Original Research Article

Evaluation of Peak Expiratory Flow Rate in Pregnancy in a South Indian Tertiary Care Centre

Aruna Shanmuganathan[1*], Krishnaveni R[2], Meenakshi Narasimhan[3], Viswambhar V[4], Ragulan R[5], Nisha Ganga[6], Gangaiamaran M[5], SSJ Shiek Fareeth Ahmed[5]

[1]Professor, [2]Postgraduate Student, [3]Professor and Head, [4]Associate Professor, [5]Assistant Professor, [6]Senior Resident
Department of Respiratory Medicine, Chettinad Hospital and Research Institute, Tamil Nadu, India
[*]Corresponding author email: **draruna.shanmuganathan@gmail.com**

International Archives of Integrated Medicine, Vol. 4, Issue 7, July, 2017.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 16-06-2017 **Accepted on:** 22-06-2017
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Aruna Shanmuganathan, Krishnaveni R, Meenakshi Narasimhan, Viswambhar V, Ragulan R, Nisha Ganga, Gangaiamaran M, SSJ Shiek Fareeth Ahmed. Evaluation of Peak Expiratory Flow Rate in Pregnancy in a South Indian Tertiary Care Centre. IAIM, 2017; 4(7): 61-66.

Abstract

Background: Pregnancy is a physiological state causing significant physical and functional changes in Cardiovascular and Respiratory system. It is important to recognize the adaptive changes during pregnancy in order to identify and manage Respiratory impairment. The Respiratory system undergoes structural and functional alterations affecting the thoracic cage, abdominal cavity and diaphragm. There is a decrease in Functional Residual Capacity (FRC), Expiratory Reserve Volume (ERV), Chest wall Compliance & increases in Tidal Volume (TV), Minute Ventilation (MV) during pregnancy. However, Airway function is postulated to largely remain unchanged during pregnancy with Peak Expiratory Flow Rate (PEFR), FVC and Forced Expiratory Rates like FEV1 showing little change. Hence, PEFR which is a simple, portable, cheap and reproducible parameter can be utilized to assess airway function during pregnancy. Due to conflicting reports of PEFR with advancing gestation in different ethnic groups and limited studies in the South Indian population, the present study was undertaken to evaluate the PEFR variation in different trimesters of normal pregnancy.
Aim: To Evaluate the Peak Expiratory Flow Rate in Pregnancy in different trimesters.

Materials and methods: Total of 165 pregnant women in the age group of 20-35 year with no respiratory illness or co morbidities (55 in each trimester) were included in our study. Control group consisted of 55 age and height matched non pregnant women. Informed consent was obtained and PEFR was performed using Mini Wright s Peak Flow Meter and best of three recordings noted. Data analyzed using SPSS package version 21.0. Association between PEFR with Age and BMI performed using Pearson correlation. The Bonferroni's Multiple Comparison Test executed to determine the significant variance of PEFR between control and study groups.

Results: PEFR was significantly lower in all trimesters of pregnancy compared to controls. However, there was no significant difference in PEFR across trimesters. Age and BMI did not correlate with PEFR.

Conclusions: PEFR was significantly lower in all trimesters compared to controls. Hence, prospective Indian studies with larger samples are needed to arrive at Normograms for PEFR in each trimester of normal pregnancy which would enable us to use PEFR as a simple tool to assess airway obstruction in pregnancy.

Key words

PEFR, Pregnancy, Trimesters, BMI, Age.

