ORIGINAL RESEARCH PAPER

Physiology

KEY WORDS:

Maximum Voluntary Ventilation: A significant parameter to guide the exercising capacity of Lungs in Indian Men

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ABSTRACT

Background: Exercise capacity in a human lung is a vital parameter to assess the integration between the human nervous system and the lung mechanics. Pulmonary function testing has become an integral part of investigations in respiratory medicine
Methods: A prospective study was performed in the Pulmonary Function Test Laboratory of the department of Pulmonary Medicine in a tertiary care hospital.
Results The Mean Height (meters) and weight (kg) was compared between different age groups of males, it was found to be statistically significant (p value<0.05). The mean MVV values in our study population changed significantly with the variation in age on different age groups. There is a progressive decline in the mean MVV with the increase in the age.
Conclusion Age dependent contribution of the anthropometric variables like height and weight were important determinants in influencing various spirometric parameters.

INTRODUCTION

The increased burden of respiratory diseases like bronchial asthma and chronic Obstructive pulmonary disease (COPD) has tremendously risen in the last 2 decades as a consequence to increased atmospheric pollution and unhealthy lifestyles.[1] The World Health Organization [2] in 2012 had estimated that about 10.8% deaths are due to COPD,4.9% deaths are due to lower respiratory tract infections and 2.7% deaths due Tuberculosis in India. There has been a rise of 13% in the premature deaths caused by

COPD alone.[3]
Pulmonary function testing has become an integral part of investigations in respiratory medicine. Many factors influence the pulmonary functions, such as ethnic origin, physical activity, environmental conditions, altitude, tobacco smoking, age, height, sex, and socioeconomic status.[4]

The environmental pollution has a great impact on the health status of the urban population. In the metropolitan city, there is a mixed diversity of people attending the outpatient department of our tertiary care hospital. Hence this present study was conducted to evaluate the pulmonary functions in the subjects

AIM:

Age and height remain the most important determinant variables for lung function parameters apart from gender and ethnicity. Maximum voluntary ventilation (MVV) is the volume of air exhaled in a specific interval during rapid forced breathing. The maneuver should last at least 12 seconds. It is recorded in liters/min BTPS, by extrapolating the volume to 1minute. It is useful in those conditions where ventilator capacity may be impaired by mechanisms that are different from those affecting FEV_1.[5] In a well performed test, MVV is approximately equal to FEV_1x40. A low MVV can occur in obstruction, restriction, neuromuscular or heart disease or due to poor effort. It correlates well with the subjects exercise capacity.

MATERIALS AND METHODS

The study was a prospective study performed in the Pulmonary Function Test laboratory of the department of Pulmonary Medicine in a tertiary care hospital. Before proceeding for the study, the required proforma & plan of the study were submitted to the Ethics committee For Research on Human Subjects of the Institute & were approved. This study was performed on normal healthy males of different age groups. The methods adopted for the present study are described under the following headings:

- Selection of the subjects
- Consent taking
- History taking
- General and systemic examination
- Methodology
- Equipment used
- Test procedure

The study was performed at a tertiary care hospital located in a metropolitan city.

Data was collected by randomly selecting in total 100 healthy non-smoking males who met the inclusion criteria (details below) and completed the pulmonary function tests (PFT). The rest of the subjects who were not able to perform the PFT correctly or did not meet the inclusion criteria were excluded. Participants were recruited from various aspects of life, either students or employees of organization. Body measurements were taken, including the standing height and weight. All subjects were healthy individuals with no history of symptoms of cardiovascular or respiratory diseases that required treatment.

