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A STUDY OF LUNG FUNCTION AND HAEMATOLOGICAL TESTS IN PREGNANT WOMEN IN SOUTH INDIANS

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ABSTRACT

Variation in some haematological indices during normal pregnancy was investigated. Some of these changes influence normal biochemical values while others may mimic symptoms of medical disease. It is important to differentiate between normal physiological changes and disease pathology. Physiology of a normal pregnancy involves major changes in both the coagulation system and hematological parameters. These changes appear to be related to the development of the uteroplacental circulation and provide a protective mechanism during delivery. The pulmonary function test does not reveal any changes with advance pregnancy. A slight increase in PEFR and statistically significant rise in PIF can be attributed to be increase in the progesterone levels. Increase in progesterone is also responsible for hyperventilation of pregnancy.

Key words: Hematological Changes, Pregnancy, Prevention, Hypercoagulable state.

INTRODUCTION

Lung function is a significant predictor of future morbidity and mortality in the general population.[1] Maintaining good lung function across adult life is important to prevent chronic respiratory diseases,which nowadays represent a serious public health problem around the world.[2] There is consistent evidence showing that overweight, obesity and weight gain in adulthood are detrimental to lung function, as described by the forced vital capacity (FVC) and/or forced expiratory volume in 1 s (FEV1). Previous population-based and occupational cohort studies have shown that excessive weight gain in adulthood is associated with lower lung function levels and with an increased rate of lung function decline independently of age and smoking status.[3–8]. This precludes a more comprehensive understanding of the role of weight change on lung function during adulthood and older life and supports the need for further studies with longer follow-up periods extending into late adult life. Understanding the effects of weight changes on lung function during adult life is of utmost importance given the epidemic levels of overweight and obesity globally.[9] Several respiratory parameters do remain essentially unchanged during pregnancy, such as total lung capacity, vital capacity, lung compliance and diffusion capacity. Respiratory rate (RR) does not change also during pregnancy and tachypnea with greater than 20 breaths per minute should be considered abnormal in the pregnant woman [10-11].

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Nonetheless, minute ventilation, tidal volume and oxygen consumption increase 20% to 50%, whereas functional residual capacity raise only 20%, total lung capacity decreases by about 4% to 5%, mostly caused by the upward displacement of the diaphragm, increased metabolic rate, changes in the mechanics of breathing, and increases in progesterone level [12-13]. Additionally, oxygen consumption increases by 30% to 60% during the course of pregnancy and maternal arterial partial pressure of CO2 decreases to a level of 26 to 32 mm Hg as a result of increased minute ventilation [14-15]. With respect to blood analysis, only slight changes in the amount of different white cells, platelets, hemoglobin and creatinine have been described [15-16].

The haematological indices of an individual to a large extent reflect their general health [17]. Blood is a special type of connective tissue composed of formed elements in a fluid matrix. Many of the hematological indices are influenced by many factors like sex, seasonal variation, lactation, pregnancy health, and nutritional status [18]. It is also acknowledged that for comparisons between individuals and with reference data in a clinical diagnostic situation, it is necessary to consider the normal variations due to sex, age, and breed in order to increase diagnostic precision [19].

Previous study conducted and reported during different trimesters of pregnancy to find out any variation in Haematological values. The platelet count was found to decrease during third trimester . The prothrombin time was markedly decreased during second and third trimesters . The study revealed the significant falling Haemoglobin and haematocrit value as pregnancy advances. Total Leucocyte count was also increased during the second and third trimesters . increased neutrophil count and decreased lymphocyte count was found during later stages of pregnancy .

MATERIALS AND METHODS:

The total number of subjects selected is 100 primi pregnant women in three trimesters and 100 nonpregnant women as control group . The pregnant women were all antenatal mothers attending anenatal O.P, Department of obstetrics and gynecology and the study was collaborated with Respiratory Medicine, Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research Institute. Pulmonary function tests and Haematological tests were conducted in both groups to study and evaluate the influence of pregnancy on pulmonary function and Haematological status. The following criteria were set in order to select the subjects All primigravidae age group range from 19 to 28 years Height not less than 5 feet weight not less than 40 kgs Not suffering from respiratory tract infection at the time of test . The maneuver with Spirovin was performed in sitting posture using pre calibrated computerized spirovin following standard procedure .The apparatus is computerized and self-calibrating thus fulfils the criteria for standardized lung functions . The following parameters of PFT were studied. Forced vital capacity, FEV, PEF and PIF. The following Haematological parameters were studied Hb, PCV, morphology of RBC, WBC count DC, ESR and Platelet count. The data regarding age in years, weight in kgs, height in cms was entered via the input key board of computer to record the graphs.

