The effect of age on pulmonary performance using (FEV_1/FVC) % as indicator

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Summary:

Background: pulmonary function can change with age for normal individual's .Spirometric measurement for the ratio of forced expiratory volume in one second (FEV1), the forced vital capacity and the ratio (FEV_1/FVC) can reveal airway obstruction and the consequence change in pulmonary performance. These parameters can be different for different race /ethnic and gender.

Methods: Pulmonary function test were carried out on 29normal male and 37 normal female the test parameters were FEV_1 and FVC from which the ratio of FEV_1/FVC %was calculated in relation to age. Iraqi average for FEV_1 and FVC and FEV_1/FVC % has also been obtained

Results: results of these tests reveled that the ratio of FEV_1/FVC % is almost the same for individual's ages between 20-60 and a significant depression in the value of the ratio FEV_1/FVC % for ages > 60 years.

Conclusion: the effect may be linked with some changes in the airways in addition to the increased weakness in the muscles in the old age people.

Keyword: spirometry, FEV_1, FVC, FEV_1/FVC and non-smokers healthy subjects

Introduction:

Spirometry is an important tool in the diagnosis of pulmonary performance; it can measure many parameters such as forced expiratory volume in one second FEV_1, forced vital capacityFVC,forced expiratory flow FEF, AND peak expiratory flow PEF which can give idea on the diagnoses of certain diseases as well as the deterioration in the pulmonary function(1). The measurement of the forced expiratory volume taken at different times to the forced vital capacity(FVC) can give a good indicator for airways obstruction as well as the general pulmonary performance(2). Many previous studies have recorded these parameters and more such as FEV6 and the ratio of FEV1/FVC%, in relation to age, height sex and race/ethnic, aiming to calculate the reference values and lower limits of normal (LLN) as well as the construction of some kind of formulae to predict the pulmonary performance and/or diseases (3). More studies considered the derivation of specific formulae for the FEV_1/FVC% for ethnic and sex in which the variables are only FVC and age (4).Several types of formulae such as the base reference equations have also been introduced (5, 6), the prediction equations (7, 8, 9) or the modification of the prediction formulae of spirometric parameters (10). Roberts S. and co workers studied the effect of age height in relation with LLN and compared to a fixed ratio of (FEV1/FVC < 70% or 75%), such spirometric study conclude that the extremes of age indicate an obstruction defect (11) In this study we have collected data from 66normal individuals and have taken the ratio of (FEV1/FVC) as an indicator for their pulmonary performance. The work was concentrated on the changes with age for both genders. Our results show that the pulmonary performance generally deteriorates with age and show a significant change at ages over 60 year.

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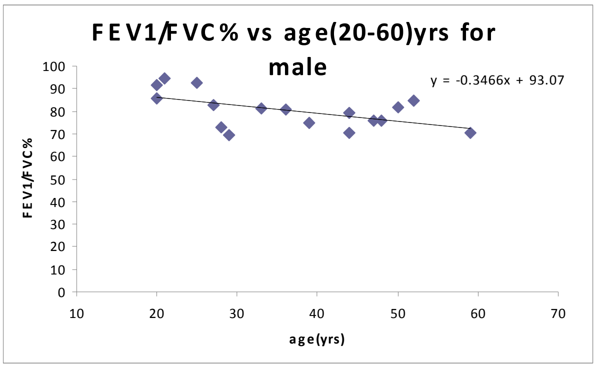
Patients and methods:

Sixty six healthy non smokers individuals from mixed gender attended the lung test department in the medical city Baghdad hospital, of them 29 male 37 female they have been subjected to spirometric tests from which the forced expiratory volume for one second (FEV_1) and for forced vital capacity (FVC) were measured, the former test people were asked to inhale as deep as they can and blow as hard as they can to get maximum exhaled air in one second while the measurement of the latter people were asked to exhale forcefully to evacuate their lungs as much as they can. The averages for each gender were calculated on ten years bases and the ratio between (FEV_1/FVC) percent was calculated. The ratio of FEV_1/FVC% for individuals of ages between 20-30 was compared with other ratios FEV_1/FVC% for other age groups i.e. (30-40, 40-50, 50-60, 60-70, 70-80), for both genders. Averages and standard deviation for all age groups were calculated for both genders separately.

