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Original Article

Estimation of Lung Functions and Risk of Developing Obstructive Sleep Apnoea in Wind Instrument Players

Rajam Krishna Subramanian[1]*, P. Saikumar[1], Silas Danielraj Joshua[2], P.R. Devaki[1] and L. Jagadeesh Marthandam[3]

[1]Department of Physiology,
Sree Balaji Medical College and Hospital,
Chennai, Tamil Nadu – 600 044 (India)

[2]III MBBS Student, Sree Balaji Medical College and Hospital,

[3]Department of Otorhinolaryngology,
Chettinad Medical College and Hospital,
Chennai, India

Abstract

Introduction: Decreased incidence of snoring and obstructive sleep apnoea in wind instrument players has been shown by a few studies, probably due to an increased tone of respiratory muscles. Hence their lung functions were evaluated and their risk of developing Obstructive sleep apnoea was assessed.

Methodology: Test subjects (n=64) belonged to high resistance wind instrument category and controls (n=65) included subjects who did not play any form of wind instrument. Based on Berlin questionnaire subjects were divided into high or low risk. Lung functions were evaluated and statistical analysis was done using student t test and chi square test.

Results: There was no difference in MVV values (P=0.63) between the tests and controls. More number of test group subjects belonged to the low risk group as compared to the controls (P=0.000*) according to the Berlin scores. Pearson's correlation showed no association between MVV and Berlin score (r=0.062, P=0.63).

Conclusion: There is no association between improved lung functions and reduced risk of developing OSA although OSA risk is reduced in wind instrument players. Hence wind instrument playing may be considered as an option to reduce the risk or treat obstruction in sleep apnoea.

***Corresponding author :**

Dr. Rajam Krishna Subramanian, Assistant Professor, Dept. of Physiology, Sree Balaji Medical College and Hospital, Chromepet, Chennai – 600 044, Tamilnadu, India
E-mail ID: rajamcv@yahoo.com

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Introduction

Obstructive sleep apnoea is a condition characterized by snoring, sleep apnoea and day time sleepiness (1, 2) and it is also associated with various disorders like stroke, hypertension, coronary artery disease

etc. (3-7). It is a common condition caused due to floppiness of the upper airway (8, 2). It is frequently suspected in many snorers but left undiagnosed and untreated (9), especially in developing countries like India because of the costs involved in the diagnostic and therapeutic procedures. But the prevalence of Obstructive sleep apnoea in India is 13.7% according to a previous study (10). Another study from India has reported a prevalence of 9.3% (11) and both the studies are from North India. According to another study the prevalence of OSA is similar in both Indian and western population (12).

It is still not clear as to what exactly leads to this floppiness. Upper airway collapsehas been postulated as a reason for OSA (8, 2). Upper airway muscles are kept patent during sleep inspite of muscle atonia which occurs in REM sleep. The pharyngeal and other upper airway muscles are found to be tonically active during sleep which helps in keeping the upper airway dilated and partially patent. The tone of these pharyngeal muscles is also modified by chemoreceptor reflex mechanisms. Snoring leads to trauma to upper airway muscles and results in denervation of these muscles thereby rendering them ineffective to respond to negative airway pressure during deep inspiration (2, 13, 14).

In one of the studies done in western countries, playing of wind instruments was used as a therapeutic measure in snorers and sleep apnoeic patients and they have shown promising results (15). The reason postulated for the decreased incidence of snoring and sleep apnoea in wind instrument players is an increased tone of respiratory muscles thereby preventing the collapse of the upper airway. Some of the studies have shown that wind instrument players have better lung functions compared to other musicians including vocalists inspite of increased incidence of chronic upper airway problems in them while other studies have reported controversial results (16-19).

Hence in this study we decided to study the lung functions in wind instrument players and then assess their risk of developing Obstructive sleep apnoea with the idea of studying the relationship between the two. The management of obstructive sleep apnoea includes surgical correction and continuous positive airway pressure (CPAP) (20). Also the diagnosis involves polysomnography which is really cumbersome for the patient. Hence OSA is left undiagnosed and untreated inspite of increasing prevalence of OSA in our community. Therefore this study hypothesis if proven can serve as a simple and cheap procedure which can be advocated to all snorers to reduce the risk of developing Obstructive sleep apnoea in them.

