ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Comparative Study of Pulmonary Functions of Clarinet and Trumpet Players

Khuje PD*[1], Sandip Meghnad Hulke[2]

[1]Dept. Physiology, Chirayu Medical College and hospital, Bhopal
[2]Dept. Physiology, Laxminarayan Medical College, Bhopal

ABSTRACT

Though instrumental music is at least 40,000 years old but physical principles governing sound production and the physiological variables during the performance are now being studied scientifically. Our study's purpose was to investigate the effect of playing a particular wind instrument on PFT. This was cross-sectional study done 56 clarinet and 58 trumpet players. Pulmonary function test was done using HELIOS 401 RMS medspiror. Graph pad prism5 software. Unpaired t test for lung function parameter. Showed significant increase in FVC, FEV1, PEFR, FEF25%, FEF 50 %, FEF25-75% and MVV in clarinet players, however no significant change was observed in FEV_1/FVC% & FEF75%. The Clarinet players had higher pulmonary functions than the trumpet players.

Keywords: FVC, FEV1, FEV1%, PEFR, FEF25%, FEF25-75%, MVV, Clarinet players.

Corresponding author
Email:drpdkhuje@ymail.com

ISSN: 0975-8585

INTRODUCTION

Though instrumental music is at least 40,000 years old but physical principles governing sound production and the physiological variables during the performance are now being studied scientifically. Various instruments have been designed to produce floral musical quality. Very few studies have been conducted to study the physical principles governing sound production and the physiological variables such as pulmonary function tests during wind instrument blowing. Some studies had been done in brass players [1, 2], trumpet players [3, 4, 5], bassoon players [6, 7], flute players [8, 9], Didgeridoo players and woodwind players [10, 11].

In all of the above studies, players were compared with the non- players but there were no comparison between the players. Thus by comparing two players groups i.e. clarinet & trumpet, the current study was conducted to determine the effect of playing a particular wind instrument on PFT.

Subjects and Methods:

The enrolled subjects were categorized into Group A (56 clarinet players) and Group B (58 trumpet players). Subjects were taken from the military music training centre.

Inclusion criteria: - Healthy male non-smoker wind players with age range 20-50 years were included in the study.

Exclusion criteria: - Smokers and those suffering from acute & chronic cardio-respiratory illnesses were excluded.

Non-smokers were ex-smokers who had ceased smoking for more than a month before the study or had smoked less than one cigarette or bidi per day in one year or one cigar per week in one year. The smokers were regular cigarette or bidi or pipe smoker up to the day of study [12].

For pulmonary function test: - HELIOS 401 RMS medspiror was used. Pulmonary function test was recorded at the home visit around morning.

All the subjects were made familiar with the instrument and the procedure for performing the test. The data of the subject as regards to name, age, height, weight, sex, date of performing the test, atmospheric temperature was fed to the computerized MIR Spirolab.

The tests were performed in sitting position. The subject was asked to take full inspiration which was followed by as much rapid and forceful expiration as possible in the mouthpiece of MIR Spirolab. Three consecutive readings were taken and the best reading

amongst the three was selected. We have followed the guidelines of American Thoracic Society. [13]

Lung function parameters studied were forced vital capacity (FVC), Forced expiratory volume in 1 sec (FEV1), FEV1 as percentage of FVC in % (FEV1 (%)), Peak expiratory flow rate in liters / sec (PEFR), Forced expiratory flow rate in liters / sec in 25% of FVC (FEF25%), Forced expiratory flow rate in liters / sec in 50% of FVC (FEF50%), Forced expiratory flow rate in liters / sec in 75% of FVC (FEF75%), Forced expiratory flow rate during 25 to 75% of expiration (FEF25-75%), maximum voluntary ventilation (MVV).

Then the data of the observation for all parameters were statistically analyzed by calculating mean and standard deviation. The data was analyzed using Graph pad prism5 software. Unpaired t test was applied and p value <0.05 was considered as statistically significant.

