WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.074
Volume 7, Issue 17, 98-106. Research Article ISSN 2277– 7105

EVALUATION OF THE EXPIRATORY FLOW RATE CHANGES IN PREGNANCY (HOSPITAL-BASED STUDY)

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Article Received on
26 July 2018,

Revised on 16 August 2018,
Accepted on 06 Sept. 2018

DOI: 10.20959/wjpr201817-13247

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ABSTRACT

Background: Pregnancy is associated with physiological changes in the control of breathing, in lung volumes, in the mechanics of respiration and in acid base balance. **Objective:** To compare the FEF25-75 and PEFR of non-pregnant & pregnant women in different trimesters of pregnancy and to determine the effect of gestational age on the PEFR and FEF 25-75 measurements. **Patients and Methods:** This cross sectional analytical study undertaken in the unit of pulmonary function in association with the Department of Gynecology and Obstetrics, in Baghdad teaching hospital in Baghdad. The study started from June 2016 to June 2017. **Results:** The study did not follow the same female in her different stages of pregnancy; we took random samples in different trimesters of the pregnancy (some of them were in the 1st, some in the 2nd and some in the third trimester). FEF25percentage was the only small airway parameter that is affected between the pregnant and the non- pregnant (P value was less than 0.05) BUT not in different trimesters of same pregnancy. In addition, there was change in the PEFR between the pregnant and the non- pregnant (P value was less than 0.05), But no change between the different trimesters. **Conclusion:** We conclude that, there is significant difference in FEF25percentage between pregnant and non- pregnant women but no difference among different trimesters of pregnancy. In addition, there are no difference in FEF50percentage, FEF75percentage between pregnant and non- pregnant women, and no difference among different trimesters of pregnancy. **Recommendation:** We recommend that every pregnant woman should have the FEF25percentage as an important parameter for small airway diseases severity assessment in pregnancy.

KEYWORD: Evaluation, expiratory, flow, rate, pregnancy.

INTRODUCTION

Studies had shown that there is a good evidence mirroring relationships between pregnancy period and respiratory system.[1] The different adaptive changes in the respiratory system in pregnant women and thus preventing any unnecessary or unneeded treatment for the physiologically changed respiratory functions misinterpreted as abnormal the pregnancy is associated with physiological changes in the control of breathing, in lung volumes, in the mechanics of respiration and in acid base balance.[1]

Maternal respiratory changes in turn affect the metabolism and the well-being of the fetus by their effect on placental gas exchange. Three cardinal changes in the thorax which happen during pregnancy were: an increase in the circumference of the lower chest wall (with increases in anterio posterior and the transverse diameters)[2,3,4]; a 50% widening of the costal angle (1 -3) and elevation of the diaphragm (a cephalic displacement of approximately 4 cm to 5 cm).[5] These changes becoming more prominent around the 37th week of pregnancy and returns back to normal within 6 months post-delivery.[6] Pulmonary function during pregnancy is influence by changes of the airway, thoracic cage, and respiratory drive. Additionally, there is capillary engorgement and congestion throughout the respiratory tract, which results in mucosal edema and hyperemia.[7] Different biochemical changes like increase in cyclic nucleotide, prostaglandins, progesterone, corticosteroid and estrogen levels happens concomitantly during the course of pregnancy.[8]

The thoracic circumference increases about 6cm but not sufficiently to present a marked reduction in the Residual Volume of air in the lungs controlled by the elevated diaphragm.

The most important change in lung function is the increase in Minute Ventilation[9], which increases by nearly 36% by the eighth week of pregnancy reaching levels, which are about 50% above the non- pregnant need. This adaptation is required to satisfy the increase in oxygen consumption of 30-35% by the growing fetus. This increase in Minute Ventilation results in a slight decrease in alveolar PCO2 and lower PaCO2 from 38 mm Hg in non-pregnant females to approximately 32-34 mm HG at term.[10] This study aimed to compare the FEF25-75 and PEFR of non-pregnant & pregnant women in different trimesters of pregnancy and to determine the effect of gestational age on the PEFR and FEF 25-75 measurements.

