aged 18–25 years, took part voluntarily after institutional ethics approval and informed consent. Those with a history of smoking, alcohol use, respiratory or cardiac illness, recent surgery, or prior yogic training were excluded. Subjects were randomly split into two groups of fifteen: an experimental group trained in Bhastrika Pranayama, and a control group with no intervention. A pre-test–post-test randomized design was used, with FVC (L), VC (mL), and BMI (kg/m²) recorded before and after six weeks.

FVC and VC were obtained via computerized spirometry, and BMI was calculated from height and weight. The experimental group practiced Bhastrika Pranayama rapid, forceful bellows-type breathing done seated with an erect spine daily for six weeks under a qualified instructor, while controls received no training. For testing, each subject inhaled fully and exhaled forcefully into the mouthpiece for FVC, and slowly and completely for VC. Pre-and post-readings were compared using the paired t-test, and group differences using the independent t-test, with SPSS and $p < 0.05$ as the significance threshold.

The following yoga practices were given to the subjects daily for 6 Weeks:

Bhastrika Pranayama

The word Bhastrika comes from Sanskrit and means "bellows," a name given to this pranayama because its breathing rhythm resembles the fast, forceful working of a blacksmith's bellows. It is performed through quick, strong, and complete rounds of inhalation and exhalation carried out one after another, so that a considerable amount of air passes through the airways with every round. Because of this vigorous pattern, both the muscles of inhalation and exhalation are put to active use, setting it apart from slower and more calming pranayama techniques. The practitioner usually sits in an upright, steady posture with the spine kept straight, breathing forcefully from the abdomen at a controlled and even pace throughout. As it places considerable mechanical demand on the diaphragm and chest wall, Bhastrika is generally considered helpful in improving breathing efficiency and lung capacity when practiced regularly.

Bhastrika Pranayama 6 Weeks Schedule for University Students.

Week	Rounds	Breaths per Round	Rest	Session Duration	Frequency
1 st	2	10	60 sec	4–5 min	5 days/week
2 nd	2	15	60 sec	5–6 min	5 days/week
3 rd	3	15	60 sec	6–7 min	5 days/week
4 th	3	20	60 sec	7–8 min	5 days/week
5 th	3	25	60 sec	8–9 min	5 days/week
6 th	3	30	60 sec	9–10 min	5 days/week

RESULTS

Following six weeks of Bhastrika Pranayama practice, the experimental group showed a marked rise in FVC, from a pre-training mean of 2.9915 ± 0.8803 L to a post-training mean of 3.2280 ± 0.8391 L, an increase of 0.2365 L that proved statistically significant ($t = 4.433$, $p < 0.001$). VC, in contrast, moved in the opposite direction, falling from 3877.87 ± 5434.34 mL to 3199.95 ± 868.26 mL, though this shift did not reach statistical significance ($t = -0.816$, $p = 0.419$). BMI showed no change at all across the study period, holding steady at 22.7798 ± 1.9149 kg/m² at both assessments. These findings are summarized in Table 1. By comparison, the control group showed no meaningful movement in any of the three variables between the two testing points (FVC 3.52 ± 0.54 L; VC 3808.77 ± 743.45 mL; BMI 23.79 ± 1.65 kg/m²; $p = 1.0$ throughout), which supports the conclusion that the gain seen in FVC among the experimental group stemmed from the Bhastrika Pranayama training itself, rather than from repeat exposure to testing or random variation.

Table1: - Effect of Bhastrika Pranayama on FVC, VC and BMI in Banaras Hindu University students (Experimental group, n=15). Data are mean $\pm$ SD. Significant value for $p < 0.05$

Parameters	Pre-training (n=15)	Post-training (n=15)	p value
FVC (L)	2.9915 ± 0.8803	3.2280 ± 0.8391	$p < 0.001$
VC (mL)	3877.87 ± 5434.34	3199.95 ± 868.26	$p = 0.419$
BMI (kg/m ²)	22.7798 ± 1.9149	22.7798 ± 1.9149	$p = 1.0$

Effect of Bhastrika Pranayama on FVC, VC and BMI (Experimental Group, n = 15)