Methodology

This is an experimental study and was approved by the Institutional ethical committee. Subjects were mainly from villages in and around Madurai. It was decided to study 100 wind instrument players and equal number of controls at the start of the study. But due to time constraint and lack of consent from wind instrument players in and around Chennai the study was performed only in 64 subjects in test group and 65 subjects in control group. Most of the test group subjects belonged to the nathasvaram category, a high resistance wind instrument and they have been playing the instrument for nearly more than ten years. A few of them belonged to trumpet and clarinet category (Table I). Control group included subjects who did not play any form of wind instrument and singers were also excluded from the control group.

TABLE I: Type of wind instrument and number of subjects playing each.

Nathasvaram	*Trumpet*	*Clarinet*
45	10	10

n=65

All the subjects were asked to fill up the study questionnaire which also included the Berlin questionnaire after obtaining their written informed consent to take part in the study. Berlin questionnaire is a standardised questionnaire used for assessing the risk of obstructive sleep apnoea in community studies which assesses the risk based on three categories- snoring, day time sleepiness and presence of hypertension (21, 22).

Based on the scores the subjects were divided into either high risk or low risk.

High risk: Two or more categories positive

Low risk: One or no category positive

Category 1 is positive when the score is two or more

Category 2 is positive when the score is two or more

Category 3 is positive if the answer to question 10 is YES

Lung functions were evaluated using the Helios spirometer and analyzed using RMS polyrite software.

Statistical analysis was done using SPSS software version 11, Minitab and MS excel. Student t test was done to compare the means of the pulmonary function tests of the two groups and chisquare test was done using Minitab to study the difference between tests and controls' risk of developing Obstructive sleep apnoea. Box plots were done using SPSS software to analyze the distribution of data.

Null hypothesis of this study was "There is no difference between the pulmonary function tests and the risk of obtaining obstructive sleep apnoea in both the test and control groups."

Results

Of the spirometric values percentage predicted FVC, FEV1, FEV1/FVC, MVV were used for analysis. Results are presented as mean±SD. Box plots were done to analyze the distribution of these values about the mean (Figs. 1, 2). It is seen from the box plots that there is not much difference between the test and control mean values and their distribution looks similar. Statistical tests were done using student t test and p values are presented in Table-IIA. It is seen that the mean FEV1, FEV1/FVC were reduced in tests as compared to controls though statistical significance was seen only in FEV1/FVC ratio. Mean FVC value is significantly higher in tests compared to controls. MVV values were almost same in tests and controls and both of them show high scores. Subgroup analysis was also done to find out the difference between smokers and non-smokers in both the tests and controls (Table-IIB) and statistical test,

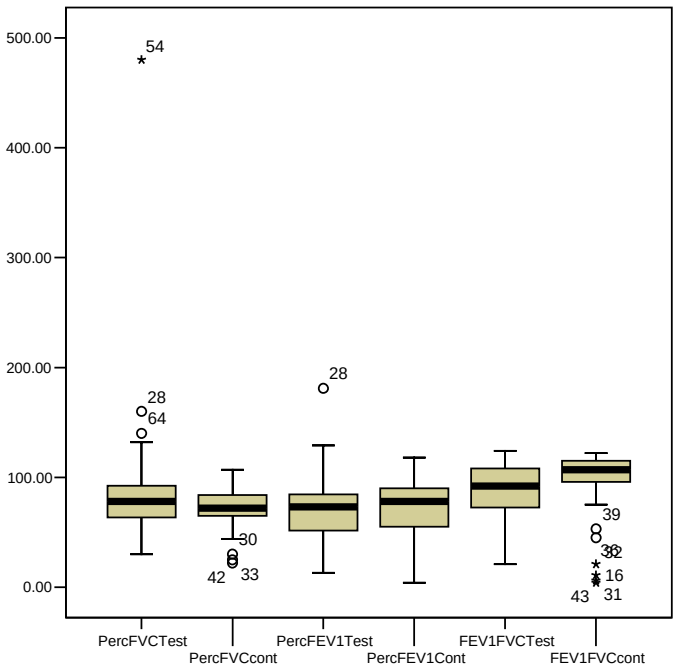

Fig. 1: Box plots showing the distribution of percentage predicted FVC, FEV1, FEV1/FVC values of both tests and controls (circles indicate the outliers).

