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Study of Lung Function Parameters among Young Healthy Adults with Special Reference to Influence of Weight in Normal BMI Category

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Abstract

Context: Young adults are exposed to air pollution and are vulnerable to its effects especially on respiratory diseases. Hence they should undergo regular screening for lung function parameters. *Aims:* To study of lung function parameters among young healthy adults. *Settings and design:* Cross sectional study carried out at GR Medical College. *Methods and Material:* 185 youngsters aged 17-22 years of age of both sexes were studied. All individuals were healthy and free from any lung disease. Weight and lung function parameters were measured. *Statistical analysis:* Student's t test was used to compare means. *Results:* FVC, FEV1, FEV.5/FVC% and FEV1/FVC% increased with weight significantly for males but not for females. FEV.5, MVV did not increase significantly with weight for both sexes. PEFR increased significantly with weight for females but not for males. FVC, FEV1, FEV1/FVC%, MVV and PEFR increased significantly with age for both sexes. FEV.5 increased significantly with age for females but not for males. *Conclusion:* Lung function parameters enhanced significantly with age and weight mostly in males while in females their changes were not significant.

Keywords: Body Surface Area; Physical Exercise; Lung Function Parameters; FEV-5.

Introduction

Population of today is exposed to the ill effects of air pollution not only in the developed countries but also in the developing countries like India. This serious problem of air pollution has arisen as a result of development taking place all over the world. Todays young generation is exposed to this air pollution since their childhood. Air pollution is not only affects respiratory system but also can lead to increased incidence of diabetes and cardiovascular diseases [1].

The important system target of air pollution is respiratory system. The major respiratory diseaes attributed to air pollution are asthma and allergic bronchitis and other respiratory problems including cancer of the lung. It affects the quality of life, hampers the healthy growht and development of childen and adolescents [2].

With the modern development, and with easy access to vehicles, increased sedentary life style, physical activity of all ages and both sexes has drastically reduced. Children are found to be more inclined towards TV watching, video games, internet chatting rather than preferring to play outdoors. Schools are giving more importance to academics rather than sports. Parents do not have time for their own children as both of them working and families are mostly nuclear. At the same time consumption of junk foods, energy rich drinks has increased and the people have forgotten the traditional healthy diet. All these factors coupled with air pollution is hampering the lung funciton of the young adults as they are going through all such insults [3].

Hence all young adults should undergo the screening for pulmonary funciton tests to make them aware of healthy life style. Lung function testing by spirometry is considered as a diagnostic

tool. It is also used to monitor the disease course. Forced vital capacity (FVC) and forced expiratory volume (FEV1) are the lung function parameters which can be used to predict the health of the lungs [4].

Hence present study was carried out to study the lung function parameters among young healthy adults.

Methods

Study Design: Present study was Institution based cross sectional study.

Settings: Present study was carried out at Department of Physiology, GR Medical College.

Study Period: The study was carried out for a period of six months from July 2017 to December 2017.

Study Population: Present study consisted of study of lung function parameters among young healthy adults

Sample Size: 185 healthy young adults were studied.

Inclusion Criteria

1. Age between 17 to 22 years
2. Free from any diseases
3. Willing to participate in the present study

Exclusion Criteria

1. Age less than 17 years and more than 22 years
2. Found suffering from any lung diseases
3. Not willing to participate in the present study

Methodology

One eighty five youngsters between 17 and 22 years of age and belong to both sexes were considered as sample for the present study. All the sampled individuals were healthy and free from any lung disease. Weight was taken by a standard weighing scale and at the time of weighing each and every individual was wearing minimum outfit without shoes or chappals.

Before the test every subject of 185 (81 girls and 104 boys) were thoroughly examined with special emphasis on respiratory system. Subject who gave history of major lung problem or suffering from any kind of respiratory disease viz. pneumonia, tuberculosis etc was not included in the sample size.