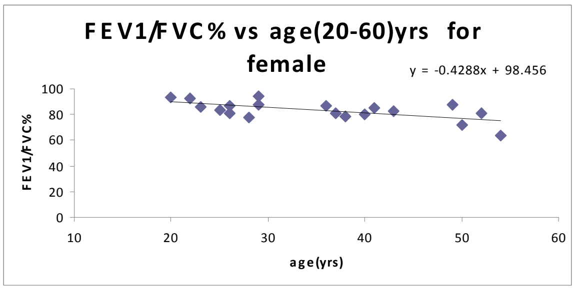
Statistical analysis was carried out using excel, standard deviation and two tailed t-test and p value were obtained for test for significance

Results:

Results revel that there is no significant change in the average of (FEV_1/FVC) % with age for ages between 20 to 60 years old. The comparison between the average of (FEV_1/FVC) % for subjects ages between (20-30) with the averages of (FEV_1/FVC) % for subjects ages between (30-40), (40-50) and (50-60) years old does not show a significant difference as their average values for male ranging between (85.3-79.9) with insignificant p values (0.13, 0.060. 0.38) respectively tables (1A and 2A) and fig (1A). a similar results obtained for female as the same comparison has given FEV1/FVC % ranging between (83.53-78.12) also with insignificant p value tables (1B and 2B) and fig. (1B). while the same comparison was made between the average of (FEV_1/FVC) % for subjects (20-30) years of age with (60-70) and (70-80) years old for both genders shows a significant depression in the ratio of (FEV_1/FVC %), change (15.5 and 22.7 %), with p value of (0.0068, 0.00092) for male respectively tables(2-A) ,fig (2A), and the change for female was (8.9 and 15%) with p value (0.00022, 0.0010) respectively table (2B), fig (2B).this result is apparent on the slope on figure (1) and figure (2) as we can clearly see that the slope of graphs drawn as FEV1/FVC versus age give higher slope for the older individuals than the younger ones. Averages for values of FEV_1, FVC and the ratio of FEV_1/FVC % for Iraqi people have also been obtained table (3).

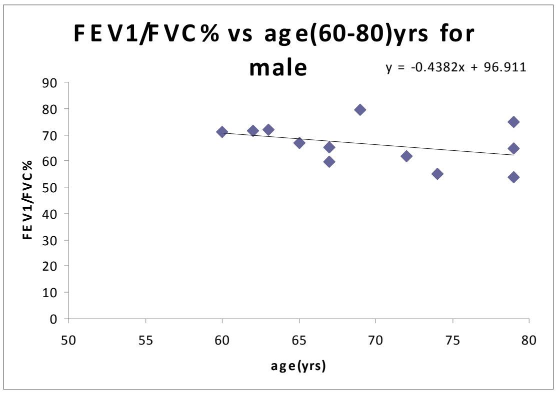


A



B

Figure (1) the change of FEV1/FVC% with age 20-60 yrs (A for male and B for female)



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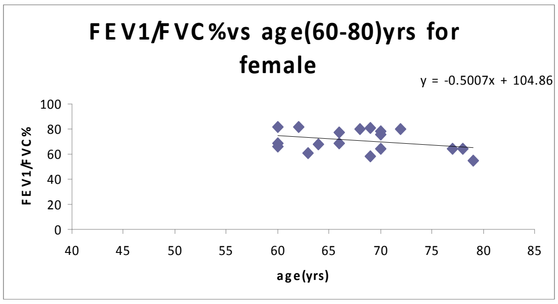

B

Figure (2) the change of FEV1/FVC% with age (60-80) yrs (A-male and B-female)

Table (1) the average values for FVC, FEV1 (in liter) and FEV1/FVC% (A- for male and B for female)