Patients and methods: This cross sectional analytical study undertaken in the unit of pulmonary function in association with the Department of Gynecology and Obstetrics, in Baghdad teaching hospital in Baghdad. The study started from June 2016 to June 2017. The study consists of recording the Pulmonary Function Tests for two major groups of Iraqi female of childbearing age. Including 120 pregnant women of various phases of gestational period subdivided into 10 weeks (I trimester), around 24 weeks (II trimester), 37 weeks (III trimester) and control group of 40 non pregnant women of age and sex compatible. The different lung function parameters measured in this study were peaked expiratory flow rate (PEFR), forced mid expiratory flow 25-75%(FEF25-75percentage). All the participants were included in the study detailed history, and a complete clinical examination. The study includes two-group (pregnant and non-pregnant) aged from 16-44 years, of different weight; height (which were recorder) and different conception from 1^{st}, 2^{nd} and 3^{rd} trimesters were included. The nature and the purpose of the study explained to each participant. Physical examination done to each participant especially regarding the cardiovascular and the respiratory system. The Statistical Package for Social Sciences (SPSS) version 22 program for Windows used to analyze this data. The mean +standard deviation (SD) used to analyze for each group.

Parameters involved

PEFR: is the maximum flow rate during the forced vital capacity in the initial 0.1 second. Normal values in young adult equals 500L/MIN. It reflects the airway status in general and it is more relate for larger airways rather than small airways.

Forced mid expiratory flow 25%-50%-75percentage: Is the maximum flow rate during the mid-expiratory part of Forced vital capacity maneuver. Normal values equals 300L/MIN. It may reflect effort independent expiration and the status of the small airways.

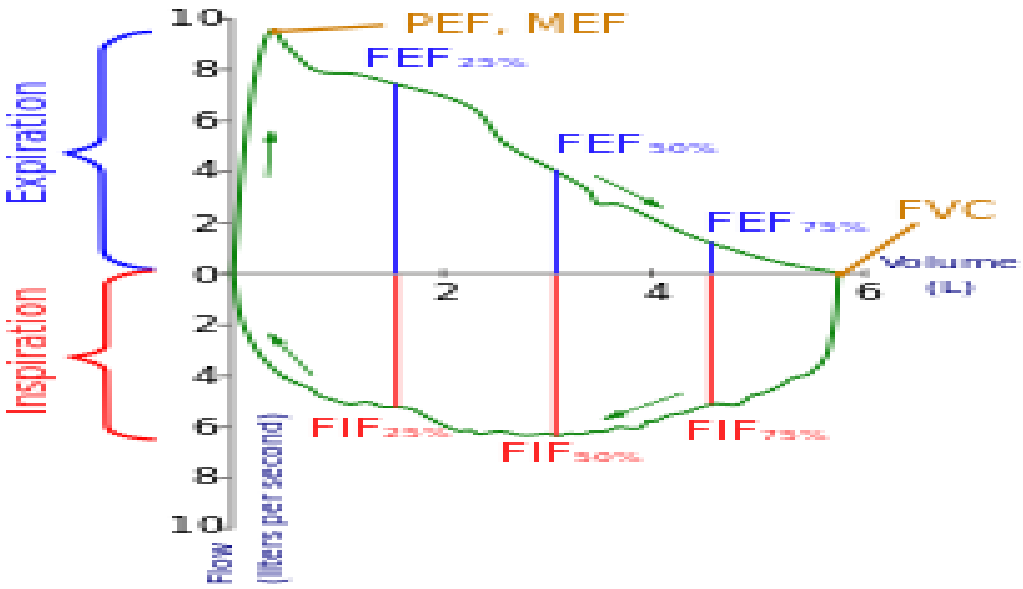

Figure 1: The PEFR, FEF25%, FEF50%, FEF75%.

Inclusion criteria: Healthy pregnant Iraqi women in the childbearing age who accepted doing the study were included in the study. The visible health status of the women determined by history taking and clinical examination. Also weight, height, oxygen saturation using pulse Oximeter (which was normal for all) and blood pressure also is recorded.

Exclusion criteria: Women suffering from acute respiratory infection in the last three months. Chronic respiratory infection including asthma. Also the clinical or history of cardiovascular diseases. Diabetes mellitus (controlled or uncontrolled), hypertension (controlled or uncontrolled). In addition, any smoking history (even small number of cigarettes for any period), alcohol consumption., endocrine disease, morbid obesity, anemia (moderate to severe).