Introduction

Pregnancy is a normal physiological state accompanied by significant hormonal, mechanical and circulatory changes. Changes in respiratory physiology during pregnancy occur due to structural changes in the chest wall and abdominal compartments as a consequence of hormonal changes, enlarging uterus and elevated diaphragm [1, 2]. Though there are changes in certain respiratory parameters, FEV1 and PEFR are largely unaffected [2, 3]. It is essential that the normal physiological changes in the respiratory system have to be kept in mind to enable accurate diagnosis of respiratory impairment in pregnancy. PEFR is a simple, non-invasive, easily performable, portable, economical and reproducible tool for effective assessment of asthma control. Though PEFR has been postulated not to significantly change throughout pregnancy, there are conflicting reports from various studies on the variation of PEFR in pregnancy [4-7]. Since studies in the South Indian population on lung function including PEFR are few [5-7], the present study was undertaken to assess the variation of PEFR in different trimesters of pregnancy. This would enable us to utilise PEFR for assessment of airway obstruction in pregnancy.

Materials and methods

Study Design: Prospective observational study conducted in Chettinad Hospital and Research Institute, Kelambakkam, Chennai.

Methodology

After obtaining Institutional Ethical Committee clearance, a total of 165 pregnant women in the age group of 20-35 year with no respiratory illness or co morbidities (55 in each trimester) were included in our study. Control group consisted of 55 age and height matched non pregnant women. Age and BMI of the study and control groups were noted. Informed Consent was obtained in both groups and education regarding the correct performance of the PEFR technique was done. PEFR was performed as per Standard Protocols with the Mini Wrights Peak flow meter and best of three values noted.

Statistical Analysis

All Statistical Analysis were done using SPSS package version 21.0. The association between the PEFR with Age and BMI was performed using Pearson correlation. The Bonferronis Multiple Comparison Test was executed to determine the significant variance of PEFR between the controls and study groups.

Results

Mean and standard deviations of Age, BMI and PEFR of control and study groups were as per **Table – 1**. Age distribution in Control and study groups was as per **Figure – 1**. BMI distribution in Control and study groups was as per **Figure – 2**. PEFR distribution in Control and study groups was as per **Figure – 3**. Correlation analysis of Age and BMI with PEFR was as per **Table – 2**. Significance analysis of PEFR was as per **Table – 3**.

Table - 1: Descriptive analysis of Age, BMI and PEFR.

Parameter	Control (Average ± SD)	First Trimester (Average ± SD)	Second Trimester (Average ± SD)	Third Trimester (Average ± SD)
Age	24.50 ± 5.14	25.79±3.15	25.88 ± 3.43	25.53±3.74
BMI	23.51 ± 3.25	24.94± 3.34	24.96 ±3.04	25.66±7.41
PEFR	306.5 ± 22.5	275.6 ± 38.07	257.4 ±40.77	266.5 ± 37.33

Figure - 1: Bar diagram showing Age distribution in Control and study groups.

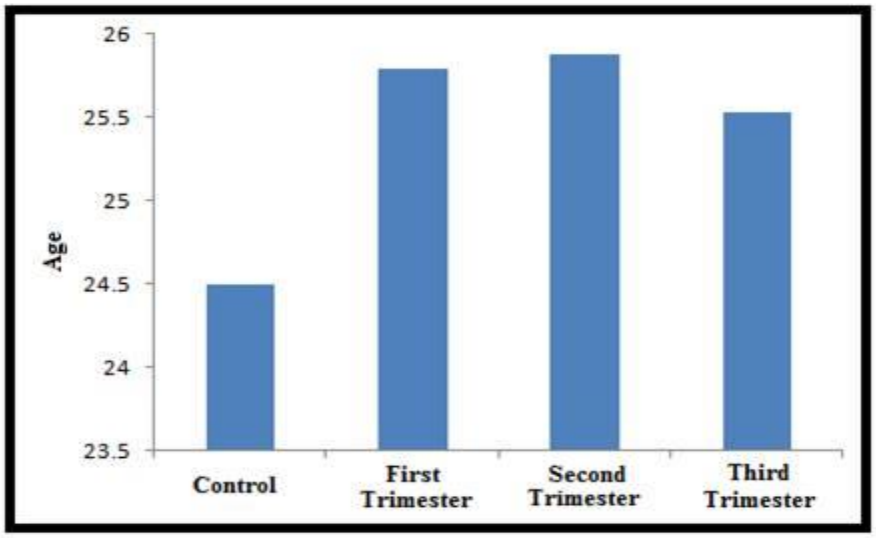

Figure - 2: Bar diagram showing BMI distribution in Control and study groups.