All subjects underwent lung function parameter testing like forced vital capacity (FVC), forced expiratory volume at five seconds (FEV-.5), forced expiratory volume at one second (FEV-1), maximum voluntary ventilation (MVV), and peak expiratory flow rate (PEFR). All these values were expressed in litres. Subjects were classified into different weight bands for comparison of lung function parameters.

Statistical Analysis

The data was expressed as mean values with two standard deviation.

Results

Table 1 shows weight-wise comparison of mean values of FVC, FEV.5 and FEV1. FVC increased gradually for both sexes but this increase was statistically significant for males and not for females. FEV.5 increased from 2.27 ltrs (36-45 kg) for males to 2.78 ltrs (76-85 kg) but this small increase was not statistically significant. FEV1 increased from 2.64 ltrs (36-45 kg) for males to 3.59 ltrs (76-85 kg) significantly. But for females this increase was not statistically significant both for FEV.5 and FEV1.

Table 2 shows weight-wise comparison of mean values of ratios. The FEV.5 and FVC ratio decreased significantly for males from 84.63% (36-45 kg) to 67.33% (76-85 kg). FEV1 and FVC ratio also decreased significantly for males from 98.54% (36-45 kg) to 87% (76-85 kg). But for females the differences of these ratios across weight band were not found to be statistically significant.

Table 3 shows weight-wise comparison of mean values of MVV. The changes in the MVV values across weight band were not found to be statistically significant for both males as well as females.

Table 4 shows weight-wise comparison of mean values of PEFR. As the weight increased the PEFR increased from 7.31 ltrs/sec (36-45 kg) for males to 7.73 ltrs/sec (76-85 kg) but this difference was statistically not significant. But for females the PEFR increased from 4.7 ltrs/sec (36-45 kg) to 6.85 ltrs/sec (76-85 kg) and this increase was found to be statistically significant.

Table 5 shows age-wise comparison of mean values of FVC, FEV.5 and FEV1. The values of FVC increased with increase in age significantly for both

Table 1: Weight-wise comparison of mean values of FVC, FEV.5 and FEV1

Number of subjects		No. of groups	FVC (ltrs)	FEV.5 (ltrs)	FEV1 (ltrs)
Total number	Sub-group (number)	(wt. in kg)			
31 (A)	Male (11)	(36-45)	2.67±0.36	2.27±0.40	2.64±0.36
	Female (20)	(36-45)	2.22±0.32	1.68±0.77	2.14±0.27
85 (B)	Male (43)	(46-55)	3.32±0.39	2.53±0.28	3.15±0.34
	Female (42)	(46-55)	2.26±0.32	1.69±0.26	2.16±0.31
55 (C)	Male (38)	(56-65)	3.55±0.33	2.60±0.31	3.31±0.34
	Female (17)	(56-65)	2.39±0.35	1.87±0.28	2.37±0.48
11 (D)	Male (09)	(66-75)	3.76±0.48	2.83±0.46	3.42±0.42
	Female (02)	(66-75)	2.64±0.25	2.14±0.33	2.55±0.38
03 (E)	Male (03)	(76-85)	4.11±0.34	2.78±0.23	3.59±0.33
	Female (00)	(76-85)	-	-	-
	T value for males (between A & E)		6.1972	2.0768	4.1065
	P value for males		0.0001	0.0600	0.0015
	T value for females (between A & D)		1.5939	1.5745	1.5313
	P value for females		0.1266	0.1311	0.1414

