

"DOES CHEST CIRCUMFERENCE AFFECT PULMONARY FUNCTION TESTS? A COMPARATIVE STUDY OF MALE AND FEMALE SUBJECTS"

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Abstract :

Objective :

The values of Pulmonary Function Tests PFTs help in the diagnosis of restrictive and obstructive diseases. There are various studies on various physical parameters evaluating PFTs. The present study had been planned to correlate the chest circumference in adults with PFTs, as this type of study are lesser in number.

Methods : The young subjects comprised of 119 males (18-27 years) and 49 females (18-23 years) of first professional M.B.B.S. of G.S.V.M. medical College, Kanpur. The Parameters recorded were Tidal volume (T.V.), Forced Expiratory volume in first second (FEV1), Forced vital capacity (F.V.C.), Forced Expiratory Ratio (F.E.R.) and Peak Expiratory Flow Rate (P.E.F.R.). The chest circumference of all the subjects was measured and subjects were divided in to 3 groups according to it. The statistical evaluation was done by 'Students's 't'-test and $p < 0.05$ was taken as significant.

Results : The mean T.V., FEV1, F.V.C., F.E.R. and P.E.F.R were 437.56 \pm 65.83 ml, 3.26 \pm 0.41L, 3.82 \pm 0.48L, 85.09 \pm 2.42% and 495.42 \pm 101.82 L/min respectively in North Indian male subjects, between mean age of 18 - 27 years.

The average T.V., FEV1, F.V.C., F.E.R. and P.E.F.R, were 386.12 \pm 37.90 ml, 2.39 \pm 0.38L, 2.79 \pm 0.43L, 85.38 \pm 2.57 % and 307.12 \pm 75.74 L/min respectively in North Indian Female subjects, between mean age of 18 - 23 years.

Conclusion :

The chest circumference in the same sex in all the three subgroups do not affect the values of PFTs after adulthood i.e. more than 18 years of age. The Gender variation between males and females do affect the various values of PFTs.

Key words : Pulmonary fuction tests (PFT), Chest circumference

Introduction :

The Pulmonary fuction tests substantiate the diagnosis of various diseases of restrictive and obstructive nature producing abnormal changes or unchanged structure of lung in X-ray chest.

There are various studies which give pulmonary function tests with relation to Age, Sex, Body mass index, Surface area etc. but there are lesser reports of changes in the values of Pulmonary function tests with relation to the circumference of the chest. Hence, the present

study has been planned to evaluate the changes in pulmonary function test values, if at all with the change in chest circumference after adulthood (>18 years).

The expected norms for the forced vital capacity, maximal Breathing Capacity and Expiratory Peak flow for Indians of various age group are widely studied in Indians of both sexes¹. Mean Vital Capacity values were higher in Western subjects than the Indian Subjects. Maximum Values seem to have been attained by 19 years and after that they stay nearly constant up to the age of 40 years². The mean FEV1 and F.V.C. of Africans of both sex were significantly greater than those of Indians³. Ethnic variation in ventilatory lung function appear to be due to differences in lung size of full inspiration and normal standard for each measurement must be obtained on the population concerned⁴. The maximal values for F.V.C. and FEV1 should be used for interpretation as standardization of spirometry⁵. Women have much lower values than men⁶. It is also opined that height and chest circumference were the best predictor of F.V.C. and F.E.V1⁷.

The difference in British and Indian data was reportedly not due to change in thoracic size but it was genetic factors rather than environmental which were responsible for the ethnic differences in various comparative studies.