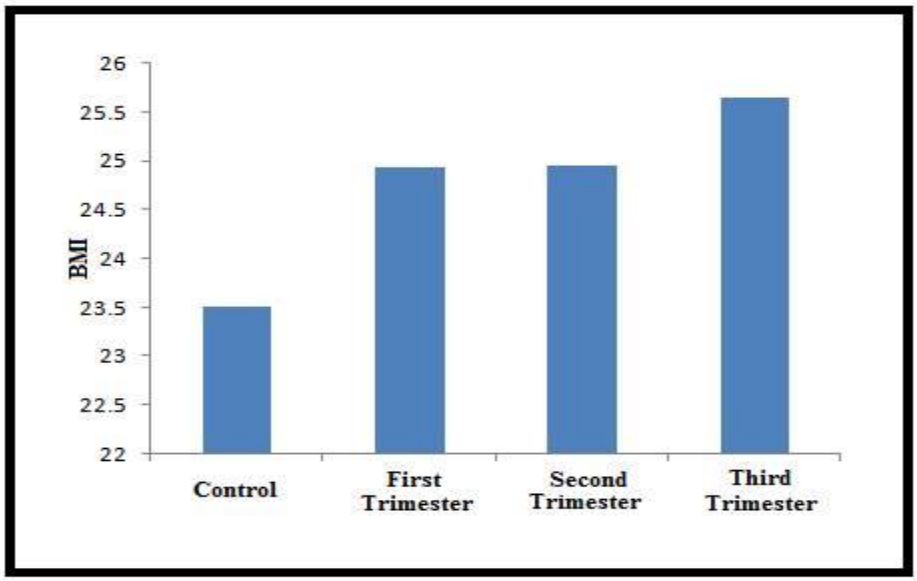

Figure - 3: Bar diagram showing PEFR distribution in Control and study groups.

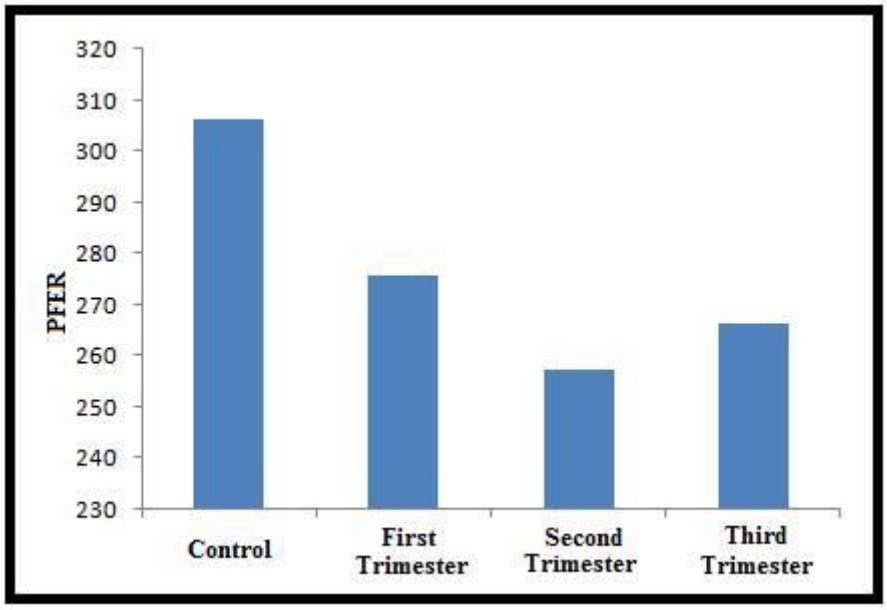

Table - 2: Correlation analysis of Age and BMI with PEFR.

