Article

Assessment of Percentage Saturation of Hemoglobin with Oxygen in Arterial Blood of Pregnant Women

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Objective: Percentage saturation of hemoglobin with oxygen in arterial blood (SaO_2) was studied in pregnant women to evaluate the lung function status in pregnancy. **Methods:** This study was conducted in the department of physiology in Dhaka medical college during July 2004 to June 2005. For this purpose total 32 women with age ranged 25-35 years without any recent history of respiratory diseases were selected from Dhaka city. Eight (8) age matched apparently healthy women was taken as control and Twenty four (24) normal pregnant women without any complication were included in experimental group. All pregnant subjects were studied during first, second and third trimester. SaO_2 was determined by "Easy Blood Gas Auto Analyzer". SaO_2 during different trimesters were compared with that of non pregnant and also among the trimesters. Statistical analysis was done by students unpaired 't' test.

Result: Mean ±SD SaO_2 during first trimester (97.73%±0.92), second trimester (98.05%±0.54) and third trimester (98.40%±0.30) were progressively increasing and were significantly higher ($p<0.05$, $p<0.001$, $p<0.001$) than that of non pregnant women (96.71±0.63). But no statistically significant differences were observed among the trimesteric values. The present result indicates increased lung function in pregnant women associated with progressively increased oxygen saturation with trimester. Higher progesterone level is related to increased ventilation which is more marked in luteal phase of menstrual cycle. In pregnant women gradually rising progesterone level reaches its peak at the later part of pregnancy.

Conclusion: Therefore it may be concluded from the present study that progressively increased SaO_2 might be related to hyperventilation induced by high progesterone level.

Key words: Pregnant women, trimester, progesterone

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Introduction

Alteration in respiratory function has been noted characteristically in the last trimester of pregnancy by reduced functional residual capacity, residual volume, increased alveolar-arterial difference for oxygen, along with reduced cardiac output in the supine position [1]. 20% reduction in functional residual capacity due to elevated diaphragm is alarming especially during sleep [2-4].

In conjunction with sleep-related apnea or hypoventilation, these could lead to maternal oxygen desaturation during sleep[1]. Reduced FRC, and slightly reduced alveolar ventilation could alter maternal blood oxygenation during sleep.

Such nocturnal hypoventilation might have adverse effect on maternal partial pressure of oxygen in arterial blood[5] leading to impaired hemoglobin saturation. Thus decreased maternal oxygenation attributed by the increased alveolar arterial oxygen gradient found in pregnancy [6] causing nocturnal hypoxemia [7-8].

Fortunately some compensating physiological mechanisms provides protection against this

include right shift of oxyhemoglobin dissociation curve [9] high level progesterone induced increased drive to breath [10-11], increased cardiac output and. In addition, this problem can be minimized or overcome by some changes in respiratory function to a different direction associated with pregnancy. Lung function during pregnancy could be influenced by anatomical, hormonal and biochemical factors [12].

Maternal ventilation and blood gases undergo substantial changes during pregnancy. There is increased minute ventilation and a15-20% progressive increase in oxygen consumption above the non pregnant level in response to increased metabolic demand of mother and fetus [13]. 40 % increase minute ventilation results in raised arterial oxygen tension and oxygen carrying capacity. Thus state of oxygen saturation has been found slightly increased in pregnant compared to non pregnant women. All these changes were mediated by the high progesterone level influencing respiratory center through lowering its threshold and increasing sensitivity [13].

With the above back ground to study the effect of pregnancy on oxygen saturation in maternal blood, SaO_2 analysis in both pregnant and non pregnant women is important. Though a number of investigations have been under taken in different countries no such data is available in our country. Therefore the present study was conducted to observe the changes in percentage saturation of Hb in pregnant women in different trimesters.

Methods

This study was conducted on pregnant women to observe the status oxygen saturation in arterial blood during different trimester. The study was done in the department of Physiology, Dhaka medical college, from July 2004 to June 2005.

