Original Article

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Corelationship of PEFR, MMF, $FEF_{25\%}$,$FEF_{50\%}$, $FEF_{75\%}$ with Age, Height and Weight among Non Smoker Apparently Healthy Adult Male

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ABSTRACT

Background: Pulmonary functions may vary due to variations in individual age, height, weight, BMI and some other factors. Spirometric pulmonary function test is an important clinical test to assess the condition of the lung. Some previous study observed the relationship between lung functions with anthropometric parameters. So this study is aimed to find out the relation of PEFR, MMF, $FEF_{25\%}$, $FEF_{50\%}$ and $FEF_{75\%}$ withage, height and weight of adult apparently healthy non smokermale within normal BMI.

Materials and methods: This study was conducted in the Department of Physiology, Chittagong Medical College, Chattogram, during January 2019 to December 2019 in collaboration with Continental Group Private Limited (Abu Baqar Ciddique) Chattogram and EPV (Energypac Power Venture) Chittagong Limited, Patiya, Chattogram. 35 apparently healthy adultnon smokermales between the ages 20-40 years, working inair conditioned environment were taken in this study. A questionnaire along with general information about previous diseases, medication and family history was filled up. Anthropometric measurements like height, weight were measured and BMI was calculated. Lung function test parameters like PEFR, MMF, $FEF_{25\%}$, $FEF_{50\%}$ and $FEF_{75\%}$ were measured by digital spirometer (Chestgraph HI-101, Japan). Pearson correlation coefficient test wasdone by using SPSS-25 for statistical analysis to see the relation of PEFR, MMF, $FEF_{25\%}$, $FEF_{50\%}$ and $FEF_{75\%}$ with age, height and weight within normal BMI.

Results: Significant negative correlation were observed between PEFR and MMF with age ($p<0.05$) in this study. But anon significant negative correlation was observed between $FEF_{25\%}$, $FEF_{50\%}$ and $FEF_{75\%}$with age. Significant positive correlation were observed between MMF and $FEV_{75\%}$ with height ($p<0.05$) in this study. PEFR, $FEF_{25\%}$ and $FEF_{50\%}$ showed non significant positive correlation with height ($p>0.05$). Significant positive correlation were observed between MMF, $FEF_{25\%}$ and $FEV_{75\%}$ with weight ($p<0.05$) in this study. PEFR and $FEF_{50\%}$ showed non significant positive correlation with weight ($p>0.05$).

Conclusion: The result of this study suggest that pulmonary function is significantly decreased with advancement of age. Pulmonary function has positive correlation with height and weight within normal BMI.

KEY WORDS

$FEF_{25\%,}$ $FEF_{50\%,}$ $FEF_{70\%}$; MMF; PEFR; Spirometer.

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INTRODUCTION

Pulmonary function test is important for assessment of lung diseases.[1] Different factors can contribute to poor lung function including cold dry environment, smoking, asthma, allergy, Chronic Obstructive Pulmonary Diseases (COPD) hypertension, obesity and stress.

Pulmonary function tests have opened a new era towards the scientific approach in diagnosis, prognosis and management of broncho-pulmonary disorders.[1] Physiological factors like age, gender, height, weight, BMI, physical activity, altitude, ethnicity and education level may affect lung functions.[2,3]

A very common effective diagnostic test to determine the lung functions is spirometry. Through this process amount of air that in and out during respiration can be determined. It is a useful diagnostic tool for assessing lung condition in both diseased and healthy person.

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As anthropometric measuremrnts are non invasive, widely acceptable and inexpensive technique, so it is used as an important tool to determine of body size, proportion and composition.

Prevalence of respiratory symptoms were more in aged and smokers.[4-6] Decrease in lung compliance, increase in airway resistance, weakness of respiratory muscle and decrease in elastic recoil of the lung with increased stiffness of thoracic cage might be the cause.[7]

Significant positive correlation of pulmonary functions with height and weight were evident in several previous studies.[8,9] Negative correlation between BMI with pulmonary functions were also observed by other investigations.[10,11]

Increased prevalence of respiratory illness were observed in air condition users those whohad long history of smoking.[6]

Physical inactivity and low cardio-respiratory fitness are important cause of morbidity and mortality.[12]

The prevalence of obesity has been increased around the world.[13]Ashvin proved that obesity had adverse effect on lung functions.[13]

As there is lack of study regarding the relationship between pulmonary functions and anthropometric indices, the study was designed to see the relationship of pulmonary functions like PEFR, MMF, $FEF_{25\%}$, $FEF_{50\%}$ and $FEF_{70\%}$ with age, height and weight with in normal BMI.

