



## EFFECT OF PREGNANCY ON MATERNAL OXYGEN SATURATION

Dr.K.Subha Revathi

M.D., Assistant Professor in Physiology, Chengalpattu Medical College, Chengalpattu.

Dr.N.Neelambikai

Professor &amp; HOD in Physiology, Coimbatore Medical College, Coimbatore.

## ABSTRACT

Pregnancy is a physiological state wherein dramatic adaptations occur in the maternal aspect to ensure the perpetuation of mankind. Maintaining maternal oxygen saturation at the optimum level is very important as it is one of the major determinant of fetal development. Aim: To study the effects of pregnancy on maternal oxygen saturation during three trimesters of pregnancy and to compare the arterial oxygen saturation between pregnant and non-pregnant females. Methodology: The study was conducted in the department of obstetrics and gynaecology. 170 female subjects were randomly chosen which included pregnant females and non-pregnant females of age group 18-35 years. After clinical examination and haemoglobin estimation, oxygen saturation was measured using pulseoximetry. Results: There is mild increase in maternal oxygen saturation during three trimesters of pregnancy when compared to oxygen saturation of non-pregnant females. The increase in oxygen saturation could be attributed to increase in progesterone levels during pregnancy which is found to change the homeostatic set points of respiratory centres during pregnancy. Conclusion: There is increase in maternal oxygen saturation during pregnancy compared to non-pregnant females and maternal pulse oximetry can be used as the oxygen saturation during pregnancy is above 90% since the sensitivity of pulseoximetry is very close to arterial blood gas analysis in saturations above 80%.

**KEYWORDS :** pregnancy, maternal oxygen saturation, pulse oximetry

## INTRODUCTION

Pregnancy, where enormous adaptive changes are involuntarily obliged in women<sup>1</sup>. The changes start as early as luteal phase of a conceptual menstrual cycle, few are more dramatic and the extent of the changes vary from system to system<sup>2</sup>.

The changes in the respiratory system seem to anticipate reproductive needs because there is a rich flow of well-oxygenated blood to the uterus during early pregnancy when organogenesis is occurring and before fetoplacental circulation is fully developed. The arteriovenous oxygen difference widens during pregnancy<sup>3</sup>. Approximately two thirds of the total increment in basal oxygen consumption during pregnancy is accounted for the combined consumption of fetus, placenta and uterine muscle<sup>4</sup>. Maintaining maternal oxygen saturation at the optimum level is important for adequate fetal oxygenation to meet the metabolic demands of the fetus in utero. Hence this study has been taken up to evaluate the effects of pregnancy on maternal oxygen saturation which is the major determinant of fetal organogenesis and development in utero.

## AIM AND OBJECTIVES

- To study the effects of pregnancy on maternal oxygen saturation
- To compare the oxygen saturation between the pregnant and non-pregnant women
- To compare the oxygen saturation during the three trimesters of pregnancy.

## METHODOLOGY

After obtaining approval from Institutional Ethics Committee, this cross-sectional study was conducted. The subjects were chosen randomly from the outpatients and inpatients in the Department of Obstetrics and Gynaecology. 160 female subjects were enrolled in the study which included healthy female subjects in the age group of 18 to 35 years who were in three trimesters of pregnancy and apparently healthy age matched non-pregnant females. Pregnant and non-pregnant females with acute or chronic respiratory diseases, cardiac illness, peripheral vascular disease and diabetes mellitus were excluded from the study.

After obtaining informed written consent, brief clinical examination of the subject was done, height was measured using stadiometer, weight was measured using standard weighing scale and blood pressure was recorded in left upper limb using mercury

sphygmomanometer. Estimation of hemoglobin was done using Automatic Cell Analyser and blood glucose estimation was done using autoanalyser which employs Glucose peroxidase method.

The oxygen saturation was measured by placing the pulseoximeter probe sensor in the right index finger in the sitting posture for pregnant and non-pregnant females.

Statistical analysis was done using SPSS version 15.0. Posthoc analysis was done for comparison within the group, one way ANNOVA and one sample 't' test was used for intergroup comparisons.  $p < 0.05$  was considered significant.

