

Original Research Article

Correlation between peak expiratory flow rate and pectoralis muscle length

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ABSTRACT

Background: Peak expiratory flow rate (PEFR) is a measure of the maximum speed of exhalation after a deep inspiration. The peak expiratory flow is measured by a device named peak flow meter. This study concentrates on the correlation of the PEFR with the pectoral muscle length.

Methods: It is a cross sectional study of 30 convenient samples based on gender distribution where the PEFR and pectoralis muscle length were measured in the subjects.

Results: Statistical analysis shows that there is a significant correlation between right pectoralis major general muscle length and PEFR ($p=0.030$), left pectoralis major general muscle length and PEFR ($p=0.014$), right pectoralis major clavicular end muscle length with PEFR ($p=0.010$).

Conclusions: There is a significant correlation between peak expiratory flow and pectoralis muscle length.

Keywords: PEFR, Pectoral muscle length, Tightness

INTRODUCTION

The peak expiratory flow also called peak expiratory flow rate (PEFR) is a person's maximum speed of expiration which is measured using a peak flow meter. A normal peak flow varies as per the height, age and gender of a person. PEFR is one such parameter that can be easily measured and is very convenient in measuring the lung functions in a field study. It is a good indicator of bronchial hyper-responsiveness and does not claim body temperature pressure saturated correction.¹

A peak flow meter is a portable, hand-held device that measures how air flows from the lungs in one "fast blast". The meter measures your ability to push air out of your lungs. The peak flows of forced expirations tend to be less than those of voluntary coughing. Which might be because of the lesser airway compression and the absence of glottal closure that aids in producing supra-maximal flows. With age, physical functions decline, influencing respiratory

performance and physio-therapists need data regarding the expiratory muscles producing the high force expiratory airflow velocity during huffs.² The position of the subject and application of any nose clip do not affect the PEFR measurement.³ However, there are limitations to PEFR measurements.⁴

To examine the length of muscles in the upper extremity there are only few tests available.⁵ The length of the inspiratory muscle fibres becomes shorter due to hyperinflation, the increased resistance to the chest wall for expansion, which results in increasing the work of breathing thus, the demand placed on respiratory muscles.

METHODS

Study design

The design of the study was cross sectional.

Place of study

The study was conducted in Dr. B. R. Ambedkar Medical College and Hospital, Bangalore, India.

Study duration

The duration of the study was from December 2019 to June 2020.

Sampling technique

Convenient sampling was used as the sampling technique.

Study sample

The sample size of the study was 30 subjects.

Inclusion criteria

Age group of 30 to 45 years.

Both male and female.

Individuals willing to participate.

Exclusion criteria

Individuals with history of or known respiratory diseases.

Individuals with recent upper limb, rib cage or spine fracture.

Procedure

A total of 30 subjects were selected based on the inclusion and exclusion criteria. The basic demographic data of each individual were collected. Every individual were assessed for pectoralis muscle length (pectoralis major and pectoralis minor) where the individuals were asked to lie down on a flat surface. Each muscle length measurement was taken as follows.

Pectoralis major muscle length general

Pectoralis major muscle length was measured with an inch tape, where the patient was asked to lie supine on a firm surface and was asked to clasp his hands behind head making sure the neck was not flexed too much.

Now with the help of measuring tape the distance was measured (inches or centimeters) between olecranon process of humerus and support surface and record the reading.⁵

Pectoralis major muscle length sternal/lower portion

Pectoralis major muscle length sternal/lower portion was measured using an inch tape where the patient was asked

to lie supine with shoulder laterally rotated and abducted to 135 degrees, elbow fully extended, and forearm supinate making sure the lumbar spine flat against support surface and does not allow trunk rotation.

Now, using tape the distance was measured (inches or centimeters) between lateral epicondyle of humerus and support surface and record the reading.⁵

Pectoralis major muscle length clavicular/upper portion

Pectoralis major muscle length clavicular/upper portion was measured using a tape where the patient was asked to lie supine, with shoulder laterally rotated and abducted to 90 degrees; elbow fully extended, forearm supinated, making sure the lumbar spine flat against support surface and does not allow trunk rotation.

Now using a tape distance was measured (inches or centimeters) between lateral epicondyle of humerus and support surface and record the reading.⁵

Pectoralis minor muscle length

Pectoralis minor muscle length was measured using an inch tape where the patient was asked to lie supine, with arms at side; shoulders laterally rotated; and forearm supinated (palms up) making sure the lumbar spine should be flat against support surface.

Now, using a tape the distance was measured from the posterior acromial border to the support surface and record the reading.⁵

Then the individuals were further examined for PEFR with the peak flow meter. The subjects were asked to take a deep breath and close the lips firmly around the cartoon mouthpiece and blow as hard as they could as if blowing out candles. The reading over the peak flow meter were measured and the pointer will be switched back to zero. The procedure was repeated for 3 times and highest reading were recorded. The collected data was statistically analyzed using statistical package for the social sciences (SPSS) 23 software.

RESULTS

A total of 30 adults formed the study population. Descriptive statistics was used to find out the frequency, percentage, mean and standard deviation from demographic data and variables studied. The age group selected ranges from 30-45 years.

