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A Comparative Study of Pulmonary Function Tests in Healthy Punjabi working and non-working Females -Effect of Air Pollution on Lungs

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Abstract: *Inhalation of polluted air over a long period of time leads to proliferation and fibrotic change in lungs. Early recognition of this damage provides an important clue to insure goodhealth. Spirometery is an invaluable screening test to identify patient with airflow obstruction. The study has been conducted on 100 working (cases) and 100 non-working (controls) healthy Punjabi females between 20-50years of age. The pulmonary function tests like FVC, FEVI and PEFR measured by computerized spirometer (Med-spiror) showed a highly significant decline in the working females. The cause of decline in flow volume in working females is due to industrial pollution (So_2, Co_2, No_2, Co), Respirable suspended particulate matter and cumulative dust exposure and exhaust emission of vehicles. The cause of better preserved pulmonary function especially the flow volumes in the non-working females is due to very less exposure to pollution, use of LPG and living in well ventilated houses. So chronic exposure to Air-Pollution is associated with chronic bronchitis and reduced lung functions in working females.*

Keywords:- *working women, PEFR, FVC, FEV_1, Air pollution.*

I. Introduction

Spirometery is vital in screening, diagnosing and monitoring of patients in clinical respiratory medicine. The interpretation of these results depend on comparison with reference values derived from a pool of normal healthy population. PFT Parameters were mainly influenced by body height and weight in both sex.[1]PFT's are affected by factors including diet, obesity, airpollution and physical activity level. In the last two decades rapid economic growth and development in peoples nutritional status. At the same time, air pollution levels have increased and peoples physical activity levels have decreased.[2]

Pulmonary function testing, measure the function of lung capacity and lung chestwall mechanics to determine weather or not the patient has a lung problem. However the required instruments are relatively expensive. Vital capacity is an important index in pulmonary function.[3]

These is increasing evidence for apossible association between chronic obstructive pulmonary disease (COPD) and the use of bio mass fuels for cooking and heating in developing countries. Indoor pollutants from biomass fuels may be an important risk factor for chronic bronchitis, COPD[4,5].

Indoor pollution exposures were associated with the presence of acute respiratory symptoms and mild lung functions in a rural and urban area.[6]There were differences in the prevalence of obstruction depending upon the distance of the place of residence from a busy traffic road, better spirometric results were observed among inhabitants living more than 150m from main roads.[7] The computed regression norms may be used to predict the spirometric values in young Indian population of similar age group as the study population.[8]One limitationof forced Spirometery is that it integrates the contribution of the complex and dynamic behaviour of all the airways and tissues of the lung into a single exhaling unit, hence it is not clear how spirometric measures are affected by local changes to the airways or tissue such as presence of "Ventilation defects."[9]

The subjects living in areas with high level of air pollution showed higher prevalence rates of respiratory symptoms and a larger decrease of FEV_1, Compared with those living in areas with low levels of air pollution. Since the traffic density is larger in areas with high air pollution, the differences among the groups may reflect the effect of air pollution attributable to particulate matter found in automobile exhaust.[10]Age had a negative relationship with the spirometery parameters. While height was positively correlated with each except for the FEV_1/FVC ratio that was related only to age.[11]

PEFR reaches a peak at about 18-20years, maintains this level upto above 30 years in males and about 40 years in females, and then declines with age. Indian PEFR values compare favorably with other ethnic groups such as Americans and Europeans.[12]

II. Material And Methods

This study was conducted among 100 working women who work in offices, banks, teaching in schools and in hospitals as cases and 100 non working women who are most of the time confined to their houses as controls in and around Patiala, Punjab between 20-50 years of age.

Judged to be healthy on the criterion of no exertional dysponea/general debility, h/o current/past cardio respiratory disorder or frequent cold, obvious sign of malnutrition, no obesity, h/o smoking and a detailed physical examination was carried out and Hb. Concentration was done.

Normal subjects were defined as one who did not have persistentcough or phlegm in the morning and did not report haemopthysis, dysponea, wheezing or nasal catarrh at the time of interview.

The lung function tests were suggested by Gandevia and Hugh Jones and cotes. The Procedure were quite simple from patients point of view. Only two maneouver were required to accumulate all test data i.e. a forced vital capacity and maximum volumetary ventaliation. All gas volumes are corrected to B.T.P.S (body temperature ambient pressure and Saturated with water vapour) automatically by the instrument. Pulmonary function tests were carried out in standing position, height was measured in centimeters, weight was measured in kilograms, body surface area was read from "Nomogram" Dobous and Dobous.

In the procedure of lung function a nose clip was attached to the subject and a clean mouth piece was inserted into the breathing tube two maneouver were performed.

1) **Forced vital capacity test:-** subjects were instructed to take maximum inspiration and then place mouth piece firmly in mouth and performed, maximum expiration.
2) **Maximum voluntary ventilation test procedures:-**After rest of five minutes the subject was asked to breathe as rapidly and deep as possible in and out from the mouth piece. MVV test was run for 12 seconds. Results were taken on the built in printer containing all patients information and calculated values of all the 14 parameters.

