"Studyof FVC, FEV_1&FEV_1/FVCin pregnant women residing near polluted areas of western Rajasthan, India" -a longitudinal study"

Tilwani Khemlata[1,*], Maheshwari Madhurima[2], Jangid Priya[3], Tilwani R K[4], Rajnee[5], Ojha K C[6]

[1,3]Assistant Professor, [5]Senior demonstrator, [6]Ex Professor & head, Department of Physiology,
[2]Medical Officer, S. N. Medical College, Jodhpur (Raj.), India;
[4]J.S Medicine, E S I Dispensary 1, Pali, (Raj.), India;

***Corresponding Author:**
E-mail: kl.tilwani@yahoo.co.in

ABSTRACT:

Objective:*To study the lung functions of pregnant women in polluted areas of Bikaner city of western Rajasthan.*

Material & Methods: *Study was conducted on 100 normal pregnant women in the age group of 20-35 years of all gravid. Out of 100 pregnant woman fifty were selected from high polluted areas as study group & fifty were from less polluted area as control group. The women were studied with repeated measures of lung function using spirometry at a gestational age of 4–12, 13–24 and 25–40 week. Pulmonary function test were conducted with the help of computerized spirometer (RMS-Helios 401 Transducer no 400-666) in sitting posture, during three different trimesters in same subject.*

Results: *On comparison of data using ONE WAY ANOVA test revealed that FVC, FEV_1 and FEV_1/FVC were statistically significantly decrease during three trimesters more in subject living in polluted area.*

Conclusion: *There is statistically significant reduction in lung functions during pregnancy in polluted areas.*

Keywords: *Longitudinal study, Air pollution, Spirometry, Lung functions during pregnancy*

Access this article online	
Quick Response Code:	**Website:** www.innovativepublication.com
	DOI: 10.5958/2394-2126.2015.00024.9

INTRODUCTION

Pregnancy is a normal but altered physiologic state that results in significant hormonal, mechanical, and circulatory changes. Increased levels of progesterone during pregnancy are thought to be responsible for the rise in ventilation above that explained by the enhanced metabolic requirements. Progesterone is strong respiratory stimulant. Progesterone increases minute ventilation, CO_2chemo sensitivity, and airway occlusion pressure.

Dyspnea in late pregnancy was explained by the hyperventilation of pregnancy and restriction due to uterine enlargement. Uterine enlargement leads to small reduction in both residual volume and functional residual capacity while the total lung capacity was maintained by the increase in the inspiratory capacity [1]. The variation of asthma severity during pregnancy was explained by the increase in the circulating cortisol[2,3]. During pregnancy there was significant increase in respiratory rate, tidal volume, vital capacity and inspiratory capacity while the expiratory reserve volume had a significant fall[4]. Several changes reported in the maternal pulmonary function tests during pregnancy are also a part of this adaptation. Increasing size of the fetus impedes the normal process of ventilation in the mother. So, increase in the respiratory function because the fetus depends on the mother's lungs for oxygenation and any impairment in the mother may result in fetal distress.The most important source of the air pollutants is vehicle exhaust, which is a complex mix of many gases and particles.The impact of vehicular pollution on human health in urban areas is at peak level as vehicle emissions are near the ground level where people live and work. Generally in urban centers the residential areas are located along the roadside. The populations of such areas are continuously exposed to vehicular pollution.

Exposure to air pollution during specific pregnancy periods may also trigger inflammation and lead to preterm birth.Pollution of atmosphere is greatly influences lung functions, so it may be important that how much extent pollution affects respiratory functions in pregnancy. We could not find any reports of lung function changes in pregnant Indian women so we decided to study the consequences of pollution in pregnant Indian women in all trimesters.

MATERIAL & METHODS

Pregnant women belonging to the 20-35 yrs. of age volunteered themselves for the present study belonging to middle socio economic status and come for regular checkup in hospital as OPD basis. General physical examination of the subject including required anthropometric measures such, as height, weight and chest circumference was noted. Resting

body temperature resting pulse rate, and Blood Pressure were taken in sitting postured after five minutes of rest for every time when they come for pulmonary function testing. In the present study the estimates are made on the lung function efficiency of the pregnant woman exposed to highway traffic pollution.

