

# Pulmonary Function Tests in Wind Instrument Players

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**Abstract:** *The playing of wind instruments has been associated with changes in respiratory function. The objective is to study the effect of playing wind instruments on lung function. The methods used in present study included 30 wind instrument players and 30 normal subjects not playing any wind instrument. They were investigated by a Electronic computerised portable spirometer (Medspiror). It is found that the wind instrument players showed significantly increased level of FVC, PEFR, MVV and lower FEV1% than control group. Our study concluded that wind instrument players had higher lung function. So, this type of respiratory exercise may be used as therapeutic purpose in many respiratory diseases.*

**Key words:** wind instrument players, lung volumes, lung capacities.

## 1. Introduction

Wind instrument playing requires adequate respiratory function and continuous control of air flow for the production of sound. Professional playing of a wind instrument may be considered to be continuous respiratory muscle training, with resultant improvement in lung function.

Few studies by Fiz et al, Munn et al(1990), Barbenel et al (1998), Kahane et al, Cossette et al(2008) showed that wind instrument blowers have higher pulmonary function due to increase in respiratory muscle strength[1]-[5]; but some studies by Schorr-Lesnick et al(1985), Heller SS, Navratil M, Borgia JF found no difference in lung functions[6]-[9].

The participation of the upper airways in sound production by a wind instrument led to the hypothesis that the exercise against high resistances stabilizes the walls of the pharynx and reduces collapse of upper airways. This hypothesis may explain the low incidence of sleep apnoea among wind instrument musicians. In a recent study, Ward and colleagues found that 847 professional musicians had a lower risk of Obstructive sleep apnoea than other instrumentalists [10]. The use of wind instruments for therapy of chronic airway disease has been studied, especially in patients with asthma.

The study of Lucia *et al* showed that teenagers with asthma who play a wind instrument have better control of their asthma [11]. Hence, the objective of present study was to determine the effects of playing wind instruments on lung function tests.

## 2. Materials and Methods

The present study included 30 healthy male, non-smoker subjects with age group of 25-35 years playing wind instruments like flute, clarinet, trumpet in marriage band party for more than 5 years. 30 healthy age matched, non-

smoker subjects having no special training of their respiratory muscles participated as control group. Those subjects suffering from any respiratory or cardiac illness were excluded. Subjects were investigated by an Electronic computerised portable spirometer (Medspiror).

## 3. Procedure

After permission from institutional ethical committee the study was conducted. Written consents of cases and controls were taken. Each subject was asked to perform the following two manoeuvres.

- a. **Forced Expiratory Manoeuvre:** Subject was asked to take a maximum inspiration, pinch his nose and then expire forcefully and completely in the mouthpiece of the instrument.
- b. **Maximum Ventilation Volume Manoeuvre:** Subject was asked to take a maximum inspiration, pinch his nose and then expire as deeply and rapidly as possible for 6 seconds in the mouthpiece.

With the help of these two manoeuvres three readings were taken and best of these was taken for calculation. The following parameters were chosen for the study, which are more relevant and pertinent to the study:

- 1) FVC (lit) 2) FEV<sub>1</sub>% 3) PEFR (lit/sec) 4) MVV (lit/min).

## 4. Results

**Table1:** Comparison of baseline features between cases and controls

Parameters	Cases n=30	Controls n= 30	Z value	Significance
	Mean $\pm$ S.D.	Mean $\pm$ S.D.		
Age (years)	27.83 $\pm$ 2.06	27.16 $\pm$ 2.001	1.27	NS
Weight (kg)	65.66 $\pm$ 4.67	65.96 $\pm$ 3.65	0.277	NS
Height (cm)	159.63 $\pm$ 5.22	159.03 $\pm$ 4.75	0.465	NS
BMI (kg/m <sup>2</sup> )	25.08 $\pm$ 1.56	26.13 $\pm$ 1.40	0.863	NS

**Table2:** Comparison of spirometric parameters between cases and controls

Spiro-metric Parameters	Cases n= 30	Controls n=30	Z value	Significance
	Mean $\pm$ S.D.	Mean $\pm$ S.D.		
FVC	3.23 $\pm$ 1.18	2.11 $\pm$ 0.34	5	significant
FEV1%	72.95 $\pm$ 5.52	89.09 $\pm$ 6.39	10.47	significant
PEFR	7.18 $\pm$ 0.95	4.60 $\pm$ 0.71	12.24	significant
MVV	97.86 $\pm$ 9.78	68.11 $\pm$ 6.48	13.89	significant

## 5. Discussion

The voluntary breath control is essential for playing wind instruments and the wind instrumentalists undergo continuous ventilatory muscle training (Fiz et al, 1993); (Schorr-Lesnicks et al,1985)[1],[6]. Training of ventilatory muscles follows the basic principle of training any striated muscle with regards to specificity, intensity and duration of training (Kisner & Colby, 2007;Kreuter et al, 2008, Wang et al, 2002)[12]-[14].