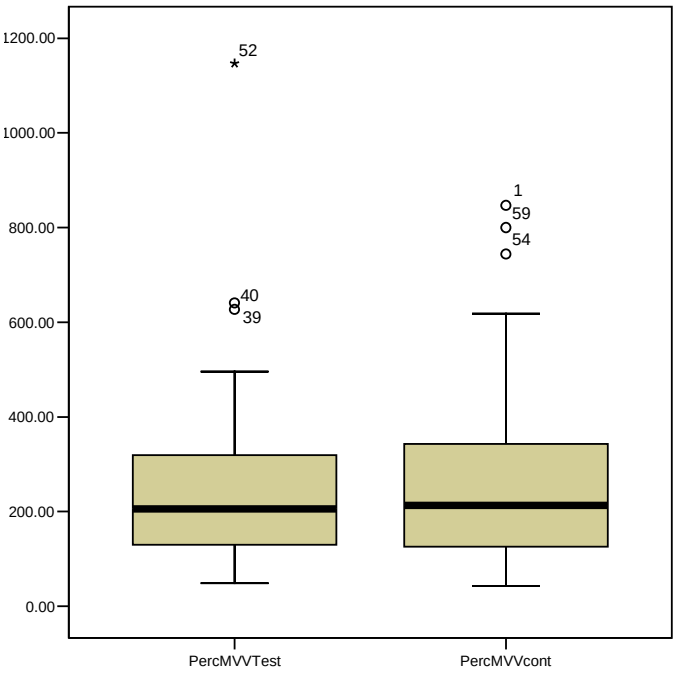

Fig. 2: Box plots showing the distribution of percentage predicted MVV values of tests and controls (circles indicate the outliers).

ANOVA with post hoc analysis (Bonferroni correction) was done but significance was obtained only between FVC in smoker-test and non-smoker test (0.007), smoker-control and non smoker-test (0.005), non smoker-test and non smoker-control (0.004). Though significance was not obtained for FEV1/FVC in smoker-test and non smoker-test (0.08) it was close to 0.05 in the post hoc test. Scoring was done using the Berlin questionnaire for the risk of developing OSA and the subjects were divided into either low risk or high risk and the results are tabulated (Table-III). It is seen that more number of test group subjects belonged to the low risk group as compared to the controls (Fig. 3 and 4). Chisquare test was

TABLE IIA : Mean PFT values of wind instrument players and controls.

Parameters	*Percent predicted FVC-test*	*Percent predicted FVC-control*	*Percent predicted FEV1-test*	*Percent predicted FEV1-control*	*Percent predicted FEV1/FVC-test*	*Percent predicted FEV1/ FVC-control*	*Percent predicted MVV-test*	*Percent predicted MVV-control*
Mean	86.7± 55.63	72.37±17.21	71.02±28.21	72.46±25.62	88.02±26.06	99.28±27.44	248.31±180.41	263.97±186.70
Student t test		0.05*		0.76		0.02*		0.63

*Indicates p<0.05; n=64 in test group and 65 in control group.

TABLE IIB : Mean PFT values of smokers and non smokers in tests and controls.

Parameter	*Test*		*Control*	
	Smokers	*Non-smokers*	*Smokers*	*Non-smokers*
FVC (ml)	75.57±23.22	111±90.12	73.37±14.23	71.2±20.33
FEV1	68.43±27	76.7±30.65	75.66±21.78	68.73±29.43
FEV1/FVC	90.82±24.44	81.85±29.01	100.46±25.56	97.9±29.87
MVV	212.4±113.63	323.7±260.39	250.14±153.04	280.1±221.27
Low Risk of developing OSA	42	17	19	17
High Risk of developing OSA	3	2	16	13

TABLE III : Number of OSA high and low risk subjects using the Berlin questionnaire.