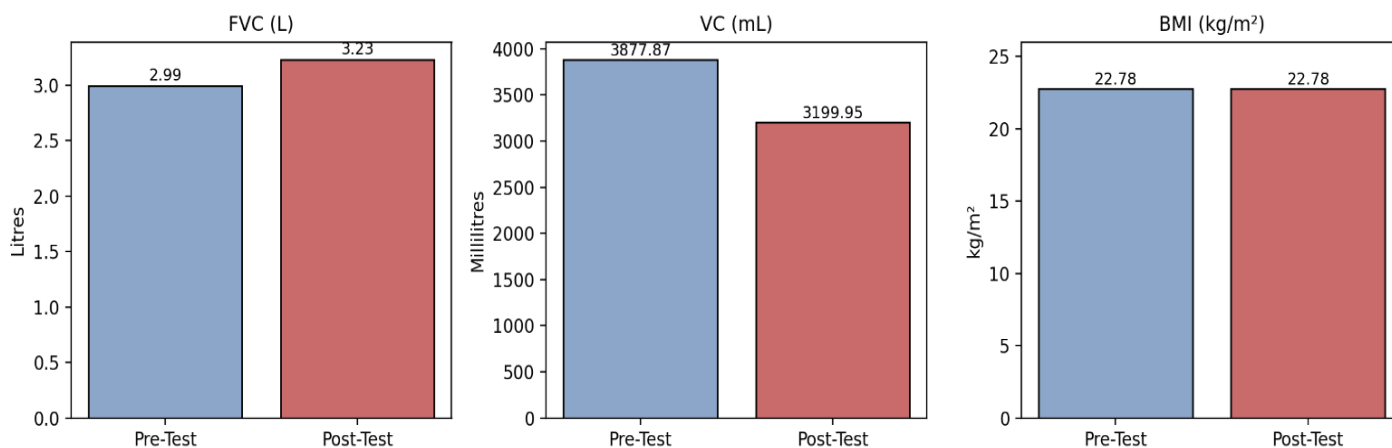


Fig: -1 It makes clear that Bhastrika Pranayama produced a statistically meaningful gain in FVC. This improvement is plausibly linked to the sustained, forceful action of the diaphragm and accessory breathing muscles that Bhastrika demands with each rapid cycle of inhalation and exhalation an effect that, sustained over six weeks, would be expected to widen chest wall movement and build strength in the muscles that govern lung inflation. VC, on the other hand, did not change to a statistically significant degree, and although its standard error narrowed considerably between the two testing points, the sizeable spread in baseline readings suggests that variability among individual participants at the outset may have masked whatever true effect the intervention produced. This particular result is best read with some caution, rather than being taken as proof that Bhastrika has no bearing on VC. As for BMI, its complete stability throughout the study is consistent with the fact that body composition tends to shift slowly and is unlikely to register measurable change over a period as short as six weeks without some accompanying adjustment to diet; a longer intervention window, possibly combined with dietary guidance, would likely be needed to capture any real movement in this parameter.

DISCUSSION

This study looked at how six weeks of Bhastrika Pranayama affected FVC, VC, and BMI in Banaras Hindu University students. FVC rose significantly in the experimental group, while VC and BMI showed no significant change; the control group stayed stable throughout. The rise in FVC fits earlier findings on pranayama. Bhastrika's rapid, forceful breathing works the diaphragm and accessory respiratory muscles harder than usual (Shyam Karthik et al., 2014), and sustained practice appears to strengthen these muscles, allowing more air to be forcibly exhaled. Similar gains have been reported after short Bhastrika programmes in healthy adults (Shankarappa et al., 2012; Kuppusamy et al., 2019; Bash et al., 2023), though most prior work has focused on clinical or older populations rather than university students (Bamne, 2017), making the present findings a useful addition. The VC result needs cautious reading. Though the mean fell, the change was not significant, and the very high baseline variability (SD = 5434.34 mL) suggests inconsistent early readings rather than a true effect of the intervention. This is supported by the much tighter spread seen at post-test. So the non-significant VC finding likely reflects measurement noise, not an absence of effect. BMI staying unchanged is expected body composition shifts slowly and needs dietary change alongside exercise to move over just six weeks. Overall, Bhastrika Pranayama appears to meaningfully improve FVC even over a short period, while its effect on VC and BMI may need longer study duration or larger samples to detect clearly. This supports Bhastrika as a simple, low-cost breathing practice worth recommending to university students.

CONCLUSION

After six weeks of practicing Bhastrika Pranayama, the students in the experimental group showed a clear improvement in their FVC, a measure of how much air the lungs can forcefully breathe out. VC and BMI, however, did not show any real change. Since the control group (who did not practice Bhastrika) showed no

change at all in any of these measures, this improvement in FVC can be linked directly to the pranayama practice itself. This suggests that Bhastrika Pranayama is a simple, low-cost, and easy way to improve lung function in healthy young people, even within a short period of six weeks. That said, the lack of significant change in VC and BMI shows that a longer practice period, a bigger group of participants, or added attention to diet may be needed to see clearer results in these areas. Larger studies over a longer duration would help build a fuller picture of how Bhastrika Pranayama affects both lung function and body weight in university students.

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