	Control	First Trimester	Second Trimester	Third Trimester
	PEFR	**PEFR**	**PEFR**	**PEFR**
AGE	0.07	0.33	-0.20	0.27
BMI	0.21	0.19	-0.08	0.15

There was no correlation of Age and BMI with PEFR

Table - 3: Significance analysis of PEFR.

Bonferroni's Multiple Comparison Test	**Mean Difference**	**t**	**95% CI of diff**	**Significant? P < 0.05?**
Control PEFR vs First Trimester	30.88	4.703	10.16 to 51.61	Yes
Control PEFR vs Second Trimester	49.12	7.48	28.39 to 69.84	Yes
Control PEFR vs Third Trimester	40	6.092	19.28 to 60.72	Yes
First Trimester vs Second Trimester	18.24	2.777	-2.488 to 38.96	No
First Trimester vs Third Trimester	9.118	1.389	-11.61 to 29.84	No
Second Trimester vs Third Trimester	-9.118	1.389	-29.84 to 11.61	No

PEFR was significantly reduced in all three trimesters compared to control. However, there was no significant difference in PEFR between Trimesters.

Discussion

There are several studies and reviews of the pregnancy on respiratory function and physiology in health and disease [2, 3]. During pregnancy, there is a 20% increase in oxygen consumption and 15 % rise in the metabolic rate achieved through a 40-50% increase in the resting minute ventilation. The mild respiratory alkalosis seen during normal pregnancy is due to the effect of progesterone causing hyperventilation. Though dramatic physical and hormonal changes occur leading to decreases in chest wall compliance, FRC, minute ventilation and ERV, PEFR and other measures of airway function like FEV1, FEV1/FVC are postulated to largely remain unchanged as airway mechanics and diaphragmatic function are unaltered [2, 3]. Pulmonary impairment during pregnancy has

been associated with adverse outcomes including Low birth weight, IUGR, Gestational Hypertension and Pre term deliveries. It is hence necessary to monitor lung function during pregnancy to ensure optimal and safe outcomes. The course of Bronchial Asthma during pregnancy may remain stable, worsen or improve [3]. Since PEFR is a simple, portable and reproducible tool compared to spirometry, it can be used for assessment of asthma control in pregnancy .However, though PEFR is postulated to be largely unchanged during pregnancy, there are conflicting data on the variation of PEFR in different trimesters and ethnic groups [4-7].

Our present study shows that PEFR is significantly lower in all trimesters of normal pregnancy as compared to healthy controls. Similar observations were noted in the study of Puranik, et al. [4] showing that PEFR decreased from the 3rd to the 9th month progressively. They also noted that the Mean PEFR values were lower in their subjects as compared to European studies. This is in concordance to our study which also showed lower mean PEFR values in comparison to European studies [6].

The studies of Memon, et al. [8] and Harirah, et al. [9] observed the variation in PEFR with advancing pregnancy in both the sitting and supine positions. They noted that PEFR was significantly lower in all trimesters of pregnancy in both positions though there was no statistical difference in PEFR between trimesters. Our study also showed that though PEFR was significantly lower in all trimesters compared to controls, the variation in PEFR between trimesters was not significant.

Studies done in South Africa and Asia [10, 11] on changes in PEFR during the different trimesters of pregnancy also note that PEFR significantly decreased during pregnancy as compared with healthy controls and there was a significant decrease between trimesters.

There are comparatively however fewer Indian studies especially in the South on Variations of PEFR during pregnancy [12].

Our study showed that PEFR did not correlate with the age and height of the subjects. However Bansal, et al. [13] have showed that PEFR had a negative correlation with age and positive correlation with height.

Studies done by Brancazio, et al. and Purohit, et al. [6, 7] noted that there was no change in PEFR with advancing gestation and hence concluded that PEFR is a reliable tool to assess Asthma control during pregnancy.

The decrease in PEFR in all trimesters of pregnancy as observed could be attributed to the muscle weakness due to inadequate nutrition and lack of antenatal exercise. Other factors could be due to the enlarging uterus and elevated diaphragm.