Risk of developing OSA	*Tests*	*Controls*
Low risk	58	36
High risk	5	29

P=0.001* (n=63 in test group and 65 in control group).

TABLE IV : Number of smokers and non smokers in tests and controls.

Smoking status	*Tests*	*Controls*
Smokers	44	35
Non smokers	19	30

P=0.063 (n=64 in test group and 65 in control group).

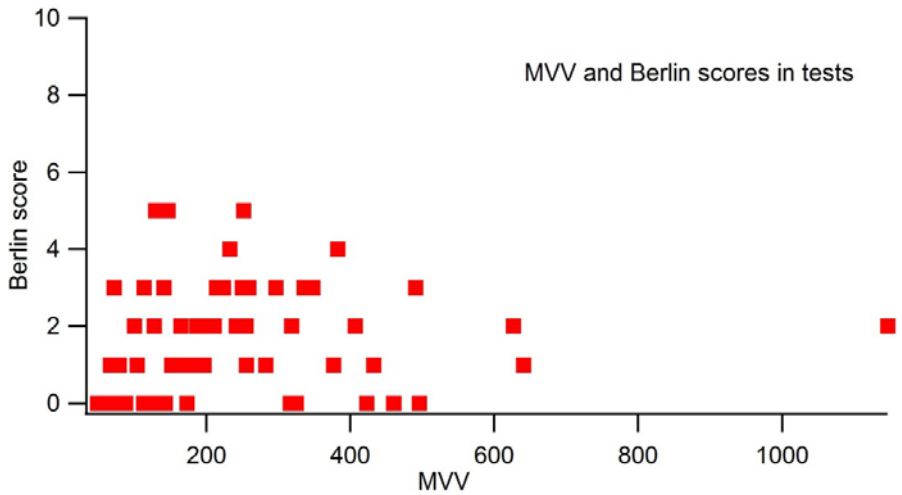

Fig. 3 : Graph showing percentage predicted Maximum voluntary ventilation against Berlin scores in test subjects.

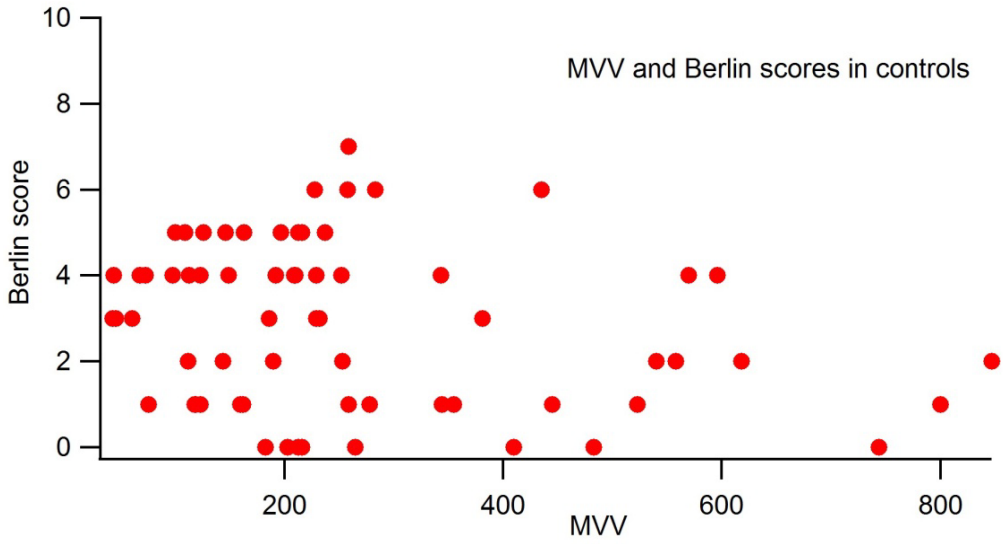

Fig. 4: Graph showing percentage predicted Maximum voluntary ventilation against Berlin scores in control subjects.

done to compare the scores of both the tests and controls (Table-III) and significant difference was observed between them (p=0.000*). Chisquare test was also done for comparing the smoking status in tests and controls and it is seen that though statistical significance (p=0.06) was not obtained there is a higher number of smokers in tests as compared the controls (Table-IV). Pearson's correlation was done to study the association between MVV which is an indicator of respiratory endurance and Berlin score and there was found to be no association (r=0.062, p=0.63) between the two. Relative risk (RR) for our study is 0.18 and the 95% confidence interval for the RR is 0.07-0.43.