(A)

age	FVC average +SD*	FEV1 average+ SD	FEV1/FVC% average+ SD
20-30	3.81±0.61	3.25 +0.76	85.3+9.77
30-40	2.94±0.87	2.44+0.80	82.99+3.57
40-50	2.79±0.78	2.23+0.86	79.92+3.70
50-60	2.76±0.71	2.22+0.28	80.43+7.36
60-70	2.72±0.27	1.96+0.32	72.05+6.35
70-80	2.41±0.45	1.59+0.45	65.97+8.36

***SD standard deviation**

(B)

Table (2) comparison of FEV1/FVC% (20-30) age group versus older age groups of FEV1/FVC %(A for male and B for female)

age	FVC average+SD	FEV1 average+SD	FEV1/FVC% average+SD
20-30	3.34±0.92	2.79+0.71	83.53+5.67
30-40	2.90±0.85	2.37+0.62	81.72+4.26
40-50	2.93±0.40	2.39+0.27	81.56+2.63
50-60	2.88±0.26	2.25+0.42	78.12+8.95
60-70	2.47±0.54	1.88+0.59	76.11 + 8.64
70-80	2.26±0.47	1.60+0.42	70.79+9.18

(A)

age	Age range	Change % ofFEV1/FVC%	p-value	significance
20-30	30-40	2.7	0.13	NS
20-30	40-50	6.3	0.06	NS
20-30	50-60	5.7	0.38	NS
20-30	60-70	15.5	0.0068	S
20-30	70-80	22.7	0.00092	S

(B)

age	Age range	Change% ofFEV1/FVC%	p-value	significance
20-30	30-40	2.2	0.20	NS
20-30	40-50	2.4	0.25	NS
20-30	50-60	6.5	0.08	NS
20-30	60-70	8.9	0.00022	S
20-30	70-80	15	0.0010	S

Table (3) the averages of FVC, FEV1 and FEV1/FVC %

gender	Total average of FVC	Total average of FEV1	Total average ofFEV1%
Male	2.27	2.90	78.96
female	2.21	2.79	79.14

Discussion:

It is well known that the flow of every fluid proportional with the forth power of the radius of the pipe in which it flows (poiseuille's law), for this reason a small narrowing in the trachea may cause a large change in the air flow. This is also applicable for the forced expiratory flow probably with small is modification. For this reason The FEV_1 as it stands for, the person should exhale forcefully in one second approximately about 85% of the vital capacity for normal individuals (12). It is therefore, values lower than this can be considered as a sort of respiratory dysfunction. In our results we found that the average FEV_1 value for female is lower than that for male the same thing was found for the average value for the forced vital volume capacity (FVC), this result is in agreement with (5), it may indicate that the lower FEV_1 is related to the possible smaller average vital volume capacity for female. The reduction in the female average of both (FEV_1 and FVC) has given a slight difference in the percentage for the ratio FEV_1/FVC% for both male and female table (3).Results of the comparison between the ratio of FEV1/FVC percent in relation to their differences in age reveal that there is a significant reduction in the ratio of (FEV_1/FVC) percent for the older people regardless of their gender and this reduction is apparent when their age exceeds 60 years a similar result has been obtained by (11) the comparison between individuals age (20-30) with those of age (60-70) and (70-80) has given higher change and low p value table (2-A and B), in addition to that the higher slope on the graph figures (1)and (2) plotted for age versus FEV1/FVC for older people give the conclusion that the deterioration in the respiratory performance is higher in the old age than in the younger individuals. This indicate a sort of respiratory impairment, but the effect may not be attributed to the trachea per se but it may be caused by the more weekend muscles caused by the old age, which may cause a lesser forced exhaled air volume and consequently, giving this significant difference table (2).

Conclusion:

Pulmonary performance for normal people is changed with age, this change does not appear for ages less than 60yrs old individuals, and the ratio of FEV1/FVC % is significantly reduced for ages > 60 years. The effect may be attributed to some changes in the airways together with possible weakness in the muscles

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