The effects of pregnancy on pulmonary function and respiratory muscles power parameters in Sudanese women.

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***Abstract*- Background:** Pregnancy has many effects on the functions of women body systems.It is known that the respiratory rate of pregnant women increases as early as the first trimester. The aim of this study is to investigate the effects of pregnancy (2^{nd} and 3^{rd} trimesters) on lung function parameters (FVC, FEV1 and PEFR) and respiratory muscles power parameters (MIP and MEP) in Sudanese women from Khartoum state.

Methods: Across sectional descriptive study was carried on fifteen normal pregnant women. Pulmonary function tests were performed by a micro-plus spirometer for measurement of FVC, FEV_1 and PEFR, which were compared with the normal Sudanese predicted values. Respiratory muscles power was measured by using Respiratory Pressure Meter (RPM) by measuring the maximum expiratory pressure (MEP) and the maximum inspiratory pressure (MIP). The results were compared with eight normal women of the same age and height.

Results: The study showed significant decrease of pulmonary function test parameters (FCV, FEV1) and inspiratory muscles power (MIP).

Conclusion: decreased pulmonary function parameter in pregnancy could be explained by decreased respiratory muscles power

***Index Terms*-** Pregnancy. Pulmonary function. Respiratorymuscles power.

I. Introduction

In pregnancy, hormonal changes and the progressive increase in abdominal volume may have mechanical and chemical impact on respiratory function. However, an increased transverse diameter of the chest, resulting from a widened sub costal angle, opposes the effect of the enlarging pregnant uterus and elevated diaphragm, leaving pulmonary function altered ,but not compromised, during pregnancy.(1) The anatomical, physiological and biochemical adaptation to pregnancy are profound .The change in a pregnant woman is in response to maternal adaptation to an increasing demand of growing fetus.Maternal pulmonary functions in pregnancy are changing because of multiple reasons like progressive enlargement of uterus,increase in progesterone,increase in blood flow and volume .These changes are said to be mediated mainly by progesterone rather than estrogens, that increase respiratory oxygen consumption.(2,3) Prostaglandins stimulate uterine smooth muscle during labor and are present during all tree trimesters of pregnancy.Prostaglandin F α increases air way resistance by bronchial smooth muscle constriction, whereas a bronchodilator effect can be a consequence of prostaglandins E and E2.(4) Pulmonary functions tests (PFTs) permit an accurate and reproducible assessment of respiratory function and allow quantification of the severity of disease.(5) Many investigators have studied pulmonary function tests during normal pregnancy ,most of them found a significant decrease in pulmonary function test parameters during all pregnancy trimesters.(1,3,6,7,8) Others showed that the PFTs parameters are normal in the first trimester but there was significant decrease in them in the second and third trimesters,(5)or in the third trimester only,(2,9) or unchanged.(11) Andrea lemos et al found that respiratory muscles power during different trimesters were not affected.(12) In a previous study in Gezira /Sudan both PFTs parameters and respiratory muscles power were found to be decreased.(13)This study aimed at investigating the effect of pregnancy on respiratory muscles power and pulmonary function test(PFTS) In Sudanese women from Khartoum state in the second and third trimesters.

II. Methods

This is a cross sectional descriptive study conducted during June and July 2016 in the National Ribat University Hospital, in Khartoum state. It included 15 pregnant women in the second and third trimesters selected randomly from antenatal outpatient clinic of Omer Sawi clinicscollection. Healthy pregnant women were included and those with twins pregnancy or illness were excluded .The control group were female students and workers from the faculty of medicine the National RibatUniversity in the same range of age and height.

Ethical clearance has been obtained from the National Ribat University and consent from the participants. All selected subjects were interviewed to fill a questionnaire including information about personal data, clinical history (past and present history of any disease), physical activity and gravidity. Data was collected in data collection sheet. A digital Spirometer was used for PFT. Height was measured standing and without shoes by a tape mounted on a wall nearest to 0.5 cm and weight was recorded without shoes on a sensitive weighing balance to the nearest 500g. The subject was asked to relax for 5 minutes, prior