Table 1: Distribution of units on the basis of gender.

Gender	Frequency	%
Female	23	76.7
Male	7	23.3
Total	30	100.0

Table 2: Mean, standard deviation (SD) of age, weight, height, and body mass index (BMI) in male, female and total.

Description		N	Mean	SD
Age	Male	7	37.7143	5.31395
	Female	23	38.2174	4.54229
	Total	30	38.1000	4.64127
Weight	Male	7	76.0000	7.18795
	Female	23	66.9783	8.56324
	Total	30	69.0833	9.02113
Height	Male	7	174.41	0.06376
	Female	23	158.43	0.06753
	Total	30	162.16	0.09503
BMI	Male	7	25.0918	3.09600
	Female	23	26.7060	3.32074
	Total	30	26.3294	3.29103

Table 3: Mean and standard deviation (SD) of pectoral muscle length and PEFR.

	N	Minimum	Maximum	Mean	SD
General pectoralis major right	30	2.00	11.20	6.5833	1.92749
General pectoralis major left	30	3.30	11.40	6.5800	1.75035
Sternal right	30	2.20	6.50	4.2800	1.24966
Sternal left	30	2.20	6.20	4.3300	1.15136
Clavicular right	30	2.00	5.70	3.5567	1.17816
Clavicular left	30	1.80	6.00	3.5133	1.23169
Pectoralis minor right	30	4.00	14.00	9.2933	2.44356
Pectoralis minor left	30	3.70	13.20	9.0267	2.35722
PEFR	30	200.00	580.00	314.6667	106.08173

Table 4: Correlation between PEFR and pectoral muscle length.

Correlation	PEFR		
	R value	P value	Result
General pectoralis major right	0.397	0.030	p<0.05
General pectoralis major left	0.442	0.014	p<0.05
Sternal right	0.324	0.081	p>0.05
Sternal left	0.294	0.115	p>0.05
Clavicular right	0.465	0.010	P<0.05
Clavicular left	0.278	0.136	p>0.05
Pectoralis minor right	-0.287	0.125	p>0.05
Pectoralis minor left	-0.225	0.232	p>0.05

DISCUSSION

The study involved the investigation of the relationship between the pectoral muscle length and the PEFR. PEFR has been used as a measure of huff strength.⁶ During forced expiration, chest wall distortion occurred leading to decline in transverse diameter than the anterior posterior diameter.⁶ Much greater distortions of the chest wall and rib cage occurred during some voluntary maneuvers.⁷

Table 1 shows that out of 30 subjects, 23 (76.7%) were female and 7 (23.3%) were male.

Table 2 shows the mean age of 38.1000±4.64127, where males show average age of 37.7143 ±5.31395 and females show average age of 38.2174±4.54229. The mean weight of 69.083±9.021, where males show average weight of 76±7.187 and females show average weight of 66.978±8.563. The mean height of 162.16±0.095, where males show average height of 174.41±0.063 and females show average height of 158.43±0.067. The mean body mass index (BMI) of 26.329±3.291, where males show average BMI of 25.091±3.096 and females show average BMI of 26.706±3.320.

Table 3 shows that the mean value of pectoralis major general right is 6.583±1.927 and pectoralis major general left is 6.580±1.750 with the minimum value of 2 and maximum of 11.2. In general left, minimum is 3.3 and maximum is 11.4. The mean value of pectoralis major sternal right is 4.20±1.249 with minimum of 2.20 and maximum of 6.5. Pectoralis major sternal left shows average of 4.330±1.151 with the minimum value of 2 and maximum of 6.2. Clavicular right shows average value as 3.556±1.178 with minimum of 2 and maximum of 5.7 whereas clavicular left has a minimum value of 1.8, maximum value 6 with average as 3.513±1.231. Pectoralis

minor right average value is 9.293 ± 2.443 with minimum reading as 4 and maximum as 14. Pectoralis minor left average value is 9.026 ± 2.357 with minimum reading of 3.7 and maximum of 13.2. In PEFR minimum reading is 200, maximum is 580. It shows average reading as 314.666 ± 106.081 .

Table 4 shows the correlation between general right and PEFR shows r value=0.397, p value=0.030, $p < 0.05$ which shows a significant positive correlation between them. Correlation between general left and PEFR shows r value=0.442, p value=0.014, $p < 0.05$ which also shows a significant positive correlation between them. Correlation between clavicular right and PEFR shows r value=0.465, p value=0.010, $p < 0.05$ which shows a significant positive correlation between them. Therefore clavicular length significantly affects PEFR i.e. increase in length shows increase in expiratory flow rate. Table also shows there is no significant correlation between PEFR and sternal right, sternal left, pectoralis minor right and pectoralis minor left. The findings of the study is supported by the study done by Nepomuceno et al which concluded that the electromyographic studies done on pectoralis major muscle showed positive correlation in forced expiration.⁸

One possible reason for the correlation might be the muscle requires to be in shortened length for the efficiency of work. So the tightness which is represented as increased distance of the bony prominence from the plinth is showing a positive correlation with PEFR.⁹

CONCLUSION

The study infers that the pectoralis muscle tightness brings a better PEFR.

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