RESEARCH ARTICLE

PEAK EXPIRATORY FLOW RATE IN INDIAN FEMALE CLASSICAL SINGERS

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ABSTRACT

Aim: To assess the Peak Expiratory Flow Rate in Indian Female Classical Singers. *Need of study*: As singers have better respiratory fitness there is need to see whether the peak expiratory flow rate in them is also higher, lower, or the same. Whether, the singing which is an expiratory activity affects expiratory flow rate. *Study Design*: Cross Sectional Study. *Procedure*: Ethical approval was taken. Total 101 Indian female classical singers were selected according to inclusion and exclusion criteria. Informed consent was obtained. Procedure was explained to them, PEFR was recorded in sitting position, and best of 3 reading were taken. Predicted PEFR were calculated from standard equation and data was analyzed for result. *Result*: Stastical analysis was done which shows that actual PEFR of female classical singers was more than their predicted value but it was not Stastically Significant. *Conclusion:* We concluded that the actual PEFR in Indian female classical singers is more than their predicted value and PEFR increases according to the experience of singing.

INTRODUCTION

Indian classical singing consists of Carnatek music and Hindustani music. Indian classical singers have a better, breath holding capacity and lung capacity. For, quality of performance breath control is taught to singers without expulsion of air the vocal cord can't vibrate and without vibration sound can't be produced (Shweta Phadke *et al.,* 2015). For singers to have sustained longer nodes, relaxed and steady expiration is recommended. The expiration rate is vary according to their lung capacity, age, gender, and respiratory fitness (Shweta Phadke *et al.,* 2015). Hindustani music conclude that all aspects of raga, while Carnatek music performances tend to be short and composition based (Adman Lewis and Phoene Cave, 2016). The classical music has two foundation elements raga and tala. The raga forms the fabric of a melodic structure, while tala measures time cycle (Adman Lewis and Phoene Cave, 2016). Classical singing has a lighter, clearer texture than other music and is less complex. It is mainly homophonic, but counterpart was by no means forgotten, especially later in the period of life. It helps to improved flexibility of respiratory muscles (Sauro Salomoni *et al.,* 2016). The classical style also includes unexpected pause, syncopations and frequency of changes from longer notes to shorter notes and the changes from one pattern of note length to another may be either sudden or gradual (Jeanette Templin *et al.,* 2013). Active control of breathing pattern affect the efficiency of the respiratory system and is considered essential singing training for the development of optimal voice performance singers commonly used abdominal muscles in during singing to improved respiratory control and tone of quality (Anjali Kulkarni *et al.,* 2013). Abdominal muscle activation, which elevates intra-abdominal pressure and expend the rib cage, thus increasing the length and the pressure generating capacity of the rib cage expiratory muscles (Anjali Kulkarni *et al.,* 2013). Respiratory kinematics has been suggested that, during singing classical singers contract abdominal muscles at the end of the inspiration phase it produced by inward movement of abdomen muscles. The passive recoil of chest wall and lungs in preparation of efficient expiratory airflow (Anjali Kulkarni *et al.,* 2013). During, phonation contracted abdominal muscles prevent shortening of diaphragm and provides the opposing force required for the rib cage to developed strong subglottal pressure in order to increase sound pitch and loudness (Skingley *et al.,* 2013). The independent and asynchronous movement between the ribcage and abdominal wall result in lung volume change, increased volume of ribcage during expiration phase of breath cycle (Skingley *et al.,* 2013). Singing often involves holding notes without taking extra breath. And proper breathing is an important aspect of singing. It applied pressure over vocal cord to vibrate (Anandita singha Roy and Amit Bandyopadhyay, 2015). So the singing play important role in mechanism of breathing, mechanism of expiratory flow rate and the mechanisms of respiratory fitness (Sand *et al.,* 2015). As singers have better respiratory fitness there is need to see whether the peak expiratory flow rate in them is also higher, lower, or the same. Whether, singing which is an expiratory activity affects expiratory flow rate.

