STUDY OF VITAL CAPACITY AND TIMED VITAL CAPACITY IN NORMAL NON-PREGNANT AND PREGNANT WOMEN

by

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Introduction

Pregnancy represents one of the best examples of selective adaptation in terms of respiratory physiology. For the evaluation of certain changes in respiratory physiology during pregnancy viz. dyspnea, orthopnea, etc. and to estimate the condition of pulmons with a considerable accuracy, knowledge of the effect of pregnancy on vital capacity is important. Now a days, usefulness of timed vital capacity is universally accepted because it gives better idea about the pulmonary ventilation and ability of bellows to ventilate. Most of the workers have measured it in 0.75, 1.00, 2.00 and 3.00 seconds by single forced expirogram, but to measure it in single forced inspirogram is also considered equally important by some workers who believe that impaired inspiratory flow rate reflects the restrictive disorders and comparison of inspiratory and expiratory flow rates help to distinguish asthma and emphysema (Luke Harris 1975). The aim of the present study is to find changes in VC and TVC during normal pregnancy as well as to establish norms.

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Materials and Methods

Seventy-five normal pregnant women (25 from each trimester) were selected from outdoor patient's department as well as antenatal ward of S.S.G. Hospital, Baroda. By performing clinical examination, subjects with normal cardio-vascular and respiratory systems and having haemoglobin more than 10 grams % were selected. All the pregnant subjects were second or third gravida and 25 to 35 years age. They were all socioeconomically of middle class. By keeping the same criteria 25 normal non-pregnant women were selected as control from the relatives of pregnant women who were attending the outdoor patient's department.

Vital capacity and timed vital capacity of subjects of all the groups were measured in the morning and in standing posture after giving full instructions and demonstrations of these tests. Vital capacity (VC) was measured by Hutchinson's Spirometer while the Timed vital capacity (TVC) was measured by a single forced spirogram (expirogram and inspirogram) obtained by Ludwig's Kymograph with the speed of 5.9 cms./second and calculated in the terms of percentage of total forced expiratory and inspiratory volume as follows:

1. Forced expiratory volume in 0.75 second (FEV 0.75).

2. Forced expiratory volume in 1.00 second (FEV 1.00).

3. Forced inspiratory volume in 0.75 second (FIV 0.75).

4. Forced inspiratory volume in 1.00 second (FIV 1.00).

Results and Discussion

Table I shows that VC decreases gradually as the pregnancy advances. This decrease in VC from first to second trimester and from second to third trimester is not statistically significant. But when the result of first trimester is compared with that of third trimester, the decrease in VC is statistically significant.

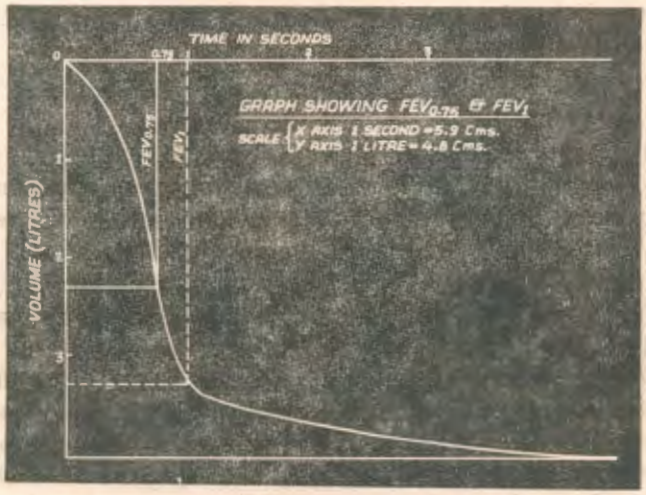

Fig. 1. Forced expirogram.

