Peak expiratory flow rate in normal advanced pregnancy

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Abstract
Background: The physiological adaptations of the pregnant woman involve the circulatory, respiratory, digestive, renal, endocrine and metabolic systems. Their precise knowledge allows the clinician to verify the extent of the adaptation in pregnant women and helps to avoid unnecessary treatment of physiological changes misinterpreted as pathological changes in reference to prepregnancy standards. We designed the study to understand changes in pulmonary function tests during advanced pregnancy. **Result:** Mean value of PEFR (% of predicted) is decreased significantly in study group as compared with control group (P=0.001) **Conclusion:** It is concluded that pulmonary function test like PEFR decreases due to gravid state in advanced Pregnancy**.**
Keywords: Body Mass Index, Systolic Blood Pressure, Diastolic Blood Pressure, Pulmonary Function Test, Peak Expiratory Flow Rate.

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INTRODUCTION
This study was undertaken to evaluate the peak expiratory flow rate of women in the third trimester of uncomplicated pregnancy and to compare them with those of normal non-pregnant women with a view to define the standards of normalcy in pregnancy and also to document expected changes in pulmonary parameters in Indian women in the last trimester of normal gestation. The changes in respiratory physiology[1] are due to increasing size of the fetus with advancing gestation which constitutes a mechanical impediment to normal process of ventilation. The physiological adaptations of the pregnant woman involve the circulatory, respiratory, digestive, renal, endocrine and metabolic systems. These adaptations are necessary to meet the increased metabolic demands of the mother and fetus. Their precise knowledge allows the clinician to verify the extent of the adaptation in pregnant women and helps to avoid unnecessary treatment of physiological changes misinterpreted as pathological changes in reference to prepregnancy standards[2] and in anticipating disease worsening in pregnancy and the peripartum period in those women with cardiopulmonary disorders.

MATERIALS AND METHODS
The present study was conducted on 50 normal pregnant women in third trimester in the age group of 20-30 years and height of 130-160cm, Hemoglobin >10gm/dl and 50 non pregnant women of the same age and height. Written informed consent was obtained from each participant. A detailed history was recorded and complete clinical examination was done. The height and weight of the subject was noted and BMI was calculated. Pulmonary function tests were carried out in pulmonary function test laboratory using spirometer and the Forced vital capacity (FVC), Forced Expiratory Volume (FEV1) and FEV1/FVC ratio was recorded in the study and control groups. Data was analyzed with Microsoft office 2007 Excel and mean was calculated. Student 't' test was applied using SPSS software version[16]. There are many systems which are used to determine the severity of disease; the most commonly used system is given below,[3]

- Normal PFT out comes: >85% of predicted values

- Mild Disease: >65% but <85% of predicted value
- Moderate Disease : >50% but <65% of predicted value
- Severe Disease: <50% predicted values

RESULTS

The collected PEFR data was analyzed by using two tailed un-paired Student's t-Test by using SPSS Software version 16 and the values were expressed as mean ± SD of observed value. Analysis was done by using Microsoft Excel 2007. The age, height, body weight and BMI, systolic blood pressure, diastolic blood pressure and hemoglobin were compared between the control and the females with normal pregnancy in third trimester, using two tailed un-paired Student's t test.

Table 1: Baseline data of study and control subjects

Parameters	Case	Control
Age (Years)	23.16±2.25	22.76 ± 1.61
Height (Cm)	147.06±7.044	149.16± 5.86
Weight (Kg)	65.82±2.24	53.88±4.87 *
Bmi (Kg / M^2)	30.72±2.87	24.35±3.03 *
Heart Rate (Beats/Min)	83.8±6.39	80.58±6.5
Sbp (Mm Of Hg)	122±2.87	119.4±5.03
Dbp (Mm Of Hg)	78.41±10.79	76.88±5.03
Hb (Gm %)	10.95±0.66	12.94±1.33

Mean ± ST *Statistically significant (P < 0.001)

It was found that there was no significant difference between two groups for age in years (23.16 vs 22.76), height in centimeters (147 vs 149.16), HR in beats/min (83.8 vs 80.58), Systolic blood pressure in mm of Hg (122 vs 119.4), Diastolic blood pressure in mm of Hg (78.41 vs 76.88) and hemoglobin in gm % (10.95 vs 12.94) but the difference in the results of weight in kg (65.82 vs 53.88) and BMI in kg/m2 (30.72 vs 24.35) are statistically significant (P < 0.001).