Table 2: Weight-wise comparison of mean values of ratios

Number of subjects		No. of groups (wt. in kg)	FEV.5/FVC%	FEV1/FVC%
Total number	Sub-group (number)			
31 (A)	Male (11)	(36-45)	84.63±10.64	98.54±3.07
	Female (20)	(36-45)	75.9±12.04	96.40±4.44
85 (B)	Male (43)	(46-55)	76.39±9.66	95.00±5.90
	Female (42)	(46-55)	74.83±9.43	95.88±6.50
55 (C)	Male (38)	(56-65)	72.93±7.54	92.61±4.86
	Female (17)	(56-65)	78.11±8.41	95.64±4.40
11 (D)	Male (09)	(66-75)	72.11±5.98	90.88±6.64
	Female (02)	(66-75)	80.50±4.94	96.00±5.65
03 (E)	Male (03)	(76-85)	67.33±7.50	87±1.00
	Female (00)	(76-85)	-	-
	T value for males (between A & E)		2.6080	6.2559
	P value for males		0.0229	0.0001
	T value for females (between A & D)		0.5262	0.1196
	P value for females		0.6045	0.9060

Table 3: Weight-wise comparison of mean values of MVV

Number of subjects		No. of groups (wt. in kg)	MVV ltrs/ min
Total number	Sub-group (number)		
31 (A)	Male (11)	(36-45)	140.54±25.16
	Female (20)	(36-45)	89.46±16.85
85 (B)	Male (43)	(46-55)	149.81±18.26
	Female (42)	(46-55)	90.09±19.98
55 (C)	Male (38)	(56-65)	149.21±19.55
	Female (17)	(56-65)	102.64±14.41
11 (D)	Male (09)	(66-75)	151.66±28.18
	Female (02)	(66-75)	78±31.11
03 (E)	Male (03)	(76-85)	145.00±9.84
	Female (00)	(76-85)	-
	T value for males (between A & E)		0.2937
	P value for males		0.7740
	T value for females (between A & D)		0.8664
	P value for females		0.3966

Table 4: Weight-wise comparison of mean values of PEFR

Number of subjects		No. of groups (wt. in kg)	PEFR
Total number	Sub-group (number)		ltrs/sec
31 (A)	Male (11)	(36-45)	7.31±1.90
	Female (20)	(36-45)	4.70±1.24
85 (B)	Male (43)	(46-55)	8.44±1.17
	Female (42)	(46-55)	4.72±1.26
55 (C)	Male (38)	(56-65)	8.35±1.40
	Female (17)	(56-65)	5.42±1.45
11 (D)	Male (09)	(66-75)	8.87±1.01
	Female (02)	(66-75)	6.85±0.63
03 (E)	Male (03)	(76-85)	7.73±0.73
	Female (00)	(76-85)	-
	T value for males (between A & E)		0.3664
	P value for males		0.7204
	T value for females (between A & D)		2.3826
	P value for females		0.0272

Table 5: Age-wise comparison of mean values of FVC, FEV.5 and FEV1

Number of subjects		Age in yrs	FVC	FEV.5	FEV1
Total number	Sub-group (number)		(ltrs)	(ltrs)	(ltrs)
15	Male (06)	17	1.32±0.37	2.46±0.24	3.07±0.21
	Female (09)		1.94±0.19	1.53±0.28	1.88±0.23
48	Male (17)	18	3.15±0.52	2.43±0.38	2.98±0.45
	Female (31)		2.37±0.41	1.77±2.31	2.31±0.46
54	Male (29)	19	3.47±0.50	2.59±0.35	3.24±0.40
	Female (25)		2.30±0.23	1.78±0.22	2.22±0.21
41	Male (26)	20	3.42±0.46	2.58±0.36	3.22±0.39
	Female (15)		2.33±0.25	1.74±0.29	2.19±0.26
22	Male (21)	21	3.42±0.46	2.54±0.28	3.18±0.38
	Female (01)		1.98	1.36	1.84
05	Male (05)	22	3.62±0.37	2.95±0.31	3.60±0.33
	Female (00)		-	-	-
	T value for males (between A & E)		10.2657	2.9605	3.2417
	P value for males		0.0001	0.0159	0.0101
	T value for females (between A & D)		4.0216	1.7390	2.9467
	P value for females		0.0006	0.0960	0.0075

the sexes. The values of FEV.5 increase with age for males significantly but not for females. the values of FEV1 increased with increase in age significantly for both the sexes.