The indices representing airway caliber do not differ between the ethnic groups⁸. The comparison of caucasian, Chinese and Indian subjects suggested that Indians had lower total lung capacity and vital capacity than the two other groups. It was related to longer chests in the other two groups but larger chest was not the sole factor as such responsible for more values. It may be due to increased number of alveoli in the other two groups due to ethnic variation.⁹ The various Pulmonary function tests amongst Chinese, Malay and Indians are studied thoroughly and the ethnic difference with Chinese having the largest lung volume and flow rate and Indians the smallest, was reported.¹⁰ Higher values in Men than those of women except FEV1 are also reported.¹¹

Material and Methods :

In the present study, the Pulmonary function tests were calculated on 119 male and 49 female students of First Professional M.B.B.S. at G.S.V.M. Medical College, Kanpur, U.P. (India). The male students were 18-27 yrs old while female students were 18-23 yrs respectively. All the students had their home town in the Northern State of India, Uttar Pradesh. The students were fully healthy and had no signs or family history of Pulmonary disease were not included at all in the study.

The Parameters recorded were Tidal

Volume (T.V.) by Benedict Roth Spirometer, forced Expirator Volume in First Second (FEV₁) and Peak Expiratory Flow Rate (P.E.F.R.) by Digital Microspirometer in the sitting posture.

The chest circumference of all the students was measured in Male and Female students. Both the male and female students were then divided into 3 groups as C₁, C₂, and C₃. The C₁ group had chest circumference of <80 cms, C₂ with 81-90 cms and C₃ group had >91 cms.

Statistical Analysis :

The mean and standard deviation was

calculated in both male and female subjects and significance of difference was calculated by "Student 't' test" and $p < 0.05$ was taken as significant.

Observation & Results :

The average age of male students was 20.74 ± 1.83 years while that of female students was 19.15 ± 1.05 Years. The variation in the various pulmonary function tests were as per expectations between male and female subjects. The various values of T.V., FEV₁, F.V.C, F.E.R. and P.E.F.R. in group C₁, C₂ and C₃ in male and female subjects are depicted in Table 1 and Table 2.

TABLE-1

Mean chest circumference (C.C.) and respiratory parameters in male subjects

Chest circumference Groups	Mean C.C.(cms)	MeanTV(ml)	Mean FEV ₁ (l)	Mean FVC (l)	MeanT1(%)	Mean PEFR (L/min)
C ₁ (n 43) (-80cms)	77.06 \pm 2.32	425.81 \pm - 6081	3.21 \pm 0.40	3.75 \pm 0.49	85.09 \pm 2.46	484.72 \pm 100.10
Range	72.80	250.600	2.22-4.09	2.66-5.03	79.89	308-670
C ₂ (n64) (81-90cms)	85.68 \pm 2.69	441.87 \pm 6601	3.30 \pm 0.43	3.84 \pm 0.49	85.23 \pm 2.37	500.82 \pm 101.71
Range	81-90	250-600	2.12-4.36	2.57-4.90	81.90	230-670
C ₁ (n 12) (-91cms)	96.08 \pm 3.98	440.00 \pm 58.15	3.30 \pm 0.33	3.89 \pm >45	84.33 \pm 2.60	488.66 \pm 128.75
Range	91-102	300-500	2.99-4.59	81-89	296-406	

In Table 1 of Male subjects, the average chest circumference in C1 group was 77.06 ± 2.32 cms having mean values of T.V. as 425.81 ± 66.81 ml, FeV1 3.21 ± 0.41 , F.V.C. 3.75 ± 0.49 L, F.E.R. 85.09 ± 2.46 and P.E.F.R. 484.72 ± 100.10 L/min. In C₂, average chest circumference was 85.68 ± 2.69 cms having mean values of T.V. as 441.87 ± 66.01 ml, FEV1

3.30 ± 0.43 L, F.V.C. 3.84 ± 0.49 L, F.E.R. $85.23 \pm 2.37\%$ and P.E.F.R 500.82 ± 101.71 L/min. In C₃ group, the average chest circumference was 96.08 ± 3.98 cms having mean values of T.V. as $440.00 \pm$ ml, FEV₁ 3.30 ± 0.33 L, F.V.C. 3.89 ± 0.45 L, F.E.R. $84.33 \pm 2.60\%$ and P.E.F.R. 488.66 ± 128.75 L/min.