to performing the pulmonary function test bythe spirometer which shows the forced vital capacity (FVC), the forced expiratory volume in one second (FEV1) and the peak expiratory flow rate (PEFR). The test was demonstrated to the subject. The subject was asked to take a deep maximal inspiration and exhale strongly, rapidly and completely into the mouth piece.All tests were recorded 3 times and out of them the best results were taken. The results were compared with the Sudanese predicted values for sex, age and height. [(14)] Respiratory muscles power was measured by Respiratory pressure meter (micro RPM).The measurement started by asking the subject to sit down on arm chair. The subject was instructed to insert mouth piece into her mouth ensuring that the flange was positioned over the gum and inside the lips and that the bite blocks is between the teeth. The subject should then inhale to total lung capacity (TLC) and then exhale as much as effort as possible through the controlled leak of the meter at least 3seconds .It measures maximum expiratory pressure (MEP).The reading displayed is maximum average expiratory pressure over 1second.Themaximum inspiratory effort was conducted by asking the su8bject to expire the residual volume (RV)and then perform a maximum inspiratory maneuver .An acceptable maneuver was defined as one that showed a 3-s plateau of inspiratory effort ,and it measures maximum inspiratory pressure (MIP).The mouthpiece was protected from contamination by immersion in Clorox solution and alcohol 20%.Rinsed with distilled water, drained and allowed to dry before re assembly. The results of pregnant women were compared with matching control. Results obtained were analyzed using the statistical package for social sciences (SPSS).version 21.0.Data were expressed as means with standard deviation(SD).$P \leq 0.05$ was considered statistically significant.

III. RESULTS

The study was carried out on fifteennormal pregnant women, six in the second trimester and nine in the third trimester and the values were compared with Sudanese female predicted normal values for PFTs. Eight non pregnant women were taken as control for respiratory muscles power. The lung function tests measurement as mean ±SD were taken and were found significantly lower than the normal predicted values for all the table (1).The lung function measurements for pregnant women in the second trimester were significantly lower for FVC,FEV1 but not for PEFR table (2).Although all of these values were significantly lower in the third trimester table (3) . The respiratory muscles power test were maximum inspiratory pressure (MIP)=43.47±23.817cmH2O,72±18.921cmH2O, maximum expiratory pressure (MEP)=68.18±22.627 cmH2O,76.00±11.952cmH2O, for pregnant women and control respectively.(Fig-1).There was significant difference in MIP but not for MEP. There was no significant difference in respiratory muscles values between the trimesters (MIP=34.0±24.282cmH2O, 49.78±22.632cmH2O.MEP=66.17±24.555cmH2O, 69.44±22.678cmH2O) for the second trimester and the third trimester respectively. (fig 2).

Table (1) PFTs of pregnant women and their predicted normal values.

	Pregnant women(n=15)	Predicted normal value	P value
FVC (L)	2.4013±0.39509	2.9427±0.12798	.000
FEV1(L)	2.3087±0.33483	2.7600±0.09681	.000
PEFR (L/min)	309.20±64.335	357.53±10.822	.008

Table (2) PFTs of second trimester pregnant women and their predicted normal values.

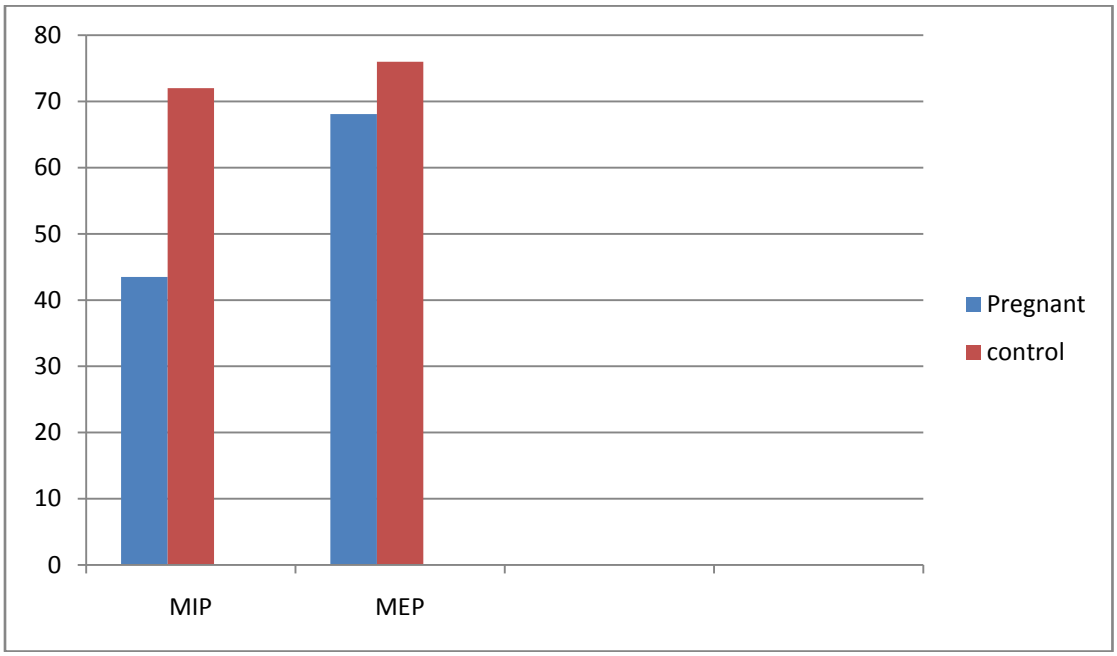
	2nd trimester(n=6)	Predicted normal values	P value
FVC (L)	2.3017±0.51047	2.9033±0.14828	0.020
FEV1 (L)	2.2050±0.44559	2.7467±0.09812	0.016