MATERIALS AND METHOS

Present study is an cross sectional study with sample size of 101 Indian female classical singers with age group 25 to 45 years and singers practicing for at least six years continuously. Subjects were enrolled in the study from singing institutes with their prior informed consent. Subjects with recent abdominal surgeries, known respiratory diseases and those who were not

able to perform the maneuver were excluded from the study. Ethical approval was taken from Institutional Ethical Committee. Procedure of measuring PEFR was explained to subjects. PEFR was recorded in sitting position and best of three readings was recorded. Predicted PEFR was calculated by from standard equation. Data was analyzed for result.

RESULTS

The above graph depicts the predicted and actual PEFR difference of female Indian classical singers. We have taken a total of 101 samples, where their predicted value was obtained which was calculated by the formula: PEFR= -1.454(AGE) +2.368(HEIGHT). Later the actual PEFR was obtained with the help of Peak Flow Meter. The obtained readings are mentioned in the above graph, where X- axis shows the total number of female classical singers versus Y- axis which contains the values of PEFR obtained by calculating the actual and predicted values.

The blue colored longitudinal bars depicts the predicted PEFR whereas the orange graph line depicts the actual PEFR. We also calculated the mean and the STDV by using paired T-test, through this test the mean of both predicted PEFR values and actual PEFR values were obtained where predicted mean is 329.1 and the actual mean is 337.9. The result so obtained shows that the mean of the actual PEFR values are more than the predicted PEFR values. The difference between the predicted and actual mean is 8.84. The STDV of both predicted PEFR values and actual PEFR values were obtained where STD predicted is 17.13 and the actual STDV is 48.3. The result so obtained shows that STDV of actual is more than predicted PEFR. The difference between the predicted and Actual and predicted STDV is 50.6. Also, we tried to find correlation in year of singing with PEFR and it has correlation with predicted value. In the above graph, the X- axis shows the experience of singing while the y axis shows the percentage of PEFR. The actual PEFR of classical singers was more than their predicted value though it was not stastically significant, clinically it was significant.

Table 1.

	N	Mean	S.D	T- value	P-value
Predicted value	101	329.1	17.13	1.756	0.082
Actual value	101	337.9	48.3		
Diffrence		8.84	50.6		
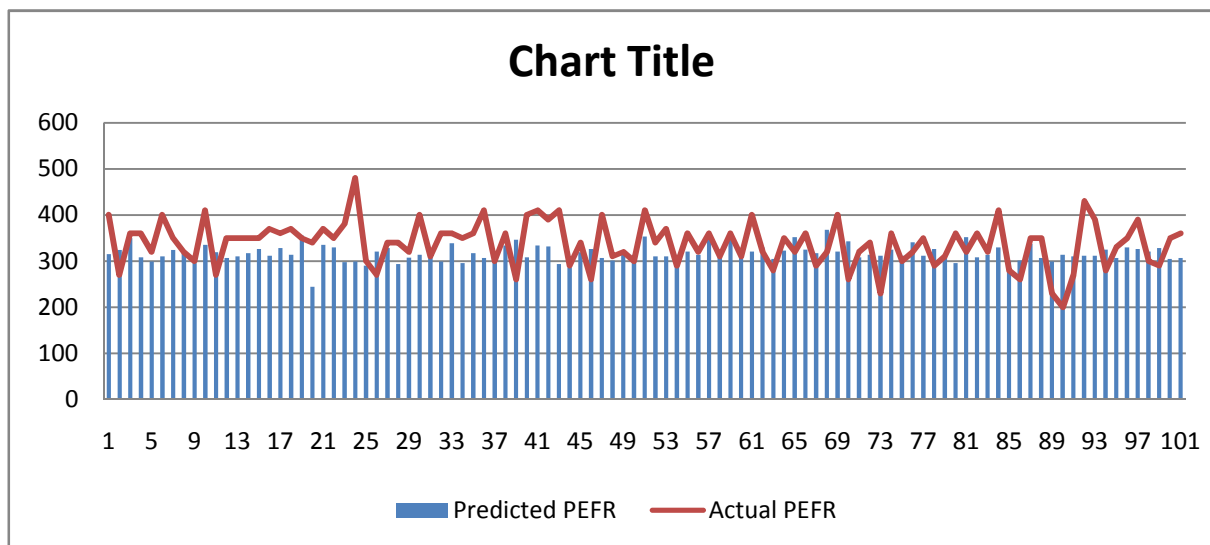
Figure 1.
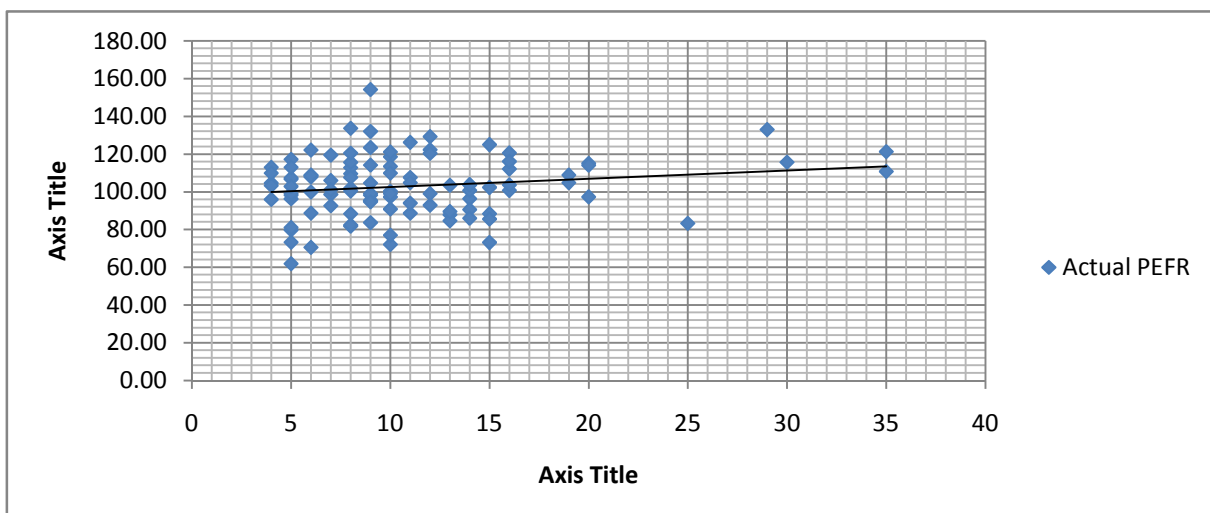
Figure 2.

