Review

Lung function in wind instrument players

Maria Antoniadou,
Vasilios Michaelidis,
Venetia Tsara

2nd Chest Clinic, General Hospital,
G.Papanikolaou, Thessaloniki, Greece

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SUMMARY. 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. Playing wind instruments, however, involves increased intra-abdominal and intrathoracic pressures that may predispose to chronic respiratory, or other diseases and cerebrovascular events. This review summarizes the literature concerning the lung function of wind instrument players, the diseases related to wind instrument playing and the use of wind instruments for the prevention and therapy of chronic airway diseases such as obstructive sleep apnoea (OSA) syndrome and asthma. *Pneumon 2012, 25(2):180-183.*

INTRODUCTION

Wind instrument musicians perform respiratory exercises during both the performance of a musical passage and their repetitive musical practice, with special use of their expiratory muscles. Wind instrument players appear to have superior pulmonary function, which may be due to either their physical characteristics (talent), which help them to cope with the demands of playing the musical instrument or to their continuous respiratory muscle training. There is, however controversy about the lung function of wind instrument musicians, as some studies reveal greater mouth pressures or spirometric values[1,2,4], while others demonstrate no differences between wind instrument musicians and those playing other musical instruments[3]. Professional wind instrument playing and smoking in combination have been shown to predispose to respiratory diseases[5,6,10-15], but there is evidence on the therapeutic use of wind instrument playing in chronic lung diseases, such as obstructive sleep apnoea (OSA) and asthma[16,17,20,21].

Correspondence:
Tsara Venetia, MD, PhD
2nd Chest Clinic, General Hospital, G. Papanikolaou,
Thessaloniki, Greece
Tel.: +30 2313 307272,
e-mail: bpneumonologiki@yahoo.gr

RESPIRATORY FUNCTION IN WIND INSTRUMENT PLAYERS

Some studies have shown that wind instrument players have superior pulmonary function (i.e., spirometric values) compared with non-musicians or musicians playing other instruments[1,2]. These findings are in conflict with

those of Schorr-Lesnick *et al*[3], who studied 113 musicians (31 string or percussion instrumentalists, 48 wind instrumentalists and 34 singers), comparing spirometric values, maximum inspiratory and expiratory pressures, respiratory symptoms and awareness of health. No significant difference was observed between the 3 groups in spirometric results and peak inspiratory pressure, when corrected for body mass index (BMI), years of performing, smoking and respiratory symptoms. There was a higher awareness of health status among the singers, as reflected by their efforts to keep fit and smoke less. In a well-designed study, Fiz and colleagues[4] measured maximum mouth pressures and spirometric values in 22 young non-smokers who were experienced trumpet players (trumpet playing for at least 4 years) and 12 healthy untrained male subjects who participated as a control group. No differences in spirometric values were observed between the two groups, but PImax and PEmax were greater in trumpet players (PImax 151±19.8 vs 106.7±10.4 cmH_2O, $p<0.01$, PEmax 234.6±53.9 vs 189.6±14.6 cmH_2O, $p<0.001$). The increase in PEmax was related to years of performing with the wind instrument; trumpet players perform respiratory exercises against the high resistance of the instrument, using primarily their expiratory muscles. The training of the inspiratory muscles also, due to the rapid inspiration after a long expiration, that is necessary for trumpet playing, may explain the increase in PImax. A study[5] of 130 orchestra musicians (99 wind instrument players and 41 string instrument players) showed that the wind instrument players demonstrated a higher prevalence of respiratory symptoms (nasal catarrh, cough, sinusitis, hoarseness), which were, however, associated with smoking. The wind instrument players had significantly greater FEV_1 and FEF_{50} compared to predicted values, and this increase was correlated with their length of employment. In contrast, the spirometric values of Turkish musicians of a traditional wind instrument (zurna) demonstrated obstruction, but this was related to smoking and not to the duration of playing the instrument[6]. Each musical passage requires breath support through recruitment of specific inspiratory muscles according to the pitch, duration of music tone and type of wind instrument. There are over 90 different directives of breath support for singers and wind instrument students[7]. It is not clear if the respiratory centre has the ability to cope with the demands of each musical passage and the different ways of playing of wind instruments.