TABLE-2

Mean chest circumference (C.C.) and respiratory parameters in females subjects

Chest circumference Groups	Mean C.C.(cms)	MeanTV(ml)	Mean FEV ₁ (l)	Mean FVC (l)	MeanT1(%)	Mean PEFR (L/min)
C1(n 23) (-80cms)	77.26 ± 2.61	391.30 ± 38.88	2.43 ± 0.39	2.82 ± 0.39	85.65 ± 2.56	321.17 ± 75.27
Range	72-80	350-450	1.87-2.97	1.98-3.50	79-89	202-449
C2(n-21) (81-90cms)	84.76 ± 2.79	379.52 ± 40.05	2.41 ± 0.43	2.81 ± 0.05	85.42 ± 2.69	289.57 ± 78.25
Range	81-90	300-500	1.51-3.02	1.85-3.45	81-89	126-411
C4 (n 5) (-91 cms)	98.0 ± 7.34	390.0 ± 22.36	2.15 ± 0.20	2.55 ± 0.22	84.0 ± 20	3162 ± 64.92
Range	92-107	350-400	1.96-2.40	2.31-2.81	81.86	213-374

In table 2 of female subjects, the average chest circumference in C1 group was 77.26 ± 2.61 cms having mean values of T.V. as 391.30 ± 38.88 ml, FEV₁ 2.43 ± 0.35 L, F.V.C. 2.82 ± 0.39 L, F.E.R. 85.65 ± 2.56 % and P.E.F.R 321.17 ± 75.27 L/min.

In C₂ group, the average chest circumference was 85.76 ± 2.79 cms having mean values of T.V. as 379.52 ± 40.05 ml, FEV₁ 2.41 ± 0.43 L, F.V.C. 2.81 ± 0.05 L, F.E.R. $85.42 \pm 2.69\%$ and P.E.F.R 289.57 ± 78.25 L/min. In C₃ group, the average chest

circumference was 98.0 ± 7.34 cms. having mean values of T.V. as 390.0 ± 22.36 ml, FEV_1 2.15 ± 0.20 L, F.V.C. 2.55 ± 0.22 L, F.E.R. $84.0 \pm 2.0\%$ and P.E.F.R. 316.2 ± 64.92 L/min.

The above values suggest that Pulmonary Function Tests do not show any appreciable difference between the 3 subgroups of C_1 , C_2 and C_3 in both Males and Females. The p value was insignificant. The comparison of different values of Pulmonary Function tests of males and females showed significant difference ($p < 0.05$) in all the 3 subgroups of C_1 , C_2 , or C_3 .

Discussion :

The observation and results show insignificant difference with changing chest circumference values of Pulmonary function tests after adulthood i.e. >18 years of age when the chest size is fully developed. There were significant differences in the values when compared between Males and Females. All the values in the same chest size subgroup showed increased values in Males and decreased values in females.

Thus, it is evident that chest size in the same gender does not affect the values of various Pulmonary function tests after adulthood, while at the same time, it is noted that gender variation between male or female can change the values of Pulmonary Function Tests.

Conclusion :

1. The mean T.V., FEV_1 , F.V.C., F.E.R. and P.E.F.R. were 437.56 ± 65.83 ml, 3.26 ± 0.41 L, 3.82 ± 0.48 L, $85.09 \pm 2.42\%$ and 495.42 ± 101.82 L/min respectively in North Indian male subjects, between mean age of 18 - 27 years.
2. The average T.V., FEV_1 , F.V.C., F.E.R. and P.E.F.R. were 386.12 ± 37.90 ml, 2.39 ± 0.38 L, 2.79 ± 0.43 L, $85.38 \pm 2.57\%$ and 307.12 ± 75.74 L/min. respectively in North Indian Female between mean age of 18 - 23 years.
3. The chest circumference in the same sex of males or females do not affect the values of Pulmonary Function Tests after the adulthood i.e. more than 18 years of age.
4. The Gender variation between males and females do affect the various pulmonary function tests.

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