Table 6 shows age-wise comparison of mean values of ratios. The FEV.5/FVC ratio increased with age in males but this increase was statistically not significant. Similar observation applied to females in this case. The FEV1/FVC ratio increased significantly with age in males but not in females.

Table 7 shows age-wise comparison of mean values of MVV. The MVV values increased significantly with age for males but not for females. in the both the sexes there was increased in MVV values but more pronounced in males than females.

Table 8 shows age-wise comparison of mean values of PEFR. The PEFR values increased significantly with age for males from 8.15 ltrs/sec at age 17 to 10.1 ltrs/sec at age 22 years. In females the value was 4.21 ltrs/sec at age 17 which increased to 5.19 at age 20 years but this increase was statistically not significant.

Table 6: Age-wise comparison of mean values of ratios

Number of subjects		Age in yrs	FEV.5/	FEV1/
Total number	Sub-group (number)		FVC%	FVC%
15	Male (06)	17	73.66±6.31	92.33±5.46
	Female (09)		78.11±11.67	95.77±5.49
48	Male (17)	18	77.35±10.70	94.52±7.62
	Female (31)		74.96±10.51	96.61±3.97
54	Male (29)	19	74.00±9.36	93.51±5.47
	Female (25)		77.20±6.63	96.60±3.53
41	Male (26)	20	75.73±10.93	94.11±5.20
	Female (15)		75.00±12.20	93.93±9.83
22	Male (21)	21	74.40±7.80	92.92±5.37
	Female (01)		68.00	92.00
05	Male (05)	22	80.80±3.63	99.20±1.30
	Female (00)		-	-
	T value for males (between A & E)		2.2293	2.7267
	P value for males		0.0528	0.0234
	T value for females (between A & D)		0.6142	0.8061
	P value for females		0.5454	0.4288

Table 7: Age-wise comparison of mean values of MVV

Number of subjects		Age in yrs	MVV ltrs/ min
Total number	Sub-group (number)		
15	Male (06)	17	138.83±11.54
	Female (09)		78.11±17.43
48	Male (17)	18	149.11±25.54
	Female (31)		91.16±18.35
54	Male (29)	19	149.03±14.29
	Female (25)		97.44±17.05
41	Male (26)	20	148.07±23.95
	Female (15)		94.73±21.57
22	Male (21)	21	146.33±18.88
	Female (01)		87.00
05	Male (05)	22	169.00±14.71
	Female (00)		-
	T value for males (between A & E)		3.8196
	P value for males		0.0041
	T value for females (between A & D)		1.9549
	P value for females		0.0634

Table 8: Age-wise comparison of mean values of PEFR

Number of subjects		Age in yrs	PEFR (ltrs/sec)
Total number	Sub-group (number)		
15	Male (06)	17	8.15±0.654
	Female (09)		4.21±1.46
48	Male (17)	18	7.91±1.62
	Female (31)		4.75±1.43
54	Male (29)	19	8.09±1.03
	Female (25)		5.30±1.07
41	Male (26)	20	8.39±1.66
	Female (15)		5.19±1.27
22	Male (21)	21	8.41±1.07
	Female (01)		2.80
05	Male (05)	22	10.1±1.24
	Female (00)		-
	T value for males (between A & E)		3.3556
	P value for males		0.0084
	T value for females (between A & D)		1.7317
	P value for females		0.0973

Discussion

FVC, FEV1, FEV.5/FVC% and FEV1/FVC% increased with weight significantly for males but not for females. FEV.5, MVV did not increase significantly with weight for both sexes. PEFR increased significantly with weight for females but not for males. FVC, FEV1, FEV1/FVC%, MVV and PEFR increased significantly with age for both sexes. FEV.5 increased significantly with age for females but not for males.

Boskabady MH et al. [5] noted that as age increased the each lung function decreased. FEV1 and FCV in both the sexes was found to be having highest correlation. As height increased there was increase in the values of lung function parameters. FVC was most commonly correlated with height among all other parameters.