MATERIALS AND METHODS

This quasi experimental study was conducted in the Department of Physiology, Chittagong Medical College, Chattogram, Bangladesh with collaboration of ABC private limited, Chattogram and EPV Chittagong, Patiya, Chattogram after ethical approval and permission of medical college authority. 35 apparently healthy, 20-45 years non smoker male, having normal BMI (18.5-22.9 kg/m^2) were selected as subjects.

With the permission of authority, aims, objectives and procedure of the study was explained in details to all the employees.They were encouraged for voluntary participation and allowed freedom to withdraw from the study. They were ensured that all the data will be kept confidential and used for research purpose.

All employees of the selected organization were provided with a predesigned case record form.Information about age of employees, duration of job, site and position of workplace,information of general health, history of present or past disease, food habits and habits of smoking and alcohol consumption or tobacco chewing werecollected and recorded in predesigned case record form.

For the purpose of exclusion we took history of respiratory distress, skin rash, chronic cough, fever and surgery in the recent past was taken. Recent history of taking paracetamol, antibiotics or any drugs such as bronchodilator, anti tubercular, sedative, antidepressant, beta blocker, ACE inhibitor, anticonvulsant, steroid, chemotherapeutic drug, aspirin and other NSAID were taken.Their contact number will be collected. ID number will be given to each subject.

General and systemic examination were done to see general physical condition of thesubjects for inclusion and exclusion. For the purpose of exclusion anemia, jaundice, cyanosis, oedema were observed. Blood pressure and temperature were measured. Pulse and respiratory rate were counted. Auscultation of heart and lung was done to exclude any other cardio-respiratory abnormality.

Height was measured in centimeter by plotting a height measuring scale against the wall. Standing straightly on bare foot from the top of the vertex to the bottom of the foot height was recorded.[14,15]

Weight was measured in kilogram on bare foot and avoiding excess clothing or any baggage by analogue standard weighing machine.[14,15]

BMI was calculated by dividing weight in kg by the square of height in meters.

For the exclusion, blood sample were collected for estimation of Hb% and RBS.

Subjects were selected by quota sampling method on the basis of inclusion and exclusion criteria by anlysing of case record form.

During data collection all subjects were descrived about the procedure and then were demonstrated about the performances.

Pulmonary function test parameters: PEFR, MMF, $FEF_{25\%}$, $FEF_{50\%}$ and $FEF_{70\%}$ were measured by using digital spirometer in relaxed and upright sitting posture.

Data were analyzed byusing SPSS-25 (Statistical Package for Social Science). Correlation analysis were done by Pearson's correlation-coefficient test for quantitative variables.

RESULTS

35 apparently healthy, 20-45 years non smoker male, having normal BMI (18.5-22.9 kg/m^2) were selected as subjects from different offices.

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Table I Age, height, weight, BMI, Hb, RBS, pulse rate, SBP and DBP of study subjects (n=35)

Attributes	Mean ± SD	Range
Age (Years)	32.77 ± 3.82	20 - 45
Height (cm)	167.31 ± 6.21	152 - 178
Weight (Kg)	62.49 ± 4.804	52 - 72
BMI (Kg/m^2)	22.21 ± 0.613	18.50 – 22.90
Hb level (gm/dl)	14.01 ± 0.445	13.2- 15.4
RBS (mmol/L)	5.63 ± 0.452	4.9-6.8
Pulse (Beats/min)	72.342 ± 5.480	60 - 85
SBP (mm of Hg)	110.571 ± 11.868	100 - 130
DBP (mm of Hg)	70.428 ± 6.810	60 – 80

Data expressed as Mean ± SD, n = number of the subjects, Figures in parenthesis indicate Range, BMI = Body Mass Index, Hb= Haemoglobin, RBS= Random Blood Suger, SBP = Systolic Blood Pressure, DBP = Diastolic Blood Pressure

Table II Pulmonary functions of study subjects (n=35)

Attributes	Mean ± SD	Range
PEFR (Liter/sec)	7.83 ± 1.187	4.25 – 8.86
MMF (Liter/sec)	4.19 ± 0.623	2.40 – 6.36
$FEF_{25\%}$ (Liter/sec)	7.52 ± 1.281	3.64 – 8.61
$FEF_{50\%}$ (Liter/sec)	4.52 ± .711	1.72– 6.41
$FEF_{75\%}$ (Liter/sec)	2.33 ± .531	1.27 – 4.24

Data expressed as Mean ± SD, n = number of the subjects, Figures in parenthesis indicate Range, FVC = Forced Vital Capacity, PEFR= Peak Expiratory Flow Rate, MMF =Maximum Mid Expiratory Flow Rate, $FEF_{25\%}$ = Forced Expiratory Volume in 25% FVC, $FEF_{50\%}$ = Forced Expiratory Volume in 50% FVC, $FEF_{75\%}$ = Forced Expiratory Volume in 75% FVC