Discussion

The results clearly show that wind instrument players do not have better lung functions compared to controls but they have low risk of developing obstructive sleep apnoea (Table-II and Table-III). Though they have a reduced FEV1/FVC values as compared to controls their mean values fall within normal range (Table-II). The controls show better pulmonary functions as compared to tests probably because of the less number of smokers in controls (Table-IV). Though there are studies which show conflicting results of pulmonary functions in wind instrument players majority of them have concluded there is not much difference in pulmonary functions of wind instrument players as compared to controls (16-19).

Inspite of no difference in lung functions the risk of developing OSA is reduced in wind instrument players compared to controls (Table-III) and this shows lower airways have nothing to do to decrease the risk of OSA in wind instrument players. Relative risk less than one indicates less risk of developing OSA in the wind instrument players compared to controls. There are only a few Western studies which have analysed the risk of developing OSA in wind instrument players and have shown conflicting results (23, 24). One study concluded nil association between wind instrument playing and lesser risk of OSA (23) whereas the other study showed lesser risk of OSA especially in musicians playing high resistance wind instruments (24) and this they attribute to the different sequence of movements of the muscles associated with the different types of instruments.

It has been also shown in a previous study that there is no correlation between decreased lung functions and risk of developing OSA (25). This study also shows that lung functions and OSA are not related and are independent of each other. But what could be the reason for reduced risk of developing OSA in the wind instrument players? The lower risk may be due to the fact that wind instrument players

have an increased tone of upper airway muscles as a result of training thereby preventing collapse of the upper airway (24). Studies have shown that per cutaneous electrical neuromuscular stimulation of the genioglossus resulted in increased diameter of the hypopharyngeal airway thereby reducing snoring (26, 27). Oropharyngeal exercises have been shown to improve the tone of upper airway muscles and reduce the risk of OSA (28). One of the studies also shows that a few months of training with didgeridoo wind instrument resulted in reduced OSA symptoms (15).

Therefore wind instrument playing has a lower risk of developing OSA by improving the tone of upper airway muscles.

Conclusion

There is no association between improved lung functions and reduced risk of developing OSA. At the same time OSA risk is reduced in wind instrument players as a result of increased tone of upper airway muscles. Hence wind instrument playing may be considered as an option to reduce the risk or treat obstruction in sleep apnoea.

Limitations of the study and future plans

This study couldn't exclude the smokers in both the groups because of the limited number of subjects willing to participate and also due to time constraint. Also people from different socio economic background were not studied. The sample size should have been much bigger but due to time constraint it was kept small.