In Contrast to the above studies, Grindheim, et al. [14] have shown that the PEFR and Forced vital Capacity increase after the 14-16th week of gestation and persist postpartum.

Varied observations on the changes in PEFR in the different trimesters of pregnancy are present from different ethnic groups across the world. Though PEFR is postulated to remain unchanged during pregnancy, majority of studies especially in Asia and Africa, show otherwise [4, 5, 8-11].

Hence more extensive large scale studies on lung function in pregnancy in the South Indian population are needed to determine the variation of PEFR with advancing gestation and to arrive at reference values for PEFR during each trimester as PEFR values vary widely in different ethnic groups and regions. This would enable us to utilise PEFR, which is a simple non-invasive tool for assessment of Asthma control during pregnancy.

Conclusion

PEFR was significantly lower in all trimesters of normal pregnancy as compared to healthy controls though there was no significant difference in PEFR across trimesters. Age and BMI did not correlate with PEFR. Hence, determination of ranges for PEFR from larger prospective studies in normal pregnancy for the South Indian population is necessary to enable PEFR to be used as a simple tool for assessment of Asthma control in pregnancy.

References

1. G. Bourjeily, K. Rosene-Montella (eds.). Pulmonary Problems in Pregnancy, Respiratory Medicine, Humana Press. Springer Business Media, LLC, 2009.
2. Belfort M. Critical care obstetrics. Chichester, West Sussex, UK: Wiley-Blackwell; 2010.
3. Das TK, Jana H. Maternal airways function during normal pregnancy. Indian J Med Sci., 1991; 45(10): 265-8.
4. Puranik BM, Kurhade GA, Kaore SB, Patwardhan SA, Kher JR. PEFR in pregnancy: A longitudinal study. Indian J Physiol Pharmacol., 1995; 39(2): 135-9.
5. Neeraj, Sodhi C, Pramod J, Singh J, Kaur V. Effect of advanced uncomplicated pregnancy on pulmonary function parameters of North Indian subjects. Indian J Physiol Pharmacol., 2010; 54(1): 69-72.
6. Brancazio LR, Laifer SA, Schwartz T. Peak expiratory flow rate in normal pregnancy. Obstet Gynecol., 1997; 89(3): 383-6.
7. Purohit G, Harsoda JM. Peak expiratory flow rate with Spirometry during pregnancy: Rural Indian perspective. IJBAP, 2014; 3(1): 238-42.
8. Memon MA, Memon SA, Bhura MS, Tariq Z, Essani R, Abid MA. Change in Peak Expiratory Flow Rate in different trimesters of pregnancy. RMJ, 2012; 37(3): 243-246
9. Harirah HM, DoniaSE, Nasrallah FR, Saadah R, Belfort MA.Effect of Gestational age and position on Peak expiratory flow rate: A Longitudinal Study. Obstet Gynaecol., 2005; 105(2): 372-6.
10. Chinko BC, Green KI. Peak Expiratory Flow Rate of Pregnant Women in Port Harcourt. Int. Res J Med Sci., 2014; 2(6): 1-5.
11. Sunyal D, Amin M, Ahmed A, Begum S, Begum M, Rahman N. Peak Expiratory Flow Rate in Pregnant Women. J Bangladesh Soc Physiol., 2007; 2: 20-23.
12. Teli A, Bagali S, Aithala M. A Study of FVC, PEFR and MEP in different trimesters of pregnancy. Int J of Biomed and Adv Res., 2012; 3(8).
13. Bansal DM, Goyal DM, Dhillon DJK, Kaur DP. Longitudinal Study of Peak Expiratory Flow Rate in Pregnant Women. NJIRM, 2012; 3(1): 34-38.
14. Grindheim G, Toska K, Estensen ME, Rosseland LA. Changes in pulmonary function during pregnancy: a longitudinal cohort study. BJOG, 2012; 119(1): 94-101.