## RESULTS

TABLE 1 BASELINE CHARACTERISTICS

Variables	Non – Pregnant Females	Pregnant Females		
		I Trimester	II Trimester	III Trimester
Age (years)	23.73±2.56	24.76 ±3.13	24.74 ±3.07	22.39 ±2.97
Height(cm)	154.67±1.58	154.60±6.30	153.48 ±5.7	150.46±7.84
Hemoglobin Concentration (g%)	10.24±1.58	10.23 ±1.54	10.01 ±1.09	10.21 ±1.17

Table 2 COMPARISON OF OXYGEN SATURATION OF NON PREGNANT WITH PREGNANT WOMEN DURING THREE TRIMESTERS

GROUPS		n	O <sub>2</sub> SATURATION Mean±SD
Non Pregnant		40	96.58±0.95
Pregnant	I Trimester	38	96.73±1.42
	II Trimester	39	97.09±1.13
	III Trimester	43	97.71±1.43*

\* $p < 0.05$ 

In the present study on the effect of pregnancy on maternal oxygen saturation, the mean maternal oxygen saturation in pregnant women during three trimesters were 96.73%, 97.09% and 97.71% respectively. The mean oxygen saturation of nonpregnant women is 96.58%. There is increase in oxygen saturation during pregnancy when compared with non-pregnant females. Though there is increase in maternal oxygen saturation during three trimesters, increase during third trimester is only statistically significant.

## DISCUSSION

In the study on effects of pregnancy on maternal oxygen saturation it is found that though there is increase in oxygen saturation during three trimesters in pregnant women when compared with nonpregnant women level of 96.58 %, statistically significant increase is seen only during the III trimester 97.71% to meet the metabolic requirements of the growing fetus.

A descriptive longitudinal study done by Richlin suggest that maternal oxygen saturation is at least 97% throughout pregnancy for healthy, non-smoking women residing at sea level which is similar to the present study<sup>5</sup>. Similarly Bourne and his colleagues found that arterial oxygen saturation in pregnant normotensive was higher than non- pregnant which was 98.5% and 95.2% respectively<sup>6</sup>.

The increase in maternal oxygen saturation during three trimesters is similar to that of Sunyal DK and his colleagues<sup>7</sup>. The increase in maternal oxygen saturation during pregnancy could be probably due to increase in progesterone levels. Progesterone increases from 25ng/ml at 6 weeks of gestation to 150ng/ml at term. It probably has a stimulatory effect on the respiratory centers in the brain and appears to change homeostatic set point during pregnancy. This has been found to increase the respiratory drive and it strongly correlates with increase in ventilation during pregnancy. In normal pregnant women there was significant shift of P50 to the right compared with the normal non-pregnant women and the extent of this shift to the right is directly related to the duration of the pregnancy<sup>8</sup>.

Macleannan et al in their study on maternal tissue oxygenation and red cell 2,3 Diphosphoglycerate in pregnancy found that following an initial fall at the beginning of pregnancy there was a significant rise in the mean level of 2,3DPG during pregnancy<sup>9</sup>. Han Madsen and Jom Ditzel in their study in 18 healthy women during first, second and third trimesters of normal pregnancy and postpartum found that there is increase in levels of 2,3 DPG during pregnancy<sup>10</sup>. Hence in the present study, the increase in oxygen saturation in III trimester when compared to II trimester, the cause could be possibly due to increased level of 2,3DPG during the III trimester of pregnancy and this may in part be accounted for the compensatory mechanisms operating to counteract for physiological anemia of pregnancy.

## CONCLUSION

The maternal oxygen saturation increases during three trimesters of pregnancy compared with nonpregnant females although only the increase during the third trimester is statistically significant. The values of maternal oxygen saturation are mostly above 90%. The pulse oximeter can be used for evaluation of maternal oxygen saturation since its sensitivity is very close to arterial blood gas analysis in saturations above 80%.

## LIMITATIONS OF THE STUDY:

The major limitation of the study is the predictability of the pulse oximetry in hypoxic conditions in comparison with arterial blood gas analysis. The sample size is less and it is not a longitudinal study.

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