PEFR (L/min)	312.00±76.412	355.00±8.556	0.201

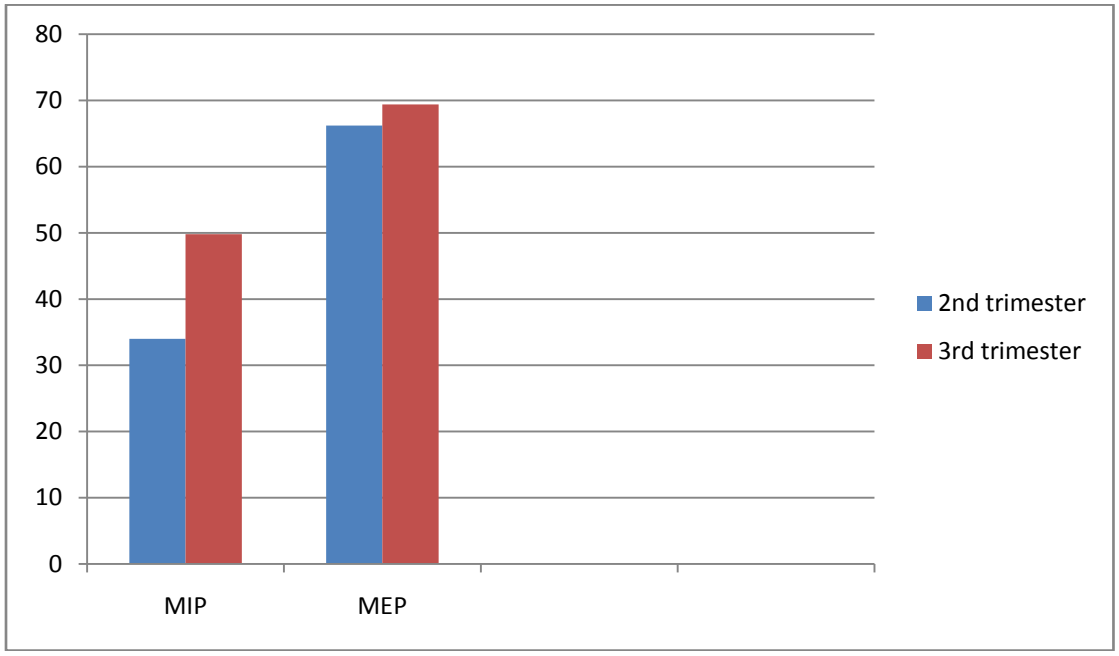
Table (3) PFTs of third trimester pregnant women and their predicted normal values.

	3rd trimester(n=9)	Predicted normal values	P value
FVC (L)	2.4678±0.31288	2.9689±0.11396	.000
FEV1(L)	2.3778±0.24222	2.7689±0.10080	.000
PEFR (L/min) 3	307.33±59.869	359.22±12.296	.022

Figure(1) MIP and MEP in cmH_2O for pregnant women and control.



Figure(2) MIP and MEP incmH_2O for 2nd and 3rd trimesters.



IV. Discussion

The physiological changes during pregnancy affect all body systems and respiratory system shows increased respiration as early as the first trimester although some studies had shown no change in lung function during pregnancy[4]. This study showed significant decrease in lung function parameters(FVC and FEV1) in both second and third trimesters, and significant decrease in PEFR in the third trimester only (Tables1-2) .Recently PEFR has been reported to decrease progressively from first to third trimester which has been attributed to a lesser force of contraction and restricted movement of respiratory muscles[3]. The pulmonary function values difference between sexes has been explained by the difference in respiratory muscles power[13,15].and that for pregnant ladies has been controversial.[12,13] This study has shown a significant decrease in MIP in pregnancy .This can explain the changes in PFT parameters in pregnancy but it needs further documentation during the whole periods of pregnancy. In conclusion PFT parameters decease during pregnancy and it might be explained by decreased respiratory muscles power and that needs more studies.

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