Original Article

Physiological Changes In Spirometric Parameters During Pregnancy In Iraqi Women

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Summary:

Background: The events in pregnancy elicit one of the best examples of selective anatomical, physiological and biochemical adaptations, with profound changes in respiratory physiology. The changes in respiratory physiology are due to increased size of the fetus with advance gestation which constitutes a mechanical impediment to normal process of ventilation.

Patients and methods: This study started from the 1st of Nov. 2009 till the 30th of Oct. 2010. pregnant women aged (16-44 years) of different weight, height and different conception from 1st, 2nd, 3rd trimester and post term were included. Spirometry was performed in Baghdad teaching hospital(pulmonary function unit) .

Result: FEV1/FVC ratio was found to be higher in the studied group as compared to the control group. The decrease in forced expiratory volume in one second (FEV1) with pregnancy is not of such amplitude as the decrease in forced vital capacity (FVC), so that the FEV1/FVC ratio was seen to increase. Decrease in FEV1, forced expiratory flow rate (FEF 0.12-0.25, 0.25-0.75) and peak expiratory flow rate (PEFR).

Conclusions: This study informed that FEV1, FVC, (FEFR 0.12 -0.25, 0.25 -0.75) and peak expiratory flow rate values decreased during each stage of pregnancy.

Keyword: pregnancy, spirometry.

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Introduction:

The events in pregnancy elicit one of the best examples of selective anatomical, physiological and biochemical adaptations, that occur during pregnancy with profound changes in respiratory physiology (1). The changes in respiratory physiology are due to increasing size of the fetus with advancing gestation which constitutes a mechanical impediment to normal process of ventilation(2). 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 pre-pregnancy standards. (3) Pregnancy does not appear to change lung compliance, but chest wall and total respiratory compliance are reduced at term reduction in the amount of air exhaled forcefully in the first second of the forced exhalation (FEV1) may be due to muscle weakness.(4) Airway obstruction is the most common cause of reduction in FEV1. Response of FEV1 to inhaled bronchodilators is used to assess the reversibility of airway obstruction (5).Thus, the FEV1 normally is 70 -75% of the FVC. The patient's breathing ability is compared against "predicted normal" values for patients with similar physiologic characteristics, because lung volumes depend on age, race, gender, height, and weight.(6)The ordinary spirometry (mechanical or electronic) records volumes against time, rather than flows against volume (7).

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Patients and Methods :

This Prospective study was conducted in Obstetrics Consultation Clinic in Baghdad teaching hospital. The study started from the 1st of Nov. 2009 till the 30th of October, 2010. The study group (pregnant group), include (108) pregnant women, aged (16-44 years) of different weight, height with different conception periods (1st, 2nd, 3rd trimester and post term).

Control group includes (106) women, aged from (17 -45 years) of different weight and height, had (one, two, three and more children). The age matched controls were volunteers from the relatives of pregnant women who were attending the obstetric consultation clinic (OCC), hospital staff and students.Pulmonary Function Test (PFT) The equipment used for PFT was Spirometer,Vitalograph (serial number 25609 ,MK).Pulmonary function test including spirometry and peak flow rate measurement. Spirometry included (FVC, FEV1, and

FEV\FVC ratio, (MVV =maximum voluntary ventilation) and equal FEV1 × 37.5) FEFR from 0.12-0.25, 0.25 -0.75, 0.75 -0.85.) , FMET (forced mid-expiratory flow time). Pregnant group were either Primigravida or multigravida. Those with known respiratory, cardiovascular diseases, anemia, multiple pregnancy, hydramnios and those on chronic therapy for any other diseases were excluded from the study.

After taking consent from each woman, a detailed history and complete clinical examination were considered to rule out the exclusion criteria. The height as well as weight were measured. Prior to performing the PFT, the procedure was thoroughly explained to each member of the study group(pregnant and control), the queries and apprehensions were satisfied emphasizing the need to maintain an effective seal with lips around the mouth piece as also the use of nose clip during the Procedure. Each member was made to relax for minimum 5 minutes prior to performing the PFT procedure.Each group woman, was asked to repeat the maximum forced expiratory effort three times, each time with adequate rest in between, and the best reading of the three was considered for analysis.

Statistical Analysis: Statistical Package for Social Sciences version 17 (SPSSv17) was used for data input and analysis. Continuous variables were expressed as mean and standard deviation. Discrete values were expressed as numbers and percentages. Pearson chi square test for independence used to verify the association between discrete variables. Chi square test for goodness of fit used to test the distribution of discrete variables. Testing for the significance of difference between independent samples; t test used if the 2 samples were normally distributed and Mann-Whitney tests used if the normality of distribution of the 2 samples was doubtful, for more than 2 samples, ANOVA test was used. Findings with P value less than 0.05 were considered significant.

