Lung function in wind instrument players

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 values1,2,4, while others demonstrate no differences between wind instrument musicians and those playing other musical instruments3.

Professional wind instrument playing and smoking in combination have been shown to predispose to respiratory diseases5,6,10-15, but there is evidence on the therapeutic use of wind instrument playing in chronic lung diseases, such as obstructive sleep apnoea (OSA) and asthma16,17,20,21.

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 instruments1-2. These findings are in conflict with
those of Schorr-Lesnick et al., 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 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 cmH2O, p<0.01, PEmax 234.6±53.9 vs 189.6±14.6 cmH2O, 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 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 FEV1 and FEF50 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. 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. 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. 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>
<thead>
<tr>
<th>Year</th>
<th>Number of Subjects</th>
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<th>Respiratory measurements</th>
<th>Results</th>
<th>Limitations</th>
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</thead>
<tbody>
<tr>
<td>BOUHUY</td>
<td>1964</td>
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<td>Woodwinds-brass</td>
<td>Spirometry</td>
<td>Increased VC</td>
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<tr>
<td>AKGUN</td>
<td>1967</td>
<td>17</td>
<td>Zurna</td>
<td>Spirometry</td>
<td>Reduced values</td>
</tr>
<tr>
<td>SCHORR-LESNICK</td>
<td>1985</td>
<td>48/34</td>
<td>Wind instrument/singers</td>
<td>Spirometry, mouth pressures</td>
<td>No differences</td>
</tr>
<tr>
<td>FIZ</td>
<td>1992</td>
<td>12</td>
<td>Trumpet</td>
<td>Spirometry, mouth pressures</td>
<td>Increased mouth pressures</td>
</tr>
<tr>
<td>COSSETTE</td>
<td>2008</td>
<td>13/13</td>
<td>Flute players/controls</td>
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</tr>
<tr>
<td>ZUSKIN</td>
<td>2009</td>
<td>99/41</td>
<td>Wind instrument/singers</td>
<td>Spirometry (Flow-volume)</td>
<td>Increased FEV1</td>
</tr>
<tr>
<td>BROWN</td>
<td>2009</td>
<td>1,111</td>
<td>Wind instrument</td>
<td>Berlin questioner Risk of OSA</td>
<td>No differences</td>
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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 documented 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 looked into 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 the respiratory system. 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. and Metersky et al. 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, while fungal or mycobacterial colonization was found in all brass instruments that were examined in another study. Increased intra-abdominal or intrathoracic pressure has been reported to be associated with haemoptysis, barotrauma, cerebrovascular events and loss of sight in wind instrumentalists. 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.

**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 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 (AHl, p=0.05) in patients with moderate OSA (AHl:15-30) compared with a control group17. In contrast to previous reports, Wardrop et al18 demonstrated no significant differences in snoring severity and daytime sleepiness between 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 colleagues19 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 al20 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 months21.

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