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Research Article

Study of Racial Influence on Pulmonary Function Test in Indian and Nigerian Students

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Abstract: There are various factors that affect pulmonary functioning. Racial influence is one among them. The aim of this study is to note the racial influence on pulmonary function test parameters between Nigerian and Indian students. The Subjects included 13 healthy Nigerian males and 14 healthy Indian males. They were all in the age group of 18-23 years. The study was done using RMS Helios spirometer-401 on a normal survey day. Considering height, weight and BMI the lung function seemed to be higher in Nigerians than in Indians but the difference was not statistically significant. This suggested a racial difference in pulmonary lung volumes between Nigerians and Indians which has to be confirmed on a larger population.
Keywords: PFT, Spirometer, Racial influence.

INTRODUCTION

Pulmonary function tests indicate both physiological changes and pathological diseases altering the functioning of lungs. Lung function indices which are commonly used for the estimation of lung volumes are forced vital capacity (FVC), forced expiratory volume in the first second (FEV1) and peak expiratory flow rate (PEFR) [1]. A considerable effort has been there to improve the precision of pulmonary function tests in the past few years [2].

One of the important factors that account for lung function differences between individuals is race. Ethnic differences in pulmonary function have been reported by many studies. These differences have been demonstrated well between populations of African descent, American descent and also been suggested in Asians [3]. Inter-ethnic differences in lung volumes persist even after adjusting for age, sex and stand height [4].

Studies have indicated that body dimensions differ for various populations [5].

Even though the differences in lung function have been demonstrated between races the factors responsible have not been well established. The characteristics of the body have been studied to establish these differences, the height and age being the most commonly used predictive factors. The total lung capacity is found to be approximately 15-22% larger in Caucasians than in Chinese and Indians. Thus the forced vital capacity (FVC) and forced expiratory volume in one second (FEV1) are also larger. The peak expiratory flow rate (PEFR), residual volume (RV), functional residual capacity (FRC) and FEV1 expressed as a percentage of FVC, however are found to be very similar for the three races [6].

Also differences may be attributed due to differences in body build, genetic factors, physical factors inherent in ethnic groups, altitude, nutrition, physical activity, and socioeconomic factors [7, 8]. In most regression equations standing height is an important variable for deriving predicted normal lung function values [4].

Poverty, exposure to tobacco smoke and other environmental factors like air pollution may also affect lung development. These factors may therefore be more proximate determinants of lung function in children than in adults [9].

It also has been demonstrated that lung volumes in healthy Asian subjects are not influenced by respiratory muscle strength [10]. However the action of the hormone progesterone has shown to influence lung volumes [11]. Geographic and ethnic variations have been found to influence predicted normal spirometric

values significantly. These variations play an important role in measuring effects of pulmonary function of various diseases and determination of prevalence of diseases [12]. Studies also have reported that anthropometric dimensions differ with age, ethnicity and gender [5]. Generally, it is accepted that the body height, of various physical dimensions, correlates best with lung volumes [12].

There are fewer studies on the racial influence on pulmonary lung volumes in Indian and Nigerian population. Hence, this study aims to note the racial influence on these two populations.

Aims and Objectives

- To perform PFT in Indians (control group) and Nigerians (study group).
- To compare the values of PFT parameters in Indians (control group) and Nigerians (study group).
- To study the probable factors that could influence the pulmonary lung volumes in different races.

MATERIALS AND METHODS

Selection of Subjects

With prior approval from Institutional Ethical Committee the study was performed on students pursuing 1st year MBBS course during the year 2013-14 in SS Institute of Medical Sciences, Davangere, Karnataka, who hail from different places of India and Nigeria. 2 groups of students from different racial background included belong to the age group 18-23 years.

Inclusion Criteria

Healthy subjects with

a) No previous history of upper respiratory tract infection within 3 months [7].
b) No history of asthma or bronchitis in the subjects as well in their family
c) No other clinically detected medical illness
d) No history of smoking

Exclusion Criteria

Subjects who were smokers[7], have had history of respiratory disorders or diseases like tuberculosis, congenital cardiac disorders and musculoskeletal deformity of chest wall were excluded

Sample Size

Subjects selected based on the above inclusion criteria included 14 Nigerians including 13 males and 1 female and 14 randomly selected Indian male students. All were healthy and all inclusion criteria were met. The Nigerian female was excluded as she could not perform well. The sample size thus included 13 male Nigerian students and 14 male Indian students.