The following were the inclusion and exclusion criteria for the subjects under this study:

Inclusion Criteria:
1. Asymptomatic from respiratory and cardiovascular point of view
2. Age >18 years
3. Sex: males
4. Non smokers

Exclusion Criteria:
1. Any cardiovascular disorder
2. Any respiratory disorder
3. Chest X-ray changes
4. ECG changes
5. Hemoglobin < 9.0 gm%
6. Poor subject co-operation
7. Debilitated subjects
8. Sputum positive Pulmonary Tuberculosis
9. No h/o tobacco chewing, alcohol, any addictions
10. No h/o bony deformities of chest

Volunteers who fit into these criteria were selected and informed about the study.

A well-valid written informed consent was taken from those volunteers who agreed to participate in the study.

Participation was entirely voluntary. The subject's age, height and weight (wearing indoor clothes without shoes) were recorded for calculation of reference values. Age was expressed in years.

Calibration was performed daily with a 3 liter syringe; ensuring that the volume recorded by the instrument is close to 3 liter over the whole range of flows i.e. from 2.91-3.11 liters.

EQUIPMENTS

1. Stadiometer - For measuring height.
2. Weighing Scale - For measuring weight.
3. The Pulmonary function tests were performed on computerized Pulmonary Function Test machine Med Graphics™ Cardio respiratory Diagnostic "BREEZE SUITE 7.1.0.32" Database Version 521 manufactured by MEDGRAFICS.

STATISTICAL ANALYSIS

1. The statistical analysis of the study was done by 'Graph pad Instat Software, San Diego, California.
2. The tabulation and interpretation along with the master-chart was compiled out using Microsoft Excel 2013

RESULTS

We enrolled 100 healthy male volunteers after taking permission from Institutional Ethics Committee & written informed consent form. This is a prospective, single centric, open labelled, observational study. In our study we got the following results.

Table No. 1 - Name of the groups depending upon various age groups

SR NO	AGE GROUP	GENDER	NAME OF GROUP
1	18-30yrs	MALE	M1
2	31-40yrs	MALE	M2
3	41-50yrs	MALE	M3
4	>50yrs	MALE	M4

TABLE NO: 2 Mean Age wise Distribution in the Various Age Groups in Study Population.

SR NO	AGE GROUPS	NO. OF SUBJECTS	MALES
1	M1	25	23.6 ± 3.4
2	M2	25	35.7 ± 3
3	M3	25	45.3 ± 2.9
4	M4	25	64 ± 6.8

TABLE NO: 3 Mean Anthropometric Measurements with respect to Age in the Study Population.

PARAMETER	AGE GROUPS	MALES
HEIGHT IN METERS	M1	1.71 ± 0.07
	M2	1.68 ± 0.07
	M3	1.64 ± 0.05
	M4	1.63 ± 0.08
	P value	<0.0001*

The following table shows that when Mean Height (meters) was compared between different age groups of males, it was found to be statistically significant (p value<0.05).

Graph no.1: Comparison of mean height in meters in various age groups in study

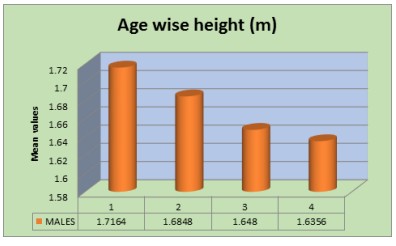


Table no.4: Comparison of mean weight (kgs) in various age groups in study population.

PARAMETER	AGE GROUPS	MALES	P VALUE
WEIGHT IN KGS	M1	64.48 ± 6.5	<0.0001*
	M2	63.04 ± 6.4	<0.0001*
	M3	68.72 ± 11.1	<0.002*
	M4	63.32 ± 9.8	<0.007*

As per the table, when Mean weight in kgs was compared between different age groups of males, it was found to be statistically significant (p value<0.05)

GRAPH NO: 2 Comparison of mean weight in kgs in various age groups in study population.