Table III Correlation of PEFR, MMF, $FEF_{25\%}$, $FEF_{50\%}$ and $FEF_{75\%}$with age, height and weight of subjects (n=35)

Variables	PEFR (L/sec) p value (r value)	MMF (L/sec) p value (r value)	$FEV_{25\%}$ (L/sec) p value (r value)	$FEV_{50\%}$ (L/sec) p value (r value)	$FEV_{75\%}$ (L/sec) p value (r value)
Age (Years)	0.146^{ns} (-0.251)	0.037* (-0.354)	0.165^{ns} (-0.240)	0.094^{ns} (-0.287)	0.890^{ns} (-0.024)
Height (cm)	0.784^{ns} (0.048)	0.002^{**} (0.515)	0.645^{ns} (0.081)	0.016* (0.404)	0.002^{**} (0.514)
Weight (Kg)	0.143^{ns} (0.253)	0.002^{**} (0.498)	0.068^{**} (0.312)	0.665^{ns} (0.315)	0.003^{**} (0.487)

Statistical analysis was done by Pearson's Correlation Coefficient Test, r=Correlation Coefficient, n = number of the subjects, FVC = Forced Vital Capacity, PEFR= Peak Expiratory flow rate, MMF=Maximum Mid Expiratory Flow Rate, $FEF_{25\%}$ = Forced Expiratory Volume in 25% FVC, $FEF_{50\%}$ = Forced Expiratory Volume in 50% FVC, $FEF_{75\%}$ = Forced Expiratory Volume in 75% FVC, ns = not significant ($p>0.05$), *indicates statistically significant ($p<0.05$), ** indicates statistically highly significant ($p<0.001$).

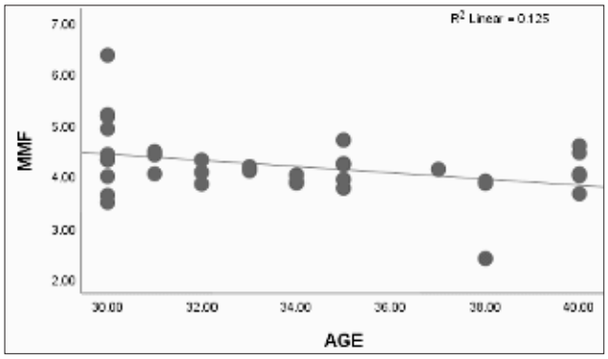

Figure 1 Significant positive correlation of MMF with age of study subjects in the study (r= -0.354) (n=35)

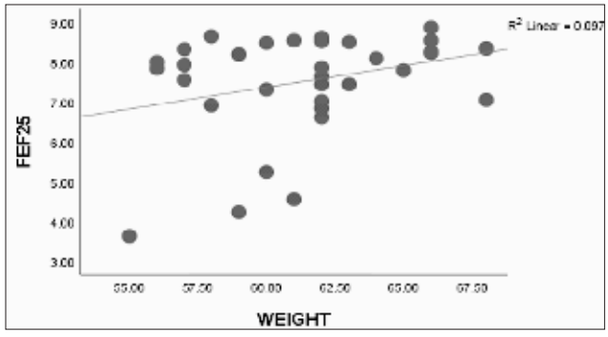

Figure 2 Significant positive correlation ($p < 0.05$)of $FEF_{25\%}$ with weight of study subjects (r= 0.312) (n=35)

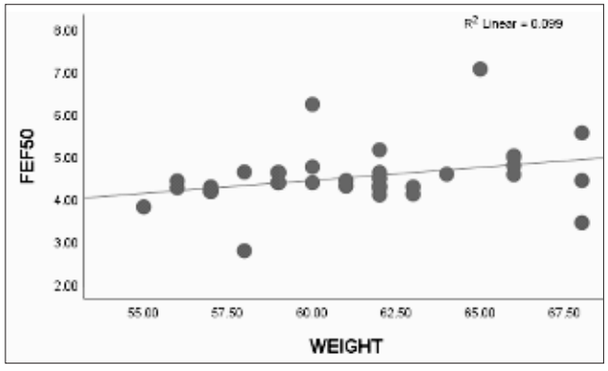

Figure 3 Significant positive correlation($p < 0.05$)of $FEF_{50\%}$ with weight ofthe study subjects (n=35)

DISCUSSION

Age, height, weight , BMI, Hb, RBS, blood pressure and pulse rate of study subjects of study group were

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measured (Table I). On the basis of general examination and inclusion and exclusion criteria 35 apparently healthy adult male were selected from non AC offices.
PEFR, MMF, $FEF_{25\%}$, $FEF_{50\%}$ and $FEF_{75\%}$ were measured with a portable digital spirometer (Chestgraph, HI-101, Japan) from the study subjects in this group.