III. Statistical Analysis

The various statistical consideration used were mean, standard deviation, correlation Co efficient and regression equation was evaluated by constructing ANOVA table.

IV. Results

Anthropometric parameters in cases and controls are shown in Table 1 showing mean standard deviation 't' value 'P' andsignificance. The value of FVC, PEFR, FEV_1shows statistical significant difference between cases and controls. FVC table 2. Shows mean 'SD' and 't' value significance in the cases and controls and show that it is statistically highly significant. FEV_1Table 3. Show mean 'SD' and 't' value significance in the cases and controls and show that it is statistically significant. PEFR Table 4. Show mean 'SD' and 't' value significance in the cases and controls and show that it is statistically significant.

Table 1
Comparison Of Anthropometric Parameters In Cases And Controls Population
(Working women – Cases, Non working women – Controls)

Para Meters	Mean+SD Cases	Mean+SD Controls	T Value	P Value	Sig.
Age	33.18±9.37	31.54±9.45	1.75	>0.05	NS
Weight	60.33±11.81	61.22±10.38	0.84	>0.05	NS
Height	167.90±6.21	167.28±6.79	0.91	>0.05	NS
FVC	2.01±0.60	3.12±0.40	15.28	<0.01	HS
$FEV_{0.5}$	1.91±0.58	1.98±0.57	1.28	>0.05	NS
FEV_1	5.33±1.90	5.77±1.88	2.31	<0.05	S
FEV_3	3.11±0.68	3.18±0.60	1.34	>0.05	NS
PEFR	6.97±2.70	7.52±2.76	2.22	<0.05	S
FEV_{25-75}	3.19±1.17	3.18±1.14	0.11	>0.05	NS
$FEF_{0.2-1.2}$	2.66±0.53	2.73±0.61	1.40	>0.05	NS
$FEF_{25\%}$	2.87±0.43	2.35±1.41	1.68	>0.05	NS
$FEF_{50\%}$	3.74±1.37	3.83±1.40	0.61	>0.05	NS
$FEF_{75\%}$	1.66±0.89	1.77±0.96	1.23	>0.05	NS
$FEV_{0.5}$/FVC	0.61±0.51	0.61±0.74	0.21	>0.05	NS
FEV_1/FVC	0.85±0.09	0.85±0.10	0.39	>0.05	NS
FEV_3/FVC	99.40±2.41	99.28±2.83	0.83	>0.05	NS
MVV	108.34±337.87	113.54±31.43	0.80	>0.05	NS

S- Significant
HS- Highly Significant
NS- Non Significant

Table 2
Mean ± Sd, T Value And Significance Of Fvc

	Mean±SD Cases	T Value	Significance
Case	2.01±0.60	15.28	< 0.01 H.S
Controls	3.12±0.40		

Table 3
Mean ± Sd, T Value And Significance Of Fev_1

	Mean±SD Cases	T Value	Significance
Case	5.33±1.90	2.31	< 0.05 S
Controls	5.77±1.85		

Table 4
Mean ± Sd, T Value And Significance Of Pefr

	Mean±SD Cases	T Value	Significance
Case	6.97±2.70	2.22	< 0.05 S
Controls	7.52±2.76		

V. Discussion

This study was done with an aim to collect more data on the working women who are exposed to air pollution and the non-working women which are less exposed to Air pollution. As there was marked difference between the urban and suburban areas and to bridge the gaps in our knowledge.

In this study, we found that the working women in the cities (Teachers, office workers, Hospital workers etc) are exposed to the Air pollution because of industries, exhaust emission of vechicles and cummulative dust for 6-8 hours daily. Whereas non-working women are very less exposed to this type of Air pollution. Moreover they stay for most of the time in the well ventilated houses and use LPG for cooking.[4,5,6]

This study showed that the working women have significant lower values of FVC, FEV_1 and PEFR. This probably due to respirable particle concentration (So_2,No_2,Co_2,Co) were higher in the polluted air.[10,12]Automobiles are necessary evils on one hand they have made living easy and convenient but on the other hand they have also made human life more complicated and Vulnerable to both toxic emissions and increased risk of accidents, Urban people are more affected because motor vehicular pollution is predominent here and significantly contribute to air quality problems.[6]There were differences in the prevalence of obstruction depending on the distance of the place of residence from a busy traffic road.[7]

VI. Conclusion

Study of lung function parameters conducted on 100 working women (Cases) and 100 non working (Controls). The cases as they have to move out of their houses for work and are exposed to air Pollution showed that decline in three parameters was due to respirable suspended particulate matter in the smoke produced by Industries and exhaust emission of vehicles and caused the noxious effect of air pollution on the lungs. The cause of better preserved lung function of controls is due to lesser exposure to the respirable suspended particulate matter Co_2,Co, No_2, So_2 etc.as most of these controls are housewives and use to stay at home most of the time and use LPG for cooking and have well ventilated houses. More phlegm production, chronic bronchitis and airflow obstruction were increased in working women who are exposed to air pollution. Air pollution can be decreased by shifting the industries out of towns, proper usage of quality fuel for vehicles, timely servicing of vehicles, planting more trees and use of air masks.

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