

## Study of pulmonary function in flutists

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### Abstract

**Background:** Flute playing requires continuous control of the airflow and high capacity of the lungs. Studies have proven that playing wind instruments improves respiratory muscle strength and that it is beneficial in bronchial asthma and obstructive sleep apnea. As there is a dearth of studies on pulmonary function among flutists specifically, and as flute playing is an important part of Indian music, we were interested in evaluating the effect of flute playing on selective pulmonary parameters in a group of flutists in our setting. **Aim:** The aim of this study was to evaluate the effect of flute playing on pulmonary function by measuring the peak expiratory flow rate (PEFR), breath holding time (BHT) and chest expansion. **Materials and Methods:** Healthy male flute players (15) from BILVAA music academy, Chennai and non-flutists (15) in the age group of 15 to 30 years were recruited. PEFR, BHT and chest expansion were recorded and analyzed statistically. **Results:** There was no significant difference in the anthropometric measurements like height, weight, BMI and neck circumference among flutists and non-flutists. There was a significant difference ( $p < 0.001$ ) in the PEFR values (flutists:  $478.0 \pm 87.12$  l/min and non-flutists  $297.33 \pm 101.6$  l/min) and BHT values (flutists: 58.07 seconds and non-flutists: 30.07 seconds). Chest expansion was also significantly higher in flutists. **Conclusion:** This pilot study shows an increased PEFR, BHT and chest expansion among flutists which could imply improved pulmonary function. However further detailed studies involving larger sample sizes are required for confirmation.

**Keywords:** breath holding time, flute, peak expiratory flow rate, pulmonary functions

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### Introduction

Every tissue in the body requires oxygen to survive and carry out normal physiological functions, and this is achieved with the help of the lungs. An increase in lung volumes and capacities enhances oxygen uptake which in turn helps in enhanced oxygenation and improved pulmonary function. Respiratory exercises in the form of breathing exercises,

chest mobility exercise, and pranayama have been proven to improve pulmonary function.<sup>1</sup>

Wind instrument blowers have been reported to have better pulmonary function due to increase in respiratory muscle strength and asthmatic adolescents who play wind instruments regularly have been proven to have better control of their disease.<sup>1,2</sup> There is also evidence for the therapeutic effect of playing

wind instruments in obstructive sleep apnea (OSA).<sup>3</sup>

While there are various studies focusing on pulmonary function in wind instrument blowers, there is a dearth of studies regarding pulmonary function among flutists specifically. The flute, which is an integral part of Indian music, is a wind instrument in which music is created by directing a stream of air across a hole in the instrument thereby creating a vibration of air.

Hence, the current study proposed to evaluate the effect of flute playing on selective pulmonary parameters of respiratory efficiency in a group of flutists in our setting in Chennai, Tamil Nadu, India. The aim of this study was to evaluate the effect of flute playing on pulmonary function by measuring the peak expiratory flow rate (PEFR), breath holding time (BHT) and chest expansion.

### Materials and Methods

The study which is a pilot study of cross-sectional type was initiated after obtaining clearance from the institutional ethics committee. Healthy male flutists (15) and controls (15) residing in Chennai aged 15-30 years, were included in the study. Informed consent was obtained from all the participants after briefing the procedure and for those under 18 years the informed consent was obtained from the parent or guardian.

Flutists who played regularly for 30 minutes a day, 3-4 days a week for 6 months to 3 years from BILVAA music academy, Chennai were included in the study. Controls were selected from apparently healthy volunteers aged 15-30 years. Subjects with acute illness; any cardiac, respiratory, metabolic or psychiatric illness, and those who gave history of any regular physical exercise were excluded from the study. Anthropometric measurements like height,

weight, body mass index (BMI) and neck circumference (NC) were taken.

Pulmonary parameters like peak expiratory flow rate (PEFR), chest expansion and breath holding time after deep inspiration were performed. Peak expiratory flow rate was performed by asking the subjects to stand comfortably, take a deep inspiration and close the nostrils with the help of the thumb and index finger and blow through Wright's peak flow meter as forcibly as they can. The values were expressed in liters per second. Three recordings were taken at regular intervals and the highest of the three was taken as the PEFR value of that subject.

Chest expansion was measured using an inch tape at the level of the 4<sup>th</sup> intercostal space - the area of maximum chest expansion. The subjects were asked to take a deep inspiration from the normal end expiratory level and the chest expansion was measured in centimeters.

Breath Holding Time (BHT) was recorded using a digital stopwatch. The subjects were asked to sit comfortably and relax for a period of time. Then they were asked to take a deep inspiration and hold it as much as they can. For each subject, the point where the subject could no longer hold his breath (Breaking or J-point) was noted and taken as his BHT. The procedure was repeated thrice with regular intervals and the best of three was noted as the BHT of that subject. The values were tabulated and data was analyzed using SPSS software version 17.

### Results

There was no significant difference in the anthropometric measurements like height, weight, BMI and neck circumference among flutists & non-flutists, as shown in Table 1.