DISSCUSSION

Classical singing has lighter, clearer texture than the other music, is less complex and is homophonic. It helps to improve the flexibility of respiratory muscles. The styles included in classical singing are unexpected pause, syncopation and frequency of changes from longer notes shorter notes and the changes from one pattern of note length to another may be either sudden or gradual. Classical singers have better lung and breathe holding capacity. For singers to have sustained longer notes relaxed, steady and prolonged expiration is recommended. The expiration rate varies according to their age, height, weight and respiratory capacity. In our study the predicted PEFR is measured according to their age, height and weight, while the actual value is measured using a peak flow meter where they were asked to breathe in, hold and expire with maximum effort. It was seen that the PEFR values were higher than their predicted values though statistically not significant. The mean value of actual PEFR was higher than mean Predicted value. During the active expiration, the abdominal wall muscles contract which in turn forms the elastic recoil of the thoracic wall hence the forceful expiration requires more elasticity of lung. In expiration activity all the abdominal muscles lowers the rib cage and adds on to the forceful expiration, so the abdominal muscle activates during expiration which elevates the intra-abdominal pressure and expands the rib cage. The mechanism of singing in singers show that, while singing the abdominal muscles contract at the end of inspiration phase which produces an inward movement of the abdominal muscles also creating an opposing force to develop the strong subglottal pressure. The peak expiratory flow rate is maximal rate of air flow which achieved during the forcefully expiration. The peak flow rate which is sustained for only fraction of seconds occurs in the start of expiration, but it is prolonged for the singers. Strong abdominal contraction and practice of singing with breath holding for years could be the probable reasons for the higher actual PEFR values. In some studies it has been shown that the singers have good abdominal and core muscle strength which they PEFR values because of extended years in singing, continuous breathing exercises demanded in singing achieved with years of singing and practice. From the above study performed, we conclude that singers have better actual PEFR values compared to the predicted value.

Conclusion

We conclude that the actual PEFR in Indian female classical singers is more than their predicted value and PEFR increases according to the experience of singing.

Abbreviations

PEFR- Peak Expiratory Flow Rate
STDV- Standard Deviation

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