RESULTS

Anthrpometric variable are and period of blowing is shown in table 1. Age and BMI were matched in both groups. Though the mean period of blowing in untrained blowers was slightly more than trained blowers but it was not statistically significant. Pulmonary function test parameters showed significant increase in FVC, FEV1, PEFR, FEF25%, FEF 50 %, FEF25-75%, and MVV in clarinet players, however non significant increase was observed in FEV_1/FVC% & FEF75%. Table2

Table 1: Baseline Features

Baseline	Group A	Group B	P value
Parameters	(n = 56)	(n =58)	
Age (years)	33.16 ± 6.77	35.5 ± 7.74	>0.05
BMI (Kg/m2)	22.63 ± 2.17	22.44 ± 2.82	>0.05
Period of blowing in yrs.	12.23± 7.23	14.08 ± 7.78	>0.05

Values are MEAN±S.D. *:= p<0.05 significant change

Table 2: PFT parameters in group A and group B

Spirometric	Group A	Group B	P value
Parameters	(n = 56)	(n =58)	
	Mean ± SD	Mean ± SD	
FVC (Predicted %)	108.66 ± 12.17	104.17 ± 13.03	<0.05
FEV1 (Lits)	110.34 ± 11.48	105.89 ± 11.53	<0.05
FEV1/FVC %	101.74 ± 4.95	102.03 ± 4.75	>0.05
FEF 25-75(Lits)	84.60 ± 17.8	73.55 ± 9.08	<0.05
PEFR (lit/s)	104.61 ± 12.7	67.6 ± 10.04	<0.05
FEF 25% (lits)	96.20 ± 16.81	69.45 ± 8.65	<0.05
FEF 50% (Lits)	73.83 ± 17.52	62.02 ± 9.19	<0.05

ISSN: 0975-8585

FEF 75 % (Lits)	53.29 ±13.35	51.65 ± 8.83	>0.05
MVV (L/m)	109.53 ± 12.69	79.93 ± 10.09	<0.05

Values are MEAN±S.D. *:= p<0.05 significant change

DISCUSSION

Exceptionally higher pulmonary functions were observed in wind instrumentalists as a result of ventilatory muscle training during performance. [10] The type of instrument is also an important factor in possible training effects. [5, 14] In the present study, the clarinet players had higher pulmonary functions than the trumpeters. Our findings were well supported by the various studies. [10, 15-17] In contrast, Deniz et al [8] found reduced pulmonary functions in trained military players.

Why did improvement occur with wind instrument playing? This is because the wind instrumentalists undergo continuous ventilatory muscle training as the voluntary breath control training is essential for playing wind instruments. Training of ventilatory muscles follows the basic principle of training any striated muscle with regards to specificity, intensity and duration of training. [19, 20] The principle of specificity of training states that the effects of training are very specific to the muscle groups being involved. [21] Similarly high intensity muscle training causes improved respiratory muscle function that has been shown to be due to recruitment of large proportion of muscle fibers. [22, 23] The duration of training required to obtain a physiological response is unclear, yet general studies show that it can be attained after 4 to 12 weeks of training. Similarly the benefits of training will be lost after 3-4 weeks of cessation. [21, 24] The physical military training, as in this study, in addition, might also cause strengthening of the respiratory muscles thereby increasing their pulmonary functions. [5, 15-17] Other factors that were thought to influence the results might be the type of instrument and the playing techniques. [5, 14, 25] So this may be factor why we had got significant different reading in both group.

During clarinet (reed-driven instrument) playing, the player's lips enclose the reed and the mouthpiece of the clarinet. When the blowing pressure exceeds the pressure that tends to close the reed against the mouthpiece, the reed begins to vibrate and thus causes oscillations in the airflow through the aperture between it and the mouthpiece into the instrument tube. [25] In contrast, trumpet is a lip-driven brass instrument where the lips take the place of the rid. During its playing, pressure in the player's mouth tends to open the lip which acts as a sound-generating valve. The muscle tension of the lips has to be adjusted constantly to match the mouth pressure and the pitch at varying notes. [3, 25]

Thus the lip muscles undergo early tiredness especially playing high notes for longer time during playing a trumpet than a clarinet. So a clarinet player can perform better for a longer time thus adding to the training effect than a trumpet player. [25]

ISSN: 0975-8585

CONCLUSION

Thus we came to a **conclusion** that the clarinet players had higher pulmonary functions than the trumpet players.