Recording the PFT

The test were performing in the early morning hours (9 am to 12am). The test done in calm conditions with subjects in sitting position according to ATS guidelines. Using master lab spirometer Jaegersn.(105052-175111:model 1998.germany). The pregnant and non- pregnant women did the procedure by their own agreement. The aim of the study was explained to them. Their written agreement was taken from each of the participant. Before recording the PFT, the procedure also, explained and demonstrated in detail until proper understanding. If any questions, it has answered to their satisfaction and instructions about the importance of nose clip and maintaining a tight seal with the lips around the mouthpiece while performing

the tests are given. Each subject was ask it to sit comfortably in a chair facing the computerized flexi flow machine. Subject's age; height, weight, and specific room temperature were entered in the computer.

RESULTS

This table shows that the descriptive statistics for FEF25%, the mean and the S.D. for the study and the control groups.

Table 1: Mean and SD for FEF25.

State	Mean	Std. Deviation	N
non pregnant	80.6525	15.25671	40
first trimester pregnancy	69.7975	23.35779	40
second trimester pregnancy	74.2550	21.44466	40
third trimester pregnancy	72.1500	14.77524	40
Total	74.2137	19.33058	160

This table shows the statistical results for FEF25percentage, there was significant change between the pregnant and the non-pregnant but no change in the different trimesters of the different pregnancies.

Table (2): Mean differences and SE for FEF25percentage.

(I) state	(J) state	Mean Difference (I-J)	Std. Error	P value
non pregnant	first trimester pregnancy	10.855*	4.267	.012
	second trimester pregnancy	6.398	4.267	.136
	third trimester pregnancy	8.503*	4.267	.048
first trimister pregnancy	non pregnant	-10.855-*	4.267	.012
	second trimister pregnancy	-4.457-	4.267	.298
	third trimister pregnancy	-2.352-	4.267	.582
second trimester pregnancy	non pregnant	-6.398-	4.267	.136
	first trimester pregnancy	4.457	4.267	.298
	third trimester pregnancy	2.105	4.267	.622
third trimester pregnancy	non pregnant	-8.503-*	4.267	.048
	first trimester pregnancy	2.352	4.267	.582
	Second trimester pregnancy	-2.105-	4.267	.622

Table 3 Abbreviates the descriptive statistics for FEF50percentage. The mean and the S.D. for the study and the control group were calculated.

Table (3): Mean and SD for FEF50percentage.

STATE	Mean	S.D.	NO.
non pregnant	83.2800	19.11358	40
first trimester pregnancy	79.0750	25.33031	40
second trimester pregnancy	81.4300	28.51465	40
third trimester pregnancy	83.2250	18.15027	40
Total	81.7525	23.02587	160

FEF50 in non-pregnant and pregnant female; in this table shows the statics for the FEF50 percentage, which shows that there was no statistically difference between the pregnant and the non -pregnant and also no change between different trimesters of the different pregnancies.

Table (4): Mean differences and SE for FEF50percentage.

(I) state	(J) state	Mean Difference (I-J)	Std. Error	P value
non pregnant	first trimester pregnancy	4.205	5.183	.418
	second trimester pregnancy	1.850	5.183	.722
first trimester pregnancy	third trimester pregnancy	.055	5.183	.992
	non pregnant	-4.205-	5.183	.418
	second trimester pregnancy	-2.355-	5.183	.650
second trimester pregnancy	third trimester pregnancy	-4.150-	5.183	.425
	non pregnant	-1.850-	5.183	.722
	first trimester pregnancy	2.355	5.183	.650
third trimester pregnancy	third trimester pregnancy	-1.795-	5.183	.730
	non pregnant	-.055-	5.183	.992
	first trimester pregnancy	4.150	5.183	.425

Descriptive statistics for FEF75percentage. In this table shows that the mean and S.D. For each group.

Table 5: Mean and SD for FEF75%.

State	Mean	Std. Deviation	N
non pregnant	80.8825	19.93008	40
first trimester pregnancy	73.9525	26.95131	40
second trimester pregnancy	76.2600	49.93274	40
third trimester pregnancy	82.8475	28.44124	40
Total	78.4856	33.13929	160

FEF75 in non-pregnant and pregnant female:- This table includes the statistics for the variable FEF75. There was no different between the pregnant and the non-pregnant and no different between the different trimesters of the different pregnancies.