RESULTS:

With the advancement of pregnancy FVC decreases slightly, which is not statistically significant. A slight decrease in FEV1 is noted in pregnancy from a normal values which is again not statically significant, PEFR increases,Inspiratory flow rate increase Which is statistically significant, RBC count, Hemoglobin estimation and PCV decrease in pregnancy and these changes are due to hemodilution. There is an increase in total WBC count and neutrophils count, but the changes are not considered in the present study, since the study depicted here towards respiratory parameters and There is slight decrease in platelet count.

Table.1: FVC [L],

	Non-Pregnant	I Trimester	II Trimester	III Trimester
MEAN	1.974	1.932	1.973	1.821
SD	O.311	0.189	0.39	0.390

Table.2: FEV1[L],

	Non-Pregnant	I Trimester	II Trimester	III Trimester
MEAN	1.741	1.822	1.821	1.645
SD	0.289	0.183	0.319	0.461

Table.3: PEF [L/S]

	Non-Pregnant	I Trimester	II Trimester	III Trimester
MEAN	3.841	4.602	4.710	4.209
SD	0.940	0.578	0.488	0.710

DISCUSSION:

Physiological conditions capable of causing remarkable and dramatic changes in haematological variables. A pregnancy is influenced by many factors, some of which include culture, environment, socioeconomic status, and access to medical care. The haematological indices also have an impact on pregnancy and its outcome [19]. Pregnancy causes a two- to three-fold increase in the requirement for iron, not only for haemoglobin synthesis but also for for the foetus and the production of certain enzymes. There is a 10- to 20-fold increase in folate requirements and a two-fold increase in the requirement for vitamin B12. All the requirements of the factors including

the respiratory necessities of the baby are to be met by the mother. To satisfy the respiratory needs a number of anatomical, biochemical, and hormonal changes both pulmonary function and ventilation will takes place. The anatomical changes consist of increased transverse diameter of the chest due to widened sub costal angle. This compensates for the level of the diaphragm, which is raised by the enlarging uterus. Pulmonary function tests are generally related to body size and age, where height is a proxy for chest size, and age reflects maturity.[19] Because of this reason every individual has different range of normal values.

Measurements of airflow are also not significantly affected by pregnancy. Lung compliance don't appear to be influenced by pregnancy, but chest wall and total respiratory compliance are reduced in the third trimester because of chest wall changes and increased abdominal pressure. A significant increase in the respiratory minute Ventilation occurs beginning in the first trimester and reaching 10 to 20% above the base line, and term Ventilation increases by 50 to 70%. The hyperventilation is due to both increase in metabolic carbon-dioxide production (which increases drive due to the gestation period), as well as increase in the respiratory drive due to the elevated serum progesterone level. The effects of progesterone manifests soon after conception and the degree of hyperventilation correlates with the serum progesterone levels. Progesterone may act either as a direct respiratory stimulant or by changing the sensitivity of the respiratory center to carbon-dioxide. The augmented ventilation is the result of an increase in tidal volume to about 30 to 35%, due to increased rib cage volume displacement. "Respiration. So the present study illustrates that hemodilution occurs in pregnancy parallel to progress of pregnancy. In spite of apparent decrease in RBC count, hemoglobin estimation and PCV it can be considered that RCV is not affected. The respiratory parameters are not altered except in the increase of PIF. Thus the entire process of pregnancy is within the physiological limits in spite of an enormous increase in the metabolic turnover necessity for increased demands created by the fetus. The hyperventilation caused in pregnancy is not distressful to the mother, because it is due to the increased sensitivity of the respiratory centers to CO_2 due to increased secretion of progesterone. White blood cells are responsible for body defense during pregnancy, WBC was reported to be elevated in this study, and the lymphocyte and granulocyte count were significantly higher in the test group compared to those of the controls. This agrees with previous work by Luppi [20], who asserted that a total lymphocyte count rising in early pregnancy will remain elevated through pregnancy. This may be as a result of the body building the immunity of the fetus and it is achieved by a state of selective immune tolerance, immunosuppression, and immunomodulation in the presence of a strong antimicrobial immunity. There is also downregulation of potentially dangerous T-cell-mediated immune responses, while activating certain components of the innate immune system, such as neutrophils. This unique dysregulation between different components of the immune system plays a central role in the maternal adaptation to pregnancy. Changes in the coagulation system during pregnancy produce a physiological hypercoagulable state.[20] The concentrations of certain clotting factors, particularly VIII, IX and X, are increased. Fibrinogen levels rise significantly by up to 50% and fibrinolytic activity is decreased. Concentrations of endogenous anticoagulants such as antithrombin and protein S decrease. Thus pregnancy alters the balance within the coagulation system in favour of clotting, predisposing the pregnant and postpartum woman to venous thrombosis. This increased risk is present from the first trimester and for at least 12 weeks following delivery. In vitro tests of coagulation [activated partial thromboplastin time (APTT), prothrombin time (PT) and thrombin time (TT)] remain normal in the absence of anticoagulants or a coagulopathy.