According to the hypothesis given by Schorr-Lesnicks et al (1985), the musicians have exceptional pulmonary functions, a physiological advantage due to the respiratory muscle training.

We also found higher pulmonary functions in our trained blowers. An explanation for higher FVC values in our trained wind instrument players might be due to their regular breathing pattern of using the whole vital capacity skilfully during the play with deep inspiration followed by prolonged expiration through the instrument. Trumpet players perform respiratory exercises against the high resistance of the instrument primarily using their expiratory muscles. Breath control training in musicians is directed at improving abdominal muscular and diaphragmatic function. This is accomplished primarily with exercises designed to increase resistance against these muscles on inspiration and to produce controlled slow expirations with an open glottis. The greater PEFR might be due to higher FVC in trained wind instrument players. The low value of FEV1/FVC (FEV1%) in trained blowers than the control group might probably be due to greater FVC. The greater MVV in trained blowers could be due to the increased respiratory muscle strength, probably the result of regular ventilatory muscle training. Overall results of our study might be due to professionally acquired training of wind instrument blowing. There appeared to be some association between increased lung volumes, capacities and high levels of habitual respiratory

muscle activity that might be true for our musicians, who performed blowing during marriage occasions.

Values are in Mean $\pm$ SD

p value < 0.05 is taken as statistically significant

NS-non significant

## 6. Conclusion

Our study concluded that the trained wind instrument players had higher pulmonary functions than the controls, which might be a physiological advantage due to regular training of blowing. Thus, the musical instrument application may be used for training patients daily over a period of 1-2 hours/day to improve expiratory muscle strength. Wind instrument playing may be helpful as a therapeutic use in chronic respiratory diseases and obstructive sleep apnoea.

Table 1 shows no statistical significant difference between the parameters of cases and controls.

Table 2 shows statistically significant increase in FVC, PEFR, MVV and decrease in FEV1% in cases as compared to controls.

## References

- [1] Fiz JA, Aquilar J, Carreras A, Teixido A, Hara M, MoreraJ;Maximum respiratory pressures in Trumpet players.Chest. 1993; 104 (4):1203-1204.
- [2] Munn NJ, Thomas SW, DeMesquitaS; Pulmonary function in commercial glass blowers. Chest 1990; 98:871-874.
- [3] Barbenel JC, Kenny P, and Davies JB: Mouthpiece forces produced while playing the trumpet. Journal of Biomechanics, 1988; 21(5):417-424.
- [4] Kahane JC, Beckford NS, Chorna LB, Teachey JC, Mecllelland DK: Videofluoroscopic and Laryngoscopic evaluation of the upper airway and Larynx of professional bassoon players. Journal of Voice, 2006; 20(2):297-307.
- [5] Cossette I, Monaco P, Aliverti A, Mackem P: Chest wall dynamics and respiratory muscle recruitment during flute playing. The Journal of Acoustical Society of America, 2008; 123(5):3241.
- [6] Schorr-Lesnicks B, Teirstein AS, Brown LK, Miller A. Pulmonary function in singers and wind-instrument players. Chest 1985; 88:201-5.
- [7] Heller SS, Hicks WR, Root WS.Lung volumes of singers. J Appl Physiol 1960; 15:40-2.
- [8] Navratil M, Bejsek K. Lung function in wind instrument players and glass blowers. Ann NY Acad Sci 1968; 155:276-83.
- [9] Borgia JF, Horvath SM, Dunn FR, Von Phul PV, Nizet PM. Some physiological observations on French horn musicians. J Occup Med 1975; 17:696-701.
- [10] Ward CP, York KM, Calzadilla AS, Walch FJ, Song JJ, Sharf M. Risk of obstructive sleep apnea in wind musicians. Sleep 2009; 32 Abstract Supplement, Ab175.
- [11] Lucia R. Effects of playing a musical wind instrument in asthmatic teenagers. J Asthma 1994; 31:375-85.
- [12] Kisner C, Colby LA: Management of pulmonary conditions, Breathing exercises & ventilation training.

In: Therapeutic Exercise Foundations and techniques. 5th Edn.; E.A. Davis Company Philadelphia. 2007; pp.861-866.

- [13] Kreuter M, Kreuter C, Herth F: Pneumological aspects of wind instrument performance-Physiological, Pathophysiological and therapeutic considerations. *Pneumologie*, 2008; 62(2):83-87.
- [14] Wang TG, Wang YH, Tang FT, Lin KH, Lien IN: Resistive inspiratory muscle training in sleep-disordered breathing of traumatic paraplegia. *Archives of Physical Medicine & Rehabilitation*, 2002; 83(4):491-496.

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