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References

1. McNicholas WT. Diagnosis of Obstructive sleep apnoea in adults. *Proc Am Thorac Soc* 2008; 5: 154–160.
2. M Casale, M Pappacena, V Rinaldi, F Bressi, P Baptista, F Salvinelli. Obstructive sleep apnea syndrome: from phenotype to genetic basis. *Curr Genomics* 2009; 10: 119–126.
3. Artz M, Young T, Finn L, et al. Association of sleep-disordered breathing and the occurrence of stroke. *Am J Respir Crit Care Med* 2005; 172: 1447–1451.
4. Dopp JM, Reichmuth KJ, Morgan BJ. Obstructive sleep apnea and hypertension: mechanisms, evaluation, and management. *Curr Hypertens Rep* 2007; 9: 529–534.
5. Peppard PE, Young T, Palta M, Skatrud J. Prospective study of the association between sleep-disordered breathing and hypertension. *N Engl J Med* 2000; 342: 178–184.
6. Shahar E, Whitney CW, Redline S, et al. Sleep-disordered breathing and cardiovascular disease: cross-sectional results of the Sleep Heart Health Study. *Am J Respir Crit Care Med* 2001; 163: 19–25.
7. Peker Y, Kraiczi H, Hedner J, Loth S, Johansson A, Bende M. An independent association between obstructive sleep apnoea and coronary artery disease. *Eur Respir J* 1999; 14: 179–184.
8. Fleury B, Hausser-HauwC, Chabolle F. Obstructive sleep apnea syndrome and the upper airway muscles. *Rev Neurol (Paris)* 2001; 157: S72–S77.
9. Gibson GJ. Obstructive sleep apnoea syndrome: underestimated and under treated. *Br Med Bull* 2005; 72: 49–65.
10. Surendra K Sharma, Gautam Ahluwalia. Epidemiology of adult Obstructive sleep apnoea syndrome in India. *Indian J Med Res* 2010; 131: 171–175.
11. Reddy EV, Kadhivaran T, Mishra HK, et al. Prevalence and risk factors of obstructive sleep apnoea among middle-aged urban Indians: A community-based study. *Sleep Med* 2009; 10: 913–918.
12. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. *N Engl J Med* 1993; 328: 1230–1235.
13. Kimoff RJ, Sforza E, Champagne V, Ofiara L, Gendron D. Upper airway sensation in snoring and obstructive sleep apnea. *Am J Respir Crit Care Med* 2001; 164: 250–255.
14. Friberg D, Gazelius B, Hökfelt T, Nordlander B. Abnormal afferent nerve endings in the soft palatal mucosa of sleep apnoics and habitual snorers. *Regul Pept* 1997; 71: 29–36.
15. Milo A Puhan, Alex Suarez, Christian Lo Cascio, et al. Didgeridoo playing as alternative treatment for obstructive sleep apnoea syndrome: randomised controlled trial. *BMJ* 2006; 332: 266.
16. Arend Bouhuys. Lung volumes and breathing patterns in wind instrument players. *J Appl Physiol* 1964; 19: 967–975.
17. Schorr-Lesnick B, Teirstein AS, Brown LK, Miller A.Pulmonary functions in singers and wind instrument players. *Chest* 1985; 88: 201–205.
18. Zuskin E, Mustajbegovic J, Scachter EN. Respiratory function in wind instrument players. *Med Lav* 2009; 100: 133–141.

19. Mario Antoniadou, Vasilios, Michaelidis, Venetia Sara. Lung functions in wind instrument players. *PNEUMON* 2012; 25: 180–183.
20. Craig A Hukins. Obstructive sleep apnea – management update. *Neuropsychiatr Dis Treat* 2006; 2: 309–326.
21. Netzer NC, Stoohs RA, Netzer CM, Clark K, Strohl KP. Using the Berlin Questionnaire to identify patients at risk for the sleep apnea syndrome. *Ann Intern Med* 1999; 131: 485–491.
22. Sharma SK, Vasudev C, Sinha S, Banga A, Pandey RM, Handa KK. Validation of the modified Berlin questionnaire to identify patients at risk for the obstructive sleep apnoea syndrome. *Indian J Med Res* 2006; 124: 281–290.
23. Brown DL, Zahuranec DB, Majersik JJ. Risk of sleep apnoea in orchestra members. *Sleep Med* 2009; 10: 657–660.
24. Ward CP, York KM, McCoy JG. Risk of Obstructive sleep apnoea lower in double reed wind musicians. *J Clin Sleep Med* 2012; 8: 251–255.
25. Sharma B, Feinsilver S, Owens RL. Obstructive airway disease and obstructive sleep apnoea: effect of pulmonary function. *Lung* 2011; 189: 37–41.
26. Mann EA, Burnett T, Cornell S, Ludlow CL. The effect of neuromuscular stimulation of the genioglossus on the hypopharyngeal airway. *Laryngoscope* 2002; 112: 351–628.
27. Randerath WJ, Galetke W, Domanski U, Weitkunat R, Ruhle KH. Tongue-muscle training by intraoral electrical neurostimulation in patients with obstructive sleep apnea. *Sleep* 2004; 27: 254–259.
28. Guimarães KC, Drager LF, Genta PR, Marcondes BF, Lorenzi-Filho G. Effects of oropharyngeal exercises on patients with moderate obstructive sleep apnea syndrome. *Am J Respir Crit Care Med* 2009; 179: 962–966.