

## Original Article

# Study of Forced Expiratory Volume in First Second (FEV<sub>1</sub>) and Ratio of Forced Expiratory Volume in First Second and Forced Vital Capacity in Percentage (FEV<sub>1</sub>/FVC%) in Pregnant Women

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### Abstract

**Background:** A few data are available on the effects of pregnancy on pulmonary function in different countries. But no such established data are available in our country. So we designed this study in our population. **Objectives:** To observe the forced expiratory volume in first second (FEV<sub>1</sub>) and ratio of forced expiratory volume in first second and forced vital capacity (FEV<sub>1</sub>/FVC%) in different trimesters of normal pregnant women and to compare them with those of healthy non-pregnant women. **Materials and Methods:** This observational and analytical study was carried out in the department of Physiology, Dhaka Medical College during July 2004 to June 2005. Total 100 women aged from 25 to 35 years without any recent history of respiratory tract diseases were selected as study population. Among them, 75 normal pregnant women were taken as experimental and 25 healthy non-pregnant women were taken as control groups. The experimental group included 25 pregnant women in first trimester, 25 in second trimester and 25 in third trimester. Forced expiratory volume in first second (FEV<sub>1</sub>), ratio of percentage of forced expiratory volume in first second and forced vital capacity (FEV<sub>1</sub>/FVC%) were measured in pregnant and non-pregnant control women. The FEV<sub>1</sub> and FEV<sub>1</sub>/FVC% were measured by using an 'automatic spirometer'. Statistical analyses were done by unpaired Student's 't' test between the study groups and p value <0.05 was taken as significant. **Results:** The mean ± SD of measured values of FEV<sub>1</sub> were 2.41 ± 0.87, 2.28 ± 0.59, 2.15 ± 0.74 and 1.89 ± 0.76 liters in non-pregnant women and in pregnant women during first trimester, second trimester and third trimester. The mean ± SD of measured values of FEV<sub>1</sub>/FVC% were 75.22 ± 16.77, 74.86 ± 11.06, 74.42 ± 17.43 and 71.81 ± 15.87% in non-pregnant women and in pregnant women during first trimester, second trimester and third trimester. **Conclusion:** The FEV<sub>1</sub> and FEV<sub>1</sub>/FVC% were significantly lower in third trimester pregnant women than that of non-pregnant and first trimester of pregnant women and FEV<sub>1</sub>/FVC% gradually decreased from first to third trimester of pregnant women.

**Key words:** Forced expiratory volume in first second, Forced vital capacity, Pregnant women

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### Introduction

In early pregnancy, capillary dilatation occurs throughout the respiratory tract. This leads to engorgement of the nasopharynx, larynx, trachea and bronchi which can cause breathing difficulties. As the uterus enlarges during pregnancy the diaphragm

is elevated as much as 4 cm and the rib cage is displaced upward and widens. The lower thoracic diameter increases about 2 cm and thoracic circumference also increases up to 6 cm. Elevation of the diaphragm does not impede its movement.

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Abdominal muscles have less tone and are less active during the pregnancy causing respiration to be more diaphragmatic. Moreover it has been seen that alteration occurs in lung volumes and capacities during pregnancy.<sup>1</sup> Mechanical effects of progressively increasing size of the uterus decrease the lung volumes and capacities by the fifth month of pregnancy which at term are about 20% below those of the non-pregnant state.<sup>2</sup> During pregnancy, changes in the thoracic configuration subsequent to progressive increase in the abdominal volume have a moderate effect on respiratory function.<sup>3</sup> It is observed that pregnancy is associated with significant changes in respiratory functions even in healthy pregnant women.<sup>4,5</sup>

On the other hand, FEV<sub>1</sub> gradually decreases as the pregnancy advances. After 28 weeks of gestation FEV<sub>1</sub> significantly decreases than that of the normal values. These results suggest that FEV<sub>1</sub> changes gradually during pregnancy especially after the 28<sup>th</sup> week of pregnancy.<sup>6</sup> Though the Indian population showed significant changes in total and timed vital capacity (FVC and FEV<sub>1</sub>), FVC did not significantly decrease in the third trimester than that of the second trimester.<sup>7</sup> Again it was also found that airway obstruction due to any cause reduces the FEV<sub>1</sub> and FVC but to a lesser extent which in turn causes the FEV<sub>1</sub>/FVC% ratio to be reduced below 60%. However, in another study reduced FEV<sub>1</sub> and FVC were observed among the study population with unchanged FEV<sub>1</sub>/FVC% ratio.<sup>8</sup> So it was important to observe the lung function assessment in pregnant women both physiologically and clinically. A few data are available on the effects of pregnancy on pulmonary function in different countries as shown by different researches.<sup>6,7</sup> But no established data is available in our country on this aspect. Therefore, the aim of this study was to observe the normal value of FEV<sub>1</sub> which is frequently used for lung function test in different trimesters of normal pregnant women and compare them with those of healthy non-pregnant women.

## Materials and Methods

This observational and analytical study was carried out in the department of Physiology, Dhaka Medical College during July 2004 to June 2005. The study subjects were taken from different areas of Dhaka city and belonged to lower, middle and poor socio-

economic classes. A total of 100 women aged from 25 to 35 years without any recent history of respiratory diseases were selected – 75 were in the experimental group and 25 were in the control group. Experimental group included 25 first trimester (Group B-I), 25 second trimester (Group B-II), and 25 third trimester (Group B-III) pregnant women. 25 healthy non-pregnant women were taken as control (Group A).

Forced expiratory volume in first second (FEV<sub>1</sub>), ratio of percentage of forced expiratory volume in first second and forced vital capacity (FEV<sub>1</sub>/FVC%) were measured in normal pregnant and healthy non-pregnant women.