For these total 32 female subjects of aged 25-35 years without any history of recent respiratory illness were selected. All subjects were residents of a slum in Dhaka city and belonged to lower socioeconomic status. 8 apparently healthy non pregnant women taken as control (group A). 24 healthy pregnant women without any complication were selected as experimental group. They were again divided into subgroup B-I, B-II, B-III according to 1st, 2nd and 3rd trimester so that each group consisted of equal number of subjects.

Before selection the aim and out come of the study were explained to each subject with a careful and friendly attitude and encouraged to ensure a voluntary participation.

At every step in the procedure all ethical view points were considered. An informed written consent was obtained from each subject. A detail medical family, personal and socioeconomic history was recorded in a prepared questionnaire. A thorough clinical examination was done and anthropometric data were recorded.

Under proper aseptic precaution by a special technique 1 ml of arterial blood was collected by a disposable syringe and it was sent immediately to the biochemical laboratory of the Ibne Sina Hospital, Dhanmandi, Dhaka for blood gas analysis.

The SaO_2 of arterial blood was determined by using "Easy Blood Gas Analyzer". Data was compared between pregnant women in different trimester and non pregnant and also among different trimesters. Data was expressed as Mean and standard deviation.

Statistical analysis was done by students unpaired t test. 5% level was considered as level of significance. Computerized SPSS 12 version was used for data analysis

Results

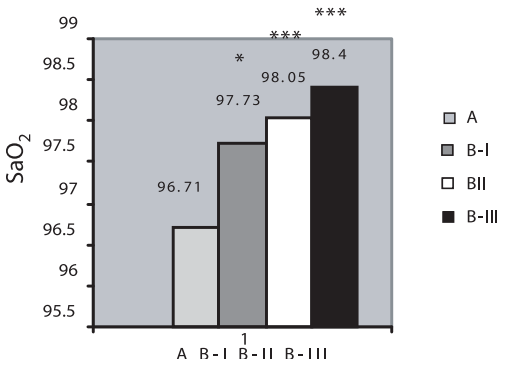
All subjects of both groups are matched for age, number and socioeconomic status. Results of SaO_2 of all groups are shown in Figure 1.

The mean (±SD) SaO_2 were 96.71±0.63, 97.73±0.92, 98.05± 0.54 and 98.40±0.30 in group A, B-I , B-II, B-III respectively. Mean SaO_2 levels are significantly higher ($p<0.001$)

in pregnant women in all 3 trimester than that of non pregnant women.

Mean SaO_2 levels are progressively increasing with trimester but no statistically significant differences were observed among the values in different trimester.

Figure 1. Shows mean SaO2 in different study groups



A = control, B-I = 1st trimester, B-II = 2nd trimester, B-III = 3rd trimester

Discussion

In the present study the mean of measured values of SaO_2 were in the first trimester second trimester and third trimester than that of non pregnant. There was gradually increased SaO_2 throughout the pregnancy from first to third trimester of pregnant women. But SaO_2 in second and third trimester were not statistically higher than first trimester. Again the difference in mean SaO_2 values between second and third trimester were not statistically significant. These findings are in agreement with other workers. [1, 5, 14] In contrast opposite finding has also been reported. [15]

It has been reported that pregnancy was associated with an increase in alveolar ventilation causing marked changes in arterial oxygen tension but small change in SaO_2 .Maternal SaO_2 at 36 weeks of gestation was not reduced compared to that measured in postpartum.[1]

There was no change in SaO_2 during pregnancy. Minute ventilation is higher in pregnant women but did not change with gestation. The higher minute ventilation was due to an increase in respiratory rate and not tidal volume. [14]

During sleep in normal non pregnant women there is a slight reduction in alveolar ventilation resulting in period of apnea. Such nocturnal hypoventilation in concert with supine position could reduce maternal partial pressure of oxygen (PaO_2) and blood oxygen saturation in arterial blood [5].

In their study probably there was no difference in hemoglobin concentration between pregnant and non pregnant. But in the present study hemoglobin concentration was not measured.

Therefore the discrepancy in this result may be due to differences in hemoglobin concentration in our control and experimental group. This is one of the limitations of our study.

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