Initial Assessment

After selection of subjects based on the above inclusion criteria, their socio demographic data was recorded. Subjects underwent general physical examination and thorough clinical examination of respiratory system to rule out significant pre-existing pathology which may influence the study parameters. The final sample was formed after obtaining written informed consent from willing subjects.

Subjects' physical characteristics like height and weight will be measured and recorded. Body surface area will be calculated for each subject, by the software incorporated in the spirometer.

PFT was assessed in the subjects selected. The test was done on a normal survey day. Subjects' physical characteristics like height and weight was measured and recorded. Lung function parameters, i.e, FEV_1, FVC, FEV_1/FVC ratio, PEFR, SVC, IRV and ERV were measured using the below described instrument, by the below described method.

Instrument

The spirometer used for this study is RMS Helios spirometer- 401.

Procedure of Recording

Pulmonary function test (PFT) parameters, viz. Inspiratory reserve volume (IRV), Expiratory reserve volume (ERV), Forced vital capacity (FVC), Forced expiratory volume in the first second (FEV_1) and FEV_1/FVC ratio were recorded using computerized spirometer- RMS Helios 401.

The subjects were asked to perform the PFT at least three times to observe FVC, FEV_1, FEV_1/FVC%. After appropriate coaching, the best of three technically acceptable attempts were recorded and the best of the three results were considered for analysis. Subjects were instructed to practice the maneuver before being attached to the instrument. To achieve good results before the test, the subjects were familiarized with the machine and the detail instructions and demonstration up to the satisfaction were done [14]. The subjects were asked to loosen tight clothing and were seated comfortably erect with feet firmly on the floor (the most comfortable position, though standing gives similar results in adults). A nose clip was applied to the subject's nose. Then, the subject was asked to breathe in fully.

- Seal his lips around the disposable mouth piece.
- Blast air out 'As fast as far as he can' until the lungs are completely empty.
- Breathe in again as forcibly and fully as possible.

Inspiration should be full and unhurried and expiration once begins should be continued without a pause.

Of the several blows ranging from 3 to 4, the best reading was selected for the study and recorded.

At least 3 technically acceptable manoeuvres were obtained ideally with less than 0.2 L variability for FEV_1 between the highest and second highest result. The largest of three FVC and FEV_1 values were accepted even if the two volumes do not come from the same curve. The ratio of FEV_1 to FVC were expressed as a percentage [15].

The largest volume was quoted. The following guidelines were used for the manoeuvre performance.

- Minimum of 3 acceptable blows.
- Rapid start is essential.
- A minimum exhalation time of 6 seconds [11].
- Spirometer temperature being 17 to 400C.
- Take largest FEV1 even if not from the same curve as the best FVC.
- Smooth, rapid take off with no hesitation, cough, leak, tongue obstruction, glottic closure, etc.
- Reproducibility: the highest and the second highest FEV1 should agree to within 0.2 L.

Spirometer was calibrated periodically with an accurate 3 liters syringe.

Peak expiratory flow rate (PEFR) was also recorded using computerized spirometer- RMS Helios 401. The subjects were asked to take a deep breath until he/she breathes in upto total lung capacity (TLC) and close the lips around the mouth piece, and to breath out as fast as possible (upto residual volume), and finally breathe it all in again as fast as possible to TLC.

The values for FEV_1, FVC, FEV_1/FVC ratio, PEFR, SVC, IRV and ERV for each subject thus obtained was entered in the proforma and tabulated. Suitable statistical methods were applied using Microsoft Excel to analyze the data, such as, mean, standard deviation, Unpaired T Test.

RESULTS

This is a pilot study done on two different racial groups. The design of this study is case control type wherein the different parameters of PFT are analyzed between the two groups. The study groups are age matched.

Table 1 shows the mean age, height, weight and BMI of the two groups. The two groups were age matched and all were males. The Mean weight and BMI is higher in Indians but not statistically significant.

Table 2 shows the mean value of different PFT parameters of the study groups. Mean values of PFT parameters are higher in Nigerians but statistically insignificant.

Table 3 shows the height adjusted mean value of different PFT parameters of the study group. The mean values are higher in Nigerians but statistically insignificant.

Table 4 shows the mean value of different PFT parameters of the study group with respect to weight. The mean values are higher in Nigerians but statistically insignificant.

Table 5 shows the mean value of different PFT parameters of the study group with respect to BMI. The mean values are higher in Nigerians but statistically insignificant.