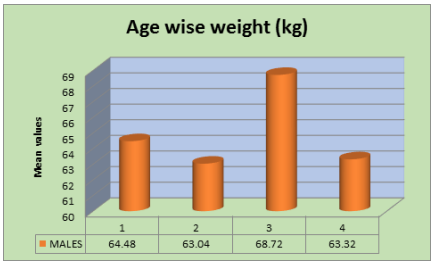
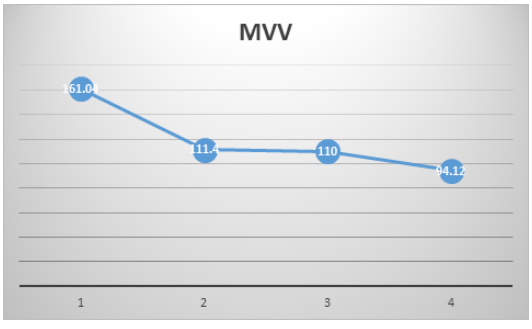


Table no.5: Comparison of MVV in Various Age Groups in the Study Population.

MAXIMUM VOLUNTARY VENTILATION	
GROUPS	MALES
1	161.04 ± 29.4
2	111.4 ± 18.2
3	110 ± 23.7
4	94.12± 24.76
P Value	<0.0001

As per the table, when MVV was compared between different age groups, it was found to be statistically significant (p value<0.05), except in the age group 2 & 3, (p value>0.05).

Graph No.3- Comparison of Mean MVV in Various Age Groups in the Study Population.



DISCUSSION

A total of 100 male subjects were included in this study after thorough history and clinical examination. The subjects were subdivided into various groups depending on different age groups.

- EFFECT OF ANTHROPOMETRIC MEASUREMENTS ON THE PULMONARY FUNCTION DEPENDING UPON THE DIFFERENT AGE GROUPS.

- Effect of height on different age groups.

The mean height values in our study population changed significantly with the variation in age on different age groups. The mean value of height in the age group of 18-30yrs was 1.71 ± 0.07 meters ; in the age group of 31-40yrs it was 1.68 ± 0.07 meters; in the age group of 41-50yrs was 1.64 ± 0.05 meters; in the age group of >50yrs was 1.63 ± 0.08 meters. The mean height was maximum in the age group of 18-30yrs. There is a progressive decline in the mean height with the increase in the age. The mean height showed statistically significant variation in males with respect to the variation in age.

The study conducted by Hisamitsu Omori et al 6 and was concordant with the present study.

- Effect of weight on different age groups.

The mean weight values in our study population changed less significantly with the variation in age on different age groups. The mean value of weight in the age group of 18-30yrs was 64.48 ± 6.5kgs; in the age group of 31-40yrs it was 63.04 ± 6.4kgs; in the age group of 41-50yrs was 68.72 ± 11.1kgs; in the age group of >50yrs was 63.32 ± 9.8kgs.

The mean weight was maximum in the age group of 41-50yrs. There is a progressive increase in the mean weight with the increase in the age. But there was a decline in the mean weight in the males of age group>50yrs. The mean weight was found to be statistically insignificant with regards to the variation of weight with respect to the increase in the age.

- Effect of MVV on different age groups

The mean MVV values in our study population changed significantly with the variation in age on different age groups. The mean value of MVV in the age group of 18-30yrs was 161.04 ± 29.4 L/ min; in the age group of 31-40yrs it was 111.4 ± 18.2 L/min; in the age group of 41-50yrs it was 110± 23.7 L/min; in the age group of >50yrs it was 94.12 ± 24.76 L/min.

The mean MVV was maximum in the age group of 18-30yrs. The variation in mean MVV values was statistically significant in the different age groups of the study population. There is a progressive decline in the mean MVV with the increase in the age.

The study conducted by Hisamitsu Omori et al and was concordant with the present study.

CONCLUSION

- Age dependent contribution of the anthropometric variables like height and body weight were important determinants in influencing various spirometric parameters.
- The spirometric values were higher in the younger age groups as compared to the older age groups.
- There was a progressive decline in the pulmonary functions with aging.

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