Pulmonary function test were conducted with the help of computerized spirometer (RMS-Helios 401 Transducer no 400-666) in sitting posture... PFT include FVC, FEV_1& FEV_1/FVC ratio. The blood pressure was recorded with a mercury column Sphygmomanometer using a standardizing technique and weight were also monitored by weighing machine. The data were expressed as mean ± SD & critical difference (CD) using ONE WAY ANOVA. Analysis was performed by using MSTAT software.

Pulmonary function tests are noninvasive diagnostic tests that provide measurable feedback about the function of the lungs. By assessing lung volumes, capacities, rate of flow, and gas exchange. The test requires the patient inhale deeply followed by a rapid exhalation so that all the air is exhausted from the lungs. Spirometry test results vary, but are based on predicted values of a standardized, healthy population. The spirometer records the amount and the rate of air that you breathe in and out over a period of time. Normal values are based upon your age, height,ethnicity and sex. Normal results are expressed as a percentage. A value is usually considered abnormal if it is less than 80% of your predicted value.

OBSERVATION AND RESULT

Table 1: FVCduring 1st, 2nd and 3rdTrimester in subjects (liters)

GROUPS (n=50)	1STTrimester (mean ± SD)	2NDTrimester (mean ± SD)	3RDTrimester (mean ± SD)	One Way Anova CD (5%)
Study group	2.26 ± 0.102	2.107 ± 0.05	1.980± 0.04	0.021
Control group	2.310 ± 0.17	2.240 ± 0.16	2.175 ± 0.17	0.011

Table 1 shows FVC decreases from 1st to 3rd Trimester in both groups. The value declines more in subjects of study groupas compared to subjects of control group.

Table 2: FEV_1 during 1st, 2nd and 3rd Trimester in subjects (liters)

Groups (n=50)	1STTrimester (mean ± SD)	2NDTrimester (mean ± SD)	3RDTrimester (mean ± SD)	One Way Anova CD (5%)
Study group	1.774± 0.09	1.582 ± 0.04	1.39 ± 0.037	0.020
Control group	1.851 ± 0.13	1.74 ± 0.14	1.65 ±0.13	0.009

Table 2 shows FEV_1 decreases from 1st to 3rd Trimester in both groups. The value declines more in subjects ofstudy group as compared to subjects of control group.

Table 3: FEV_1/FVCduring 1st, 2nd and 3rd Trimester in subjects(%)

Groups (n=50)	1STTrimester (mean ± SD)	2NDTrimester (mean ± SD)	3RDTrimester (mean ± SD)	One Way Anova CD (5%)
Study group	78.44 ± 1.52	75.00 ± 1.55	70.26 ± 1.28	0.441
Control group	80.16 ± 1.14	78.00 ± 1.21	75.96 ± 1.03	0.265

Table 3 shows FEV_1/FVC decreases from 1st to 3rd Trimester in both groups. The value declines more in subjects of study group as compared to subjects of control group.

DISCUSSION

Our study suggests decrease in pulmonary efficiency in pregnancy as pregnancy advances from first to third trimester and also byexposed to higher level of pollution.The highly efficient and sensitive respiratory system becomes vulnerable with profound changes during pregnancy where adaptability is a key feature to combat stress, anxiety and fear resulting in altered performance of systems to need demandsIncreasing size of the fetus impedes the normal process of ventilation in the mother.[5] Ultra fine particles can penetrate through the lung barriers into the bloodstream and via the blood, they can enter other organs including the brain and placenta. These particles can cause inflammation, which may trigger premature labor. The residential population of this area is exposed to the air Pollutants continuously. The results are compared to the less exposed group of pregnant woman from the city. The result shows variations in the lung parameters (FVC, FEV_1 & FEV_1/FVC)the effect of the enlarged uterus displacing the diaphragm upwards is evident in the significantly reduced forced vital capacity among the pregnant subjects. The mechanical factors are not the only causative factors. Other factors such as hormonal influences also play a role, in altering and compromising the pulmonary flow parameters. FEV_1, FVC decrease in pregnant case group providing that pregnancy is a restrictive condition and not obstructive. Decrease in FVC in our study may be due to a relative decrease in the negativity of the intrapleural pressure brought about by an upward displacement of the diaphragm by the enlarging uterus.[6] Decrease in FEV_1 may be due to a decline in alveolar pCO2 (caused by hyperventilation) which acts as bronchoconstrictor. FEV_1 progressively declines during different trimesters of pregnancy due to mechanical pressure by enlarging gravid uterus, elevating the diaphragm and restricting the movement of lungs hampering the forceful expiration. We found that the FEV_1 / FVC ratio shows a definite decrease due to relative decrease in FEV_1 as compared to FVC. Hormonal alternation in pregnancy causes a reduction in the tracheo-bronchial smooth muscle tone and the increasing thoracic width may be compensating for the rise in the level of the diaphragm which occurs as a result of the enlarging gravid uterus.[7]