Table 1: Mean Age, height and weight of the study groups

Parameters	Indians (14)	Nigerians (13)	p Value*
Age	19.07±1.14	19.46±0.88	0.331592
Height	172.78±5.85	172.92±8.17	0.960101
Weight	65.57±10.17	62±3.92	0.246967
BMI	22.05±3.89	20.85±2.30	0.341452

*Unpaired T Test

Table 2: Mean value of PFT parameters of the study groups

Parameters	Indians (in ml)	Nigerians (in ml)	p Value*
FVC	3597.14±598.3	3653.08±481.24	0.0792164
FEV1	3412.14±489.98	3504±376.02	0.589291
FEV1/FVC RATIO	95.35±6.683419	96.31±4.831736	0.674214
PEFR	7502.86±1374.06	8183.08±1298.07	0.198863
SVC	3862.86±645.17	3847.69±547.18	0.948213
IRV	1425±548.41	1571.54±906.6	0.612741
ERV	1608.57±527.14	1660±602.51	0.814969

*Unpaired T Test

Table 3: Mean value of PFT parameters of the study group with respect to height

Parameters	Indians (in ml/cm)	Nigerians (in ml/cm)	p Value*
FVC	20.78±3.09	21.13±2.61	0.754088
FEV1	19.72±2.55	20.28±2.14	0.539725
PEFR	43.42±7.86	47.51±8.3	0.200664
SVC	22.34±3.47	22.25±2.92	0.943174
IRV	8.25±3.17	9.2±5.65	0.590155
ERV	9.29±2.98	9.77±4.25	0.736661

*Unpaired T Test

Table 4: Mean value of PFT parameters of the study group with respect to weight

Parameters	Indians (in ml/kg)	Nigerians (in ml/kg)	p Value*
FVC	55.24±7.89	59.03±7.9	0.224325
FEV1	52.67±8.16	56.64±6.28	0.17051065
PEFR	117.05±28.13	132.71±23.86	0.132886
SVC	59.37±8.35	62.06±7.91	0.398988
IRV	21.87±7.71	25.27±14.59	0.451106
ERV	25.37±10.77	26.85±10.14	0.717518

*Unpaired T Test

Table 5: Mean value of PFT parameters of the study group with respect to BMI

Parameters	Indians (in ml/BMI)	Nigerians (in ml/BMI)	p Value*
FVC	166.24±33.46	177±31.41	0.481983
FEV1	158.33±32.03	169.96±26.12	0.313196
PEFR	350.75±90.14	395.97±73.91	0.168256
SVC	178.24±32.84	186.51±32.02	0.513994
IRV	65.57±23.99	74.46±40.66	0.491222
ERV	76.27±32.81	78.21±20.66	0.856728

*Unpaired T Test

DISCUSSION

The study groups were age matched. Mean weight and BMI was higher in Indians when compared to Nigerians though not significant. This can be attributed to racial difference between the two groups as evidenced in other studies [5].

Mean values of PFT parameters were higher in Nigerians when compared to Indians but not significant. Earlier studies did by Rosnah *et al*. [5], A Fulambarker *et al*. [7], Raida I *et al*. [9], A Johan *et al*. [10], B Korotzer *et al*. [3], WS Yap *et al*. [4], EA Elebute *et al*. [13] and YA Mengesha *et al*. [8] show ethnic difference in pulmonary functioning.

Mean values of PFT parameters expressed with respect to height, weight and BMI are higher in Nigerians when compared to Indians but not significant. Earlier studies have shown ethnic difference in PFT parameters in their study population when anthropometric measurements are considered for linear regression. A study by Mengesha *et al*. showed that in their study group FVC, FEV1, and PEFR significantly regress with age and height [8].

The difference in pulmonary functioning can be attributed to the racial difference in their built and respiratory muscle strength. But, a study done by A Johan *et al*. [10] on different Asian population concluded that among Asians, ethnic differences occur in respiratory muscle strength and lung volumes. However respiratory muscle strength does not explain the differences in lung volumes in healthy Asian subjects [10].

This study hints racial difference in pulmonary functioning between Indians and Nigerians. The results of this study have to be confirmed over larger population.

During clinical evaluation of pulmonary functioning in patients, racial difference has to be considered in distinguishing between normal and abnormal absolute values.

CONCLUSION

This study suggests influence of racial difference over pulmonary function between Indians and Nigerians which has to be confirmed over a large population.

Limitations

This is a pilot study done to note racial influence over PFT parameters in Indians and Nigerians. The results have to be confirmed over larger population.

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