Memon MA et al. [6] found that as the age increased there was decrease in the vital capacity and deterioration of the lung function parameters. This finding is in contrast with the present study. This is due to the fact that the age group studied by author was wide and our age group was narrow limited to 17-22 years only. They also noted that all parameters of the lung function tests were positively correlated with height.

Tabatabaie SS et al. [7] also reported a positive correlation between PEFR with age which was statistically significant. We also found that for males with increase in age there was increase in PEFR but not for females. they compared the value with height while we used weight for correlation in the present study.

Bae JY et al. [8] observed that the weight was one of the important factors which affected pulmonary function in both boys and girls. We also found that FVC, FEV1, FEV.5/FVC%, FEV1/FVC%, correlated well with increase in weight for males but not for females. this predilection towards males may be due to the fact that muscle mass increases more strongly in males in this age range of 17-22 years compared to girls which in turn has an influence on the overall lung functions. Hence the author concluded that children and adolescents needs to be exposed to exercises to enhance their strength of the muscles which will definitely improve the lung function.

Bhatti U et al. [9] found that mean vital capacity increased with increase in height. This association, the authors attributed to the more available surface area in heighted persons compared to less heighted persons. Thus authors concluded that even though the persons belong to same age and ethnic groups, their vital capacity may remain different due to difference in the height. We did not consider height in the present study.

Budhiraja S et al. [10] noted that age, height and weight were positively correlated with parameters of the lung function tests and this was found to be true not only for boys but also for girls. We also observed similar findings of association of age and weight with lung function parameters. The authors found that these parameters were more significant for boys compared to girls. We also found that most of the lung parameters were significantly associated in boys rather than girls.

Key Messages

Regular screening of young adults will help to identify initiation of respiratory diseases among them and help prevent further progression with proper counseling and life style modification.

Conclusion

Thus we conclude that most of the lung parameters especially vital capacity of the lungs for persons within normal BMI range increase with age in younger adults and also with weight.

We therefore recommend more amount of sports and exercise as well as yoga to be practiced at these younger age to have improved lung functions and hence proper health for life.

References

1. Brook RD, Cakmak S, Turner MC, et al. Long-term fine particulate matter exposure and mortality from diabetes in Canada. Diabetes Care, 2013;36:3313-20.
2. McConnell R, Berhane K, Yao L, et al. Traffic, susceptibility, and childhood asthma. Environ Health Perspect, 2006;114:766–72.
3. Kim JH, Kim JK, Son BK, et al. Effects of air pollutants on childhood asthma. Yonsei Med J, 2005;46:239–44.
4. Hills AP, Andersen LB, Byrne NM. Physical activity and obesity in children. Br J Sports Med, 2011;45:866–70.
5. Boskabady MH, Keshmiri M, Banihashemi B, Anvary K. Lung Function Values in Healthy Non-Smoking Urban Adults in Iran. Respiration 2002;69:320–26.
6. Memon MA. Sandila MP, Ahmed ST. Spirometric reference values in healthy, non-smoking, urban Pakistani population. J Pak Med Assoc 2007;57(4):193-5.

7. Tabatabaie SS, Boskabady MH, Mohamadi SS et al. Prediction equations for pulmonary function values in healthy children in Mashhad city, North East Iran. J Res Med Sci 2014;19(2):128-33.
8. Bae JY, Jang KS, Kang S, Han DH et al. Correlation between basic physical fitness and pulmonary function in Korean children and adolescents: a cross-sectional survey. J Phys Ther Sci 2015;27(9):2687-92.
9. Bhatti U, Rani K, Memon MQ. Variation in lung volumes and capacities among young males in relation to height. J Ayub Med Coll 2014;2626(2):200-2.
10. Budhiraja S, Singh D, Pooni PA et al. Pulmonary Functions in Normal School Children in the Age Group of 6–15 Years in North India. Iran J Pediatr 2010;20(1): 82-90.