Limitations of the study

Our study was limited to the Spirometric pulmonary functions only. It should have been supported by other tests like measurement of mouth pressures during blowing (PImax & PEmax), EMG of respiratory muscles, etc.

REFERENCES

[1] Bouhuys A. J Appl Physiol 1964; 19:967-975.
[2] Papsin BC, Maaske LA, McGrail JS**.** Laryngoscope 1996**;** 106: 757-60.
[3] Berbenel JC, Kenny P, Davies JB. J Biomech 1988; 21:417-24.
[4] Chen FC, Weinreich g. J Acoust Soc Am 1996; 99:1227-33.
[5] Fiz JA, Aquilar J, Carreras A, Teixido A, Hara M, Morera J. Chest 1993; 104:1203-4.
[6] Puhan MA, Suarez A, Lo Cascio C, Zahn A, Heitz M, BraendLi O. BMJ 2006; 332:266-70.
[7] Kahane JC, Beckford NS, Chorna LB, Teachey JC, Meclelland DK. J Voice 2006; 20:297-307.
[8] Cossette I, Monaco P, Aliverti A, Mackem P. J Acoust soc Am 2008; 123: 3241.
[9] Cossette I. Rev Mal Respir 2002; 19:197-206.
[10] Lesnick SB, Teirstein AS, Brown LK ,Miller A. Chest 1985; 88:201-5.
[11] Gallivan GJ, Eitnier CM. J Voice 2006; 20(1):157 -64.
[12] Blackburn H, Brozek J, Taylor HL. An Intern Med 1958; 51:68-77.
[13] American Thoracic Society. Standardization of spirometry, 1987 up-date. Am Rev Respir Dis 1987; 136:1285-98.
[14] Gilbert TB. Md Med J 1998; 47:23-7.
[15] Cheng YJ, Macera CA, Addy Cl et al. Br J Sports Med 2003; 37(6):521-8.
[16] Munn NJ, Thomas SW, DeMesquita S. Chest 1990; 98:871-874.
[17] Zuskin E, Butkovic D, Schachter NE, Mustajbegovic J. Am J Industrial Med 2007; 23:835-844.
[18] Deniz O, Savci S, Tozkoparan E, Ince DI, Ucar M, Ciftci F. Arch Med Res 2006; 37:506-10.
[19] Kisner C, Colby LA. Management of pulmonary conditions. In, E.A.Davis (ed), Therapeutic Exercise Foundations and techniques, 5th ed, New Delhi Jaypee Brother 2007; 861-65.
[20] Pryor JA. Physiotherapy technique. In Jennifer A Pryor, S. Ammani Prasad (eds), Physiotherapy for respiratory & cardiac problems. 3rd ed. Churchill Livingstone Publication, Edinburgh, London 2004; 87-206.
[21] Brenda O'Neill, Bradley JM, Moran F. Exercise in the treatment of Respiratory diseases. In John Gormley, Juliette Hussey (eds), Exercise therapy : prevention and treatment of disease, 1st ed Oxford ; Malden, MA : Blackwell Publication 2005; 138-53.
[22] Hill K, Jenkins SC, Philippe DL, Shepherd KL, Hillman DR, Eastwood PR. Eur Respir J 2007; 30:479-86.

[23] Gareth W, Davison, Tony Ashton & Ciara M, Hughes. Exercise and Musculo-skeletal system. In John Gormley, Juliette Hussey (eds), Exercise therapy : prevention and treatment of disease, 1st ed Oxford ; Malden, MA : Blackwell Publication 2005; 40-47.
[24] Green RH, Singh SJ et al. A randomized controlled trial of 4 wks. verses 7 wks. of pulmonary rehabilitation in COPD; Thorax 2001; 56:143-5.
[25] Fletcher NH. Acoustics Australia 2000; 28:53-6.