Excess of abdominal fat may restrict the diaphragmatic movement which leads to a decrease in pulmonary function. This study suggested significant impairment of pulmonary functions in overweight and obese population due to limited expansion of thoracic cavity which leads to possibility of small airway diseases. The lung functions might be improved by weight loss. According to WHO, BMI is the gold standard to classify obesity at present time. But BMI does not take an account of body fat distribution. Thoracic and abdominal fat have direct effects on movement of diaphragm rather than fat in hips and thighs. Hence, along with BMI, other indicators of fat distribution should also be considered.

Thus hematological and respiratory adjustments in pregnancy are more physiological. The Vital capacity in the I trimester is 1.932±0.189 liters and the II trimester is 1.974±0.311 and in the III trimester is 1.973±0.39. These values as compared in the normal control group where FV is 1.984±0.301 liters. This test is no change in FVC because of the pregnancy. These findings correlate with available data. However FVC values comparable to the predicted values are uniformly slightly lower indicating the lower nutritional and social status capable even with the normal control group. The FEV1, in the control group is 1.751 ± 0.280 litres as compared with the I trimester in FEV1 is 1.822±0.183 letres and in the II trimester is 1.821±0.319 L and in III trimester 1.645 ±0.461 L. Thus in FEV1 there is no change in control group and in all the trimesters of pregnancy. Peak expiratory flow rate : the obtained values of PEFR in control group is 3.841±0.940 L IS in the I trimester 4.602±0.578, II trimester 4.710±0.488 L/S, and in the III trimester 4.209±0.710 L/S. The increase in the I and II trimesters is statistically significant $P <= 0.01$ in the I trimester, $P< 0.05$ as compared to the normal group. This change is attributable to the effect of progesterone to relaxation of bronchiolar smooth muscle and the parts of the diaphragm .

Inspiratory flow rate increases in the present study and the changes are uniform with available data. The observed lymphopenia during pregnancy may be due to monocytosis which helps prevent fetal allograft rejection during the first trimester. The above dysregulation among and within different immune system components is central in maternal adaptation to pregnancy. An increased platelet production can be inferred from the increase in circulating platelets width and volume. There is also an increase in thromboxane A_2 with an increased tendency for platelets aggregation in pregnancy.

CONCLUSION:

The pulmonary function test does not reveal any changes with advance pregnancy. A slight increase in PEFR and statistically significant rise in PIF can be attributed to be increase in the progesterone levels. Increase in progesterone is also responsible for hyperventilation of pregnancy. Coagulation tests can be added only once there is thrombocytopenia, as increased platelet consumption is an early feature of this disorder. This also reduces the expenses of investigations. The importance of liver enzymes is furthermore emphasized, especially in patients with thrombocytopenia. Clinicians' familiarity with this pregnancy related physiological changes in the hematologic system will encourage an optimal management of pregnancies in addition to facilitating the use of simple explanatory terms to aid the parturient in understanding the course of pregnancy. pregnancy is a physiological phenomenon not toxing the mother. Regular pulmonary function monitoring may assess adverse effects of obesity on pulmonary functions. Hence, proper and timely advice regarding lifestyle modification to obese subjects will prevent unwanted complications of obesity.

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