Table 6: Mean differences and SE for FEF75.

(I) state	(J) state	Mean Difference (I-J)	Std. Error	P value
non pregnant	first trimester pregnancy	6.930	7.438	.353
	second trimester pregnancy	4.623	7.438	.535
	third trimester pregnancy	-1.965-	7.438	.792
first trimester pregnancy	non pregnant	-6.930-	7.438	.353
	second trimester pregnancy	-2.308-	7.438	.757
	third trimester pregnancy	-8.895-	7.438	.234
second trimester pregnancy	non pregnant	-4.623-	7.438	.535
	first trimester pregnancy	2.308	7.438	.757
	third trimester pregnancy	-6.588-	7.438	.377
third trimester pregnancy	non pregnant	1.965	7.438	.792
	first trimester pregnancy	8.895	7.438	.234
	second trimester pregnancy	6.588	7.438	.377

DISCUSSION

According to the aims of this study, our result found that there was statistically significant changes in FEF25percentage between pregnant and non-pregnant but not in the different trimesters of the different pregnancies. The possible cause could be due to smooth muscle relaxing effects of progesterone, Relax in and Corticosteroids during pregnancy. In addition, there was no change between pregnant and non-pregnant regarding FEF 50%-75%.

Although some workers have already studied the effect of pregnancy on pulmonary Function, but in my study I focused mainly on the difference of expiratory flow rates at different stages of pregnancy particularly the changes at the small airways level. Previous studies have concluded that forced spirometry values largely remain unchanged in normal pregnancy, compared with a non-pregnant control group.[11,12]

According to other study[13], they found that there is no significance change in FEF25-FEF 75% between the pregnant and the non-pregnant in different stages of the different pregnancy. Spiro metric values despite being lower than those of the controls are remained within normal physiological ranges throughout pregnancy. These changes in the maternal pulmonary function during pregnancy are actually adaptive in nature. In spite of the mechanical disadvantage to the respiratory apparatus, pregnant women are able to achieve adequate ventilation, which facilitates feto maternal gas exchange. Other study done by Emilia kolarzyk et al showed that there is no statistical significant change in FEF25percentage, FEF 50% & FEF 75%.[14]

In a study conducted by NEERAJ et al, they found that there was decrease in the FEF25-75percentage in the third trimester of pregnancy. This decrease was because of decrease in alveolar Pco2 caused by hyperventilation, which acts as Broncho constrictor. Hormonal changes also play a role in altering & compromising the FEF25-75percentage.[15]

A study by SAVITA SINGH et al have reported that there was decrease in FEF25%, FEF 50% & FEF 75% in second trimester as compared with third trimester. The cause assumed that, the fetal bulk does a greater restriction on the breathing of pregnant women of Indian race who are generally diminutive compared to their western counterparts.[16] In a study by RUPA. M et al, they found that the values of MMF (maximal mid expiratory flow) were significantly lower in first trimester compared to control.[17]

To establish the cause of decrease in respiratory parameters more in FEF25percentage more than FEF50percentage and FEF75percentage, further longitudinal studies are be done on acid-base balance, hormonal assay in different trimesters to know the possible compensatory mechanism.

CONCLUSION

We conclude that, there is significant difference in FEF25percentage between pregnant and non- pregnant women but no difference among different trimesters of pregnancy. In addition, there are no difference in FEF50percentage, FEF75percentage between pregnant and non-pregnant women, and no difference among different trimesters of pregnancy.

Recommendation: We recommend that every pregnant woman should have the FEF25percentage as an important parameter for small airway diseases severity assessment in pregnancy.

Limitations of the study: Because of time limit, the research conducted only on a small size of population who were attending the hospital. As well, the bias and hesitation of the volunteers affect the research and the busy schedule of our hospital makes collection data a difficult job. In addition, Studies on larger population for longer periods are require to set a standard reference range of the PFT values in the different trimesters of pregnancy. Such norms would help in accurate evaluation of the changes in maternal respiratory function by treating physicians during management of pulmonary complications in pregnancy.

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