Respiratory sensation was assessed in 13 professional flute players and 13 age-matched control subjects with the same anthropometric characteristics[8]. Tidal volume and PImax were measured at rest and at different levels of total lung capacity, and the precision of volume and pressure achievement at recurrent efforts were estimated. The musicians were more precise, having a better 'memory' for recent respiratory events, probably because of the greater sensitivity of the respiratory centre to adducent triggers, due to the continuous training of respiratory and laryngeal muscles in players of wind instruments. The various studies that have evaluated the lung function of wind instrumentalists are summarized in Table 1. It ap-

TABLE 1. Lung function parameters in wind instrument players: Summary of published studies

	Year	Number of Subjects	Instrument	Respiratory measurements	Results	Limitations
BOUHUYS	1964	42	Woodwinds-brass	Spirometry	Increased VC	control group: non musicians
AKGUN	1967	17	Zurna	Spirometry	Reduced values	heavy smokers, small number
SCHORR-LESNICK	1985	48/34	Wind instrument/singers	Spirometry, mouth pressures	No differences	Methodology of respiratory tests
FIZ	1992	12	Trumpet	Spirometry, mouth pressures	Increased mouth pressures	One type of wind instrument only
COSSETTE	2008	13/13	Flute players/controls	Tv, VC, mouth pressures	Breathing control	Small number
ZUSKIN	2009	99/41	Wind instrument/singers	Spirometry (Flow-volume)	Increased FEV1	Methodology of respiratory tests
BROWN	2009	1,111	Wind instrument	Berlin questioner Risk of OSA	No differences	Diagnosis of OSA without PSG

OSA=obstructive sleep apnoea

pears that there is a disagreement in findings among the studies regarding the spirometric measurements in wind instrument players, which may be due to the methods used and the size of the samples.

CHRONIC DISEASES IN WIND INSTRUMENT PLAYERS

There are no documentated data to show that professional playing of a wind instrument predisposes to chronic diseases due to continuous strain of the respiratory system. Fuhrmann et al[9] studied the answers of 1,960 musicians (wind/brass and non-wind/brass) who completed the Respiratory Health Questionnaire. Asthma prevalence among musicians was similar to that in the overall population and asthma did not significantly affect either professional playing or the choice of instrument. A few cases of wind instrument musicians with lung cancer have been described, possibly attributed to the continuous distress of respiratory system[10]. The playing of wind instruments requires breathing large volumes of air, making the lung alveoli expand more than in other people. This could facilitate the penetrance of inhaled carcinogens into the cells of the lung epithelium and could be more harmful in smokers who play wind instruments. Recently, Metzger et al[11] and Metersky et al[12] reported two cases with hypersensitivity pneumonitis due to wind instruments contaminated by mold, mycobacteria and bacteria. Additionally, mycological sampling from the saxophones of 15 musicians showed fungal colonization in 13 of the 15[11], while fungal or mycobacterial colonization was found in all brass instruments that were examined in another study[12]. Increased intra-abdominal or intrathoracic pressure has been reported to be associated with haemoptysis, barotrauma, cerebrovascular events and loss of sight in wind instrumentalists[13,14]. In a study of 1,083 musicians, wind instrument players reported a higher prevalence of typical gastro-oesophageal reflux symptoms than players of other instruments[15].

SLEEP AND BREATHING OF WIND INSTRUMENT PLAYERS

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 of 847 professional musicians using the Berlin questionnaire, Ward and colleagues[16] showed that high resistance woodwind players had a lower risk of OSA than other instrumentalists. These findings suggest that the type of instrument (low or high resistance) and the pressure and airflow demands of playing reduce the risk of OSA by strengthening the oropharyngeal walls. Based on this theory, the hypothesis that the exercise of the upper airways by playing the didgeridoo may reduce daytime sleepiness in patients with moderate sleep apnoea was examined. The didgeridoo (Fig. 1) is a wind instrument of the indigenous Australians that is played by using a special breathing technique called circular breathing. This technique enables the wind instrumentalist to maintain a sound for long periods of time by inhaling through the nose and maintaining airflow through the instrument, while using the cheeks as bellows. It has been observed that didgeridoo playing for four months reduces daytime sleepiness, as assessed by the Epworth Sleepiness Scale

FIGURE 1. An Australian aboriginal man playing the didgeridoo. *(source: internet).*

(p<0.04) and the apnoea-hypopnoea index (AHI, p=0.05) in patients with moderate OSA (AHI:15-30) compared with a control group[17]. In contrast to previous reports, Wardrop et al[18] demonstrated no significant differences in snoring severity and daytime sleepiness betweeen brass/wind players and other professional orchestral musicians, but this may be because of the low levels of snoring and daytime sleepiness in this population. Brown and colleagues[19] studied the risk of sleep apnoea in 1,111 professional orchestra members, including 369 wind instrument players, according to their answers to Berlin questionnaire. Wind instrument musicians were mainly males and they had higher BMI than the rest of musicians. There was no significant difference in the incidence of OSA between wind instrument players and the rest of the members of the orchestra.