Result:

Table 1: Distribution of study sample according to demographic data and clinical variables

	Study Group				
	Pregnant	Control	Total		
Variables	N =108 (100.0%)	N =106 (100.0%)	N =214 (100.0%)	X^2	P
Age (year)					
< 18	8(7.4)	1(0.9)	9(4.2)		
18 – 35	86(79.6)	62(58.5)	148(69.2)	24.074	0.000
> 35	14(13.0)	43(40.6)	57(26.6)		
BMI (kg/m^2)					
18.5 - 24.9	11(14.3)	2(8.0)	13(12.7)		
25.0 - 29.9	26(33.8)	15(60.0)	41(40.2)		
30.0 - 34.9	19(24.7)	6(24.0)	25(24.5)	7.340	0.119
35.0 - 39.9	14(18.2)	2(8.0)	16(15.7)		
≥ 40.0	7(9.1)	0(0.0)	7(6.9)		
Trimester					
First Trimester	12(11.1)	---	---		
Second Trimester	10(9.3)	---	---	104.667	0.000
Third Trimester	73(67.6)	---	---		
Post Term	13(12.0)	---	---		
Parity					
0	8(7.4)	0(0.0)	8(5.9)		
1 – 3	69(63.9)	18(64.3)	87(64.0)	2.437	0.296
> 3	31(28.7)	10(35.7)	41(30.1)		
Symptoms					
None	68(63.0)	81(76.4)	149(69.6)		
Shortness of Breath	36(33.3)	25(23.6)	61(28.5)	7.100	0.029
Cough	4(3.7)	0(0.0)	4(1.9)		
Palpitations	7(6.5)	2(1.9)	9(4.2)	2.803	0.094
N; number, %; percent, X^2; chi square statistic, P; P value, BMI; Body Mass Index.					

Observed results of pulmonary function compared to control groups (expressed as percent).in table 2 shows Levels of FVC, FEV1, FEFR0.12-0.25,0.25-0.75, PEFR are significantly lower in pregnant group compared to their control values, and P values are lower than 0.05.

Table 2: Observed results of pulmonary function compared to control groups (expressed as percent).

Variables	Study Group	N	Mean ± SD	Test Statistic	P
FVC.	Pregnant	108	92.71 ± 13.54	-2.247 [A]	0.026
	Control	106	97.07 ± 14.86		
FEV1.	Pregnant	108	89.47 ± 14.26	-2.716 [A]	0.007
	Control	106	95.04 ± 14.77		
FEV_1/FVC	Pregnant	108	96.95 ± 9.87	-1.914 [A]	0.057
	Control	106	99.37 ± 7.89		
MVV%	Pregnant	105	90.92 ± 17.29	-1.952 [A]	0.052
	Control	89	95.66 ± 16.34		
FEFR25%	Pregnant	92	67.74 ± 22.48	-4.573 [A]	0.000
	Control	101	83.89 ± 26.22		
FEFR75%	Pregnant	82	74.81 ± 24.52	-1.991 [A]	0.048
	Control	102	85.46 ± 43.12		
FMET%	Pregnant	72	115.74± 67.15	0.442 [B]	0.660
	Control	40	110.47± 45.99		
PEFR%	Pregnant	99	86.32 ± 11.84	-2.137 [A]	0.034
	Control	102	90.04 ± 12.79		

N; number, SD; standard deviation, P; P value, FVC; forced vital capacity, %; percent of observed value from predicted value, FEV1; forced expiratory volume in one second, FEV_1 / FVC; ratio of forced expiratory volume in one second to forced vital capacity, MVV; maximum voluntary ventilation, FEFR 25; average forced expiratory flow rate over the middle 25% of the FVC, FEFR 75; average forced expiratory flow rate over the middle 75% of the FVC, FMET; forced mid expiratory time, PEFR; peak expiratory flow rate.

[A] t test

[B] Mann-Whitney test

Discussion:

Table I shows baseline data of the study group (pregnant and control group).

Age, number (108) pregnant, control (106), total (214) X= 24. 074, P value 0.000 shows statistically significant ($p<0.05$) .

Gestation, 1st, 2nd, 3rd, and post term x = 104.667,P value0.000 shows statistically significant. Symptom, whether sob, cough, or none, X=7.100, P value 0.029 shows statistically significant ($p<0.05$). .

In table 2 shows Levels of FVC, FEV1, FEFR0.12-0.25,0.25-0.75, PEFR are significantly lower in pregnant group compared to their predicted values, and P values are lower than(0.05).

We found a similarity in our findings with those reported byMokkapatti et al (8), Monga and kumari (9), Harirah et al (10).In this study all the pulmonary function parameters except FEV1/FVC ratio was found to be lower in the studied (pregnant) group as compared to the control group. The decrease in FEV1 with pregnancy is not of such amplitude as the decrease in FVC, so that the FEV1/FVC ratio was seen to be increased. This finding is in agreement with those by NeeraJ et al (11). 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. Other contributory factors are relative mobility of thoracic cage due to progressive enlargement of gravid uterus (12). Decrease in FEV1, FEF 0.12-0.25, 0.25-0.75 and PEFR may be due to a decline in alveolar Pco2 (caused by hyperventilation) which acts as a bronchoconstrictor(14). In one study on a small groups of pregnant women showed that forced expiratory volume in one second (FEV1) remained essentially unchanged during pregnancy (13). 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 (14).

This study validates the physiological changes, adaptations and decline in pulmonary function in the 1st, 2nd, 3rd, trimester and post term. The effect of the enlarged uterus displacing the diaphragm upwards is evident in the significantly reduced forced vital capacity among the pregnant compared to the control. The mechanical factors are not the only causative factor. Other factors such as hormonal influences may play a role in altering and compromising the pulmonary flow parameters like FEV1, PEFR and FEF (.025-0.75). Found that the FEV1 / FVC ratio shows a definite increase due to less decrease in FEV1 as compared to FVC. The present study highlights the observation that the respiratory parameters are significantly compromised due to gravid state in the gestation of pregnancy in Iraqi women.

Conclusions:

This study conclude that spirometric values are decreased during each stage of pregnancy.

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