However, there were significant differences in the chest expansion, breath holding time and PEFR between flutists and non-flutists with a p value <0.001, as shown in Table 2.

**Table 1: Comparison of the anthropometric parameters of flutists (study group) and non-flutists (control group)**

Parameter	Groups	N	Mean ± SD
Height (cm)	Study group	15	164.4 ± 7.0
	Control group	15	162.2 ± 6.0
Weight (kg)	Study group	15	63.23 ± 7.4
	Control group	15	56.60 ± 11.6
BMI (kg/m <sup>2</sup> )	Study group	15	23.42 ± 2.6
	Control group	15	21.47 ± 3.9
Neck circumference (cm)	Study group	15	14.0 ± 0.51
	Control group	15	14.0 ± 0.51

Data expressed as Mean ± SD; p<0.05 considered significant

**Table 2: Comparison of the pulmonary parameters between flutists (study group) and non-flutists (control group)**

Parameter	Group	N	Mean ± SD	p value
Chest Expansion (cm)	Study group	15	3.89 ± 0.8	<0.001 *
	Control group	15	2.41 ± 0.77	
Breath Holding Time (BHT) after deep inspiration (seconds)	Study group	15	58.07 ± 8.2	<0.001 *
	Control group	15	30.67 ± 9.6	
Peak expiratory flow rate (l/min)	Study group	15	478.0 ± 87.12	<0.001 *
	Control group	15	297.33 ± 101.6	

Data expressed as Mean ± SD; \*p<0.05 considered significant

## Discussion

The current study aimed at studying the effect of flute playing on pulmonary function in flutists. Results showed that the height, weight, BMI and neck circumference were not significantly different among flutists and non-flutists. In general, neck exercises can have a positive effect on the neck circumference (NC) and flute playing is a coordinated activity involving neck and chest muscles. Lifestyle and exercise interventions have been found to have a beneficial effect on neck and waist circumference.<sup>4</sup> A decrease in neck circumference has been found to decrease the risk of cardiovascular diseases.<sup>5</sup> In our study, there was no significant difference in the neck circumference among groups.

The chest expansion of the flutists in our study was significant higher than that of the non-flutists. Regular exercise of chest muscles - both inspiratory & expiratory muscles but particularly inspiratory muscles, increases chest expansion.<sup>6</sup> Exercise against high resistance primarily using expiratory muscle stabilizes the pharyngeal region and chest wall thereby preventing collapse of upper airway and decreases the incidence of sleep apnea.<sup>7,8</sup>

In flutists, voluntary breath control is an essential factor that improves respiratory efficiency. Breath control training in musicians improves both diaphragmatic function and abdominal muscle function.<sup>9,10</sup> Through controlled and measured breaths, flute playing can strengthen the lung capacity. In our study, BHT after deep inspiration was found to be higher in flutists than in non-flutists and the difference was statistically significant which was concurrent with the findings of Fiz *et al.*<sup>1</sup>

PEFR was found to be higher in the flutists in our study, when compared to the non-flutists. Other studies have also proven such beneficial effects. Muscles of the chest and thorax play a prime role in normal pulmonary functions. Flute playing, a modified form of breathing exercise increases extensibility, flexibility,

power and endurance of the chest muscles, which in turn increases the lung volumes and capacities.<sup>11,12</sup> Flute playing increases pulmonary ventilation & oxygenation because of high residual volume<sup>13</sup> which brings about well being of an individual. The vital capacity of an individual is influenced by age, weight and respiratory muscle strength.<sup>14</sup> During flute playing, breathing techniques like pursed lip breathing, inspiratory hold technique and diaphragm breathing are used, which increases the lung volumes and capacities and the respiratory muscle activity.<sup>15</sup>

Pulmonary function is higher in flutists when compared with non-flutists which could be due to increased respiratory muscle strength.<sup>16</sup> Flute playing can be used as an adjunct healing therapy for patients suffering from respiratory disorders such as bronchial asthma, Chronic Obstructive Pulmonary Disease (COPD) and obstructive sleep apnea.<sup>17</sup>

Researchers have proven other beneficial effects of flute playing also. Regular practice using the flute brings good hand-eye coordination among children, keeps the mind calm and causes release of endorphins which helps in relieving stress and the management of pain.<sup>18</sup> Apart from its musical effects, the flute also seems to have positive benefits on physical and mental health.<sup>19</sup> Hence, flute playing when performed regularly could improve overall well being of an individual also.

Limitations of this study include the small sample size. Although this pilot study was conducted among a small group of flutists in Chennai alone, we are presenting our findings as it could be of potential interest to other researchers. Flutists constitute a small population among wind-blowers community. Further large-scale studies of appropriate sample size including a larger population of flutists from different locations are planned in the future.

## Conclusion

This study done to evaluate the effect of flute playing on pulmonary function by measuring the peak expiratory flow rate (PEFR), breath holding time (BHT) and chest expansion, revealed an increased PEFR, BHT and chest expansion among flutists, when compared to non-flutists, which could imply improved pulmonary function. However further detailed studies involving larger sample sizes are required for confirmation.

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**Conflicts of interest:** Nil

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