The FEV<sub>1</sub> and FEV<sub>1</sub>/FVC% were measured by automatic spirometer during different trimesters of pregnant women and compared with that of non-pregnant women. Statistical analyses were done by unpaired Student's 't' test between the study groups and p value <0.05 was taken as significant.

## Results

Table I shows the FEV<sub>1</sub> and FEV<sub>1</sub>/FVC% values in different groups. The mean ± SD of measured values of FEV<sub>1</sub> were 2.41 ± 0.87, 2.28 ± 0.59, 2.15 ± 0.74 and 1.89 ± 0.76 liters in non-pregnant women and in pregnant women during first trimester, second trimester and third trimester. The mean ± SD of measured values of FEV<sub>1</sub>/FVC% were 75.22 ± 16.77, 74.86 ± 11.06, 74.42 ± 17.43 and 71.81 ± 15.87% in non-pregnant women and in pregnant women during first trimester, second trimester and third trimester. Table II shows that the mean ± SD of measured values of FEV<sub>1</sub> was significantly lower in third trimester compared to that of the non-pregnant women and first trimester pregnant women. There were no statistically significant differences of FEV<sub>1</sub> in first trimester and second trimester compared to that of non-pregnant women, in second trimester compared to that of first trimester pregnant women and third trimester compared to that of second trimester pregnant women.

Table III shows that the mean ± SD of measured values of FEV<sub>1</sub>/FVC% was significantly lower in third trimester compared to that of the non-pregnant women and first trimester pregnant women. There were no statistically significant differences of FEV<sub>1</sub>/FVC% in first trimester and second trimester

Table I: FEV<sub>1</sub> and FEV<sub>1</sub>/FVC% values in different groups (n= 100)

Parameters	Group A (n = 25)	Group B-I (n = 25)	Group B-II (n = 25)	Group B-III (n=25)
FEV <sub>1</sub> (in liters)	2.41 ± 0.87	2.28 ± 0.59	2.15 ± 0.74	1.89 ± 0.76
FEV <sub>1</sub> /FVC%	75.22 ± 16.77	74.86 ± 11.06	74.42 ± 17.43	71.81 ± 15.87

Table II: Comparison of FEV<sub>1</sub> values between different groups

Groups	FEV <sub>1</sub> values (in liters)	P values
A vs B-I	2.41 ± 0.87 and 2.28 ± 0.59	>0.50
A vs B-II	2.41 ± 0.87 and 2.15 ± 0.74	>0.10
A vs B-III	2.41 ± 0.87 and 1.89 ± 0.76	<0.05
B-I vs B-II	2.28 ± 0.59 and 2.15 ± 0.74	>0.10
B-I vs B-III	2.28 ± 0.59 and 1.89 ± 0.76	<0.05
B-II vs B-III	2.15 ± 0.74 and 1.89 ± 0.76	>0.10

Table III: Comparison of FEV<sub>1</sub>/FVC% values between different groups

Groups	FEV <sub>1</sub> /FVC%	P values
A vs B-I	75.22 ± 16.77 and 74.86 ± 11.06	>0.50
A vs B-II	75.22 ± 16.77 and 74.42 ± 17.43	>0.10
A vs B-III	75.22 ± 16.77 and 71.81 ± 15.87%	<0.05
B-I vs B-II	74.86 ± 11.06 and 74.42 ± 17.43	>0.10
B-I vs B-III	74.86 ± 11.06 and 71.81 ± 15.87%	<0.05
B-II vs B-III	74.42 ± 17.43 and 71.81 ± 15.87%	>0.10

compared to that of non-pregnant women, in second trimester compared to that of first trimester pregnant women and third trimester compared to that of second trimester pregnant women.

**Discussion**

The mean ± SD of measured values of FEV<sub>1</sub> was significantly lower in third trimester than that of non-pregnant women and first trimester pregnant women. There were statistically no significant differences of FEV<sub>1</sub> in first and second trimester compared to that of non-pregnant women, in second trimester compared to first trimester and third trimester compared to second trimester pregnant women. The results are in agreement with the findings of other researchers.<sup>10-12</sup> The mean ± SD of FEV<sub>1</sub>/FVC% in

third trimester was statistically significantly lower compared to that of non-pregnant women and first trimester pregnant women. FEV<sub>1</sub>/FVC% gradually decreased throughout pregnancy from first to third trimester. The findings are in consistence with those of other researchers.<sup>13,14</sup>

The mean vital capacity in late pregnancy was significantly lower than that of non-pregnant women. This reduced vital capacity during pregnancy was due to a decrease in the expiratory reserve volume.<sup>9</sup> The FEV<sub>1</sub> was gradually decreased as pregnancy advanced. After the 28<sup>th</sup> weeks of gestation, FEV<sub>1</sub> significantly decreased as compared to the normal values due to obstructions in the bronchial tubes. After the 28<sup>th</sup> weeks of gestation, it may be the reason for occurrence of breath shortness and lung infection.<sup>10</sup> FEV<sub>1</sub> progressively declines during different trimesters of pregnancy due to mechanical pressure by enlarging gravid uterus, elevating the diaphragm and restricting the movement of lungs hampering the forceful expiration.<sup>11</sup>

In this study, it may therefore be concluded that FEV<sub>1</sub> and FEV<sub>1</sub>/FVC% significantly decreased during third trimester of pregnancy compared to that of non-pregnant control women and first trimester pregnant women. There was progressively decreased FEV<sub>1</sub> throughout pregnancy due to poor nutrition as all the study subjects belonged to lower middle class and poor socio-economic status. Poor nutritional status leads to poor growth of muscles and development of lungs and consequently decreased pulmonary functions. Because of gradual increase in the size of the gravid uterus there was progressive decrease in lung volumes and capacities.

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