Inhalation of air pollutants can cause inflammatory responses and oxidative stress[8].Carbon monoxide crosses the placenta in the fetus, and causes inadequate circulation of oxygen for the baby, and result in fetal growth retardation.Nitrogen dioxide in pregnant women can result in babies being born with low birth weight.Particular populations living near busy roads are more susceptible to respiratory infection.[9]Active surface of particles inhaled several hours to days before spirometry was found related to short-term reductions in FVC, FEV_1 and maximal expiratory flow rate at 50% of vital capacity. [10]

The FEV_1/FVC ratio shows a definite decrease due torelative decrease inFEV_1 as compared to FVC.[6] Pollution is a significant cause of FEV_1/FVC decrease which is almost proportionate to progression of pregnancy.[11]

CONCLUSION

In our study all the values were less in pregnant subjects of polluted area than non or less polluted area hinting a definite role of pollution in reduction of lung functions incrementally as the pregnancy advanced, demanding a strategy to save people living in polluted areas.

ACKNOWLEDGMENT

We thank to all members of department of physiology and department of obstetrics and Gynaecology, Sardar Patel medical college, Bikaner. We are indebted to all the subjects participated in this study.

REFERENCES

1. Gazioglu K, Kaltreider NL, Rosen M and Yu PN (1970). Pulmonary function during pregnancy in normal women and in patients with cardiopulmonary disease. Thorax; 25(4): 445-50.
2. Gluck (1976). The effect of pregnancy on asthma: a prospective study. Ann Allergy. Sep; 37(3): 164-8.
3. Nolten WE and Ruckert PA (1981). Elevated free cortisol index in pregnancy: possible regulatory mechanisms. Am J Obstet Gynecol. 15; 139(4): 492-8.
4. Gilory RJ, Mangura BT and Lavietes MH (1988).Ribcage and abdominal volume displacement during breathing in pregnancy. Am Rev Respir Dis; 137(3): 668-72.
5. Saxena SC, Rao VSC, Mudgal S. A study of pulmonary function tests during pregnancy. J ObstetGynaecol India 1979;29(4):993-5.
6. Neeraj, Candy Sodhi, John Pramod, Joydeep Singh and VaneetKaur.Effect of advanced uncomplicated pregnancy on pulmonary function parameters of north Indian subjectsIndian Journal of Physiology and Pharmacology 2010, 54(1) : 69-72.
7. Savita Singh,K C Singh, Sabyasachi S. Sircar and Kamal N Sharma (ijjp 1995;39(2): 160-162)airway function in pregnant indian woman.
8. Kelly FJ. Oxidative stress: its role in air pollution and adverse health effects. Occupational Environmental Medicine.2003; 60(8):612–616.
9. Singh V, Khandelwal R, Gupta AB. Effect of air pollution on peak expiratory flow rate variability. Journal Asthma 2003 Feb 40(1): 81-86.
10. Wien KlinWochenschr.Neuberger M, Moshammer H. Suspended particulates and lung health. 2004; 116(1):8-12.
11. HaidongKan, Gerardo Heiss, Kathryn M Rose, Eric Whitsel, Fred Lurmann and Stephanie. Traffic exposure and lung function in adults: the Atherosclerosis Risk in Communities study. Journal London doi:10.1136/thx.2006.