Table 2: Values of PEFR in cases and control

PEFR	Min	Max	Mean	SD	T	P
Cases	82.8	97.3	88.78	3.41	183.82	0.00
Control	89.7	98.5	95.71	1.74	387.13	0.00

Table 2: Comparison of PEFR (% of predicted) between control group and study group

Parameter	Control group (n=50)	Study group (n=50)	Significance (p value)
PEFR (% of predicted)	95.71± 1.74	88.78± 3.41	< 0.011*

*statistically significant

Mean value of PEFR (% of predicted) is decreased significantly in study group as compared with control group (P=0.001)
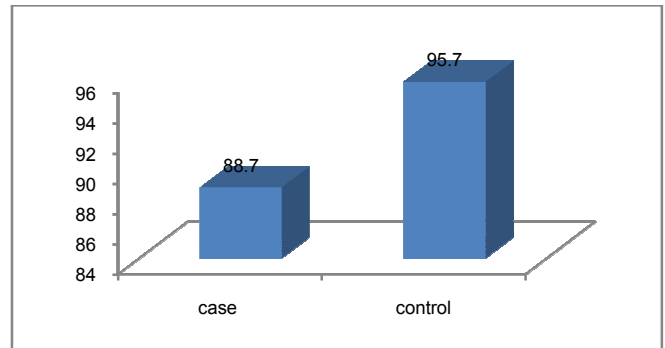

Figure 4: PEFR in control and case Group

DISCUSSION

The study and control groups are matched with one another with respect to age in years *(23.16 vs 22.76)*, height in centimeters *(147 vs 149.16)*, HR in beats/min (83.8 vs 80.58), Systolic blood pressure in mm of Hg (122 vs 119.4), Diastolic blood pressure in mm of Hg (78.41 vs 76.88) and hemoglobin in gm % (10.95 vs 12.94) but it was found that the difference in weight and Body Mass Index is statistically significant (P < 0.001). This is because of the normal weight gain, edema and uterine enlargement which occur in pregnancy. This gain in weight may be one of the reasons for the changes in PFTs. PEFR (% of predicted) is decreased significantly in study group as compared with control group (0.001) The mean PEFR of the study subjects showed statistically highly significant decline as the pregnancy advanced to 3rd trimester .This observation was similar to the observations by the authors in the earlier studies([1,4,5,6,7,8,9,10,11,12].) However, Brancazio *et al*[13] observed not significant change during the 3rd trimesters and postpartum. Decrease in PEFR may be due to a decline in alveolar Pco_2 (caused by hyperventilation) which acts as bronchoconstrictor. Also the decrease in PEFR could be due to lesser force of contraction of main expiratory muscles like the anterior abdominal wall muscles and internal intercostals muscles[4,14] caused due to increased maternal weight gain, edema and uterine enlargement which limit the maternal effort significantly especially in late third trimester[6]. We found that our findings were in agreement with those of Mokkapatti *et al*[13], Monga and kumara[7], Puranik *et al* (1995)[14] Phatak and Kurhade and Harirah *et al*[6]. In our study significantly lower Peak Expiratory Flow Rate in subjects in gestational age group >34 weeks as compared to those in Control group may be attributed to increase in gestational age, increasing size of the gravid uterus with advancing gestational age causing upward displacement of the diaphragm resulting in more decrease in the pulmonary function parameters in late third trimester

SUMMARY AND CONCLUSION

The present study concluded that pregnancy causes changes in PEFR. The mechanical and hormonal changes which take place in pregnancy leads to decrease in all parameters of PEFR. The combination of hormonal changes and mechanical effects of the enlarging uterus result in significant changes in pulmonary physiology. These adaptations are necessary to meet the increased metabolic demands of the mother and fetus. It is important for the clinician to be familiar with the normal physiologic changes in pregnancy. Understanding these changes is critical in distinguishing the common dyspnea that occurs during normal pregnancy from pathophysiologic states associated with cardiopulmonary diseases seen in pregnancy, and in anticipating disease worsening in pregnancy and the peripartum period in those women with cardiopulmonary disease.

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