After getting data, statistical analysis was done by SPSS-25. Mean ± SD (Standard Deviation) were calculated and tabulated from the collected data. Attempts were done to see the relationship between the anthropometric measurements and respiratory parameters of the subjects by Pearson's correlation coefficient test . Results were expressed by using different tables and figures.

For exclusion purpose Hb level and random blood sugar were done. Patients were non diabetic, non anaemic and normotensive.

Lung functions of study subjects is shown Table II.

In this research work, age showed a strong negative correlation with PEFR, MMF, $FEF_{25\%,}$ $FEF_{50\%}$ and $FEF_{75\%}$ (Table III). These findings are consistent with the study of Taluza et al. Nepal GB et al. Golczewski T et al. Age showed a significant negative correlation with PEFR and MMF in study groups.[8,14,15] Age showed a non significant negative correlation with $FEF_{25\%,}$, $FEF_{50\%}$ and $FEF_{75\%}$ in this study.

According to Taluza et al. Nepal GB et al. and Golczewski T et al. pulmonary functions were supposed to increase up to middle twenties and then decrease with age.[8,14,15] According to them it might be due to decrease static recoil pressure of lung, decrease lung compliance, increase airway resistance. Also decrease elasticity of lung and increase stiffness of thoracic cage and reduced respiratory muscle strength.

In the present study, age showed negative correlation with pulmonary functoons. It might be by the above mentioned factors.

In our study height showed a positive correlation with PEFR, MMF, $FEF_{25\%,}$, $FEF_{50\%}$ and $FEF_{75\%}$ (Table III). These findings are consistent with the study of Taluza et al. Bhatti et al. Ojoawoet al. and Nagpal et al.[8,16-18] They supposed that increase height in experimental group causes increase length of thoracic cavity and lungs. Sovolumes, capacities and expansibility of lungmay be more irrespective of age.[8,16] Height showed a significant positive correlation with MMF, $FEF_{50\%}$ and $FEF_{75\%}$. In our study height showed a positivenon significant correlation with PEFR and $FEF_{25\%}$. It might be due to height is proportionate to total surface area, volumes and capacities of lung.

Weight showed a positive correlation with PEFR, MMF, $FEF_{25\%,}$, $FEF_{50\%}$ and $FEF_{75\%}$ in the current study (Table-III). This findings are consistent with the study of Nagpal et al. Ojoawo et al. Cibella et al. and Taluza et al.[8,17-20] Weight showed a significant positive correlation with MMF, $FEF_{25\%}$ and $FEF_{75\%}$ within normal BMI of study groups in current study.
The result of present study showed lung functions may vary due to variations in individual age, height, weight, BMI and some other factors.

LIMITATIONS

This study was conducted for academic purpose in short period of time. Although optimal care had been tried by the researcher in every step of the study but there were some limitations. The limitations were-

- Small sample size that might not represent the whole community.
- Study was done with limited age group.
- Short period of study.
- Facilities were limited.
- Blood pressure was measured only in left hand.
- Chest X-ray was not done due to not giving permission by office authority.
- Pre-employment data regarding lung functions were not available.
- Follow up of the subjects were not done.

CONCLUSION

The present study suggest that pulmonary function is significantly decreased with advancement of age. They supposed that increase height in experimental subjects causes increase length of thoracic cavity and lungs. It was suggested that the increase pulmonary function with weight may reflect incresing muscle strength. So pulmonary function is positively correlated with height and weight within normal range of BMI in adult healthy male.

RECOMMENDATIONS

From this study, the following recommendations can be made for further study:

- Similar study with different age groups and longer duration can be conducted.
- Chest X-ray should be done to ensure any pathological changes in lungs.
- Further study can be done by giving intervention with breathing exercise and proper facemask.
- Advice can be given to the authorityof offices to do periodical medical check up of the employees at least once a year for early diagnosis of respiratory dysfunction.Periodic analysis of lung functions can be an effective measure for early diagnosis of

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- respiratory impairment of subjects working in air conditioned environment which may help in initiating early treatment intervention and preventing different pulmonary complications.
- Authority can also advise to do mandatory pre-employment medical check upof the new employees.
- Advice can be given to the employees of that offices about consumption of fresh fruit, fish, vegetables;
- vitamin A,C,E supplementation and increase dietary
- fibre intake for improvement of lung functions.

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DISCLOSURE

All the authors declared to no competing interests.

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Journal of Brahmanbaria Medical College
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