WIND INSTRUMENT MUSIC AS A THERAPY FOR CHRONIC RESPIRATORY DISEASES

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*[20] showed that teenagers with asthma who play a wind instrument have better control of their asthma. They examined 18 teenagers with asthma, 8 of whom were wind instrument players and 10 non-wind instrument players and found that the first group had fewer bronchoconstrictive symptoms, panic-fear responses and changes of mood than the non-wind instrument players. In Australia an asthma management programme includes the teaching of wind instruments to children. A significant improvement in their respiratory function and a trend towards improvement in their quality of life were observed in schoolboys participating in the programme after playing the didgeridoo for 6 months[21].

CONCLUSIONS

Few studies have been reported, with conflicting results, regarding the impact of professional wind instrument playing on respiratory function and its association with respiratory symptoms and chronic disease, mainly because of the small numbers of wind instrument musicians and the variety of instruments. Larger studies, with greater statistical strength, are needed to investigate these issues and also to evaluate the therapeutic use of wind instrument playing for chronic respiratory diseases.

REFERENCES

1. Bouhuys A. Lung volumes and breathing patterns in wind instrument players. J Appl Physiol 1964; 19:967-75.
2. Strauffer DW. Physical performance, selection and training of wind instrument players. Ann NY Acad Sci 1968-9; 155:284-89.
3. Schorr-Lesnick B, Teirstein AS, Brown LK, Miller A. Pulmonary function in singers and wind-instrument players. Chest 1985; 88:201-5.
4. Fiz JA, Aguilar J, Carreras A et al. Maximum respiratory pressures in trumpet players. Chest 1993; 104:1203-4.
5. Zuskin E, Mustajbegovic J, Schachter EN et al. Respiratory function in wind instrument players. Med Lav 2009; 100:133-41.
6. Akgün N, Ozgönül H. Lung volumes in wind instrument (zurna) players. Am Rev Respir Dis 1967; 96:946-51.
7. Cossette I, Monaco P, Aliverti A, Macklem PT. Chest wall dynamics and muscle recruitment during professional flute playing. Respir Physiol Neurobiol 2008; 160:187-95.
8. Smith J, Kreisman H, Colacone A, Fox J, Wolkove N. Sensation of inspired volumes and pressures in professional wind instrument players. J Appl Physiol 1990; 68:2380-3.
9. Fuhrmann A, Wijsman S, Weinstein P, Poulsen D, Franklin P. Asthma Among Musicians in Australia: Is There a Difference Between Wind/Brass and Other Players? Med Probl Perform Art 2009; 24:170.
10. Ruano-Ravina A, Figueiras A, Barros-Dios JM. Musicians playing wind instruments and risk of lung cancer: is there an association? Occup Environ Med 2003; 60:143.
11. Metzger F, Haccuria A, Reboux G, Nolard N, Dalphin JC, De Vuyst P. Hypersensitivity pneumonitis due to molds in a saxophone player. Chest 2010; 138:724-6.
12. Metersky ML, Bean SB, Meyer JD et al. Trombone player's lung: a probable new cause of hypersensitivity pneumonitis. Chest 2010; 138:754-6.
13. Kreuter M, Kreuter C, Herth F. Pneumological aspects of wind instrument performance--physiological, pathophysiological and therapeutic considerations. Pneumologie 2008; 62:83-7.
14. Evers S, Altenmüller E, Ringelstein EB. Cerebrovascular ischemic events in wind instrument players. Neurology 2000; 55:865-7.
15. Cammarota G, Masala G, Cianci R et al. Reflux symptoms in wind instrument players. Aliment Pharmacol Ther 2010; 31:593-600.
16. 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.
17. Puhan MA, Suarez A, Lo Cascio C, Zahn A, Heitz M, Braendli O. Didgeridoo playing as alternative treatment for obstructive sleep apnoea syndrome: randomised controlled trial. BMJ 2006; 332:266-70.
18. Wardrop PJ, Ravichandran S, Hair M, Robertson SM, Sword D. Do wind and brass players snore less? A cross-sectional study of snoring and daytime fatigue in professional orchestral musicians. Clin Otolaryngol 2011; 36:134-8.
19. Brown DL, Zahuranec DB, Majersik JJ et al. Risk of sleep apnea in orchestra members. Sleep Med 2009; 10:657-60.
20. Lucia R. Effects of playing a musical wind instrument in asthmatic teenagers. J Asthma 1994; 31:375-85.
21. Eley R, Gorman D. Music Therapy to Manage Asthma. Aborig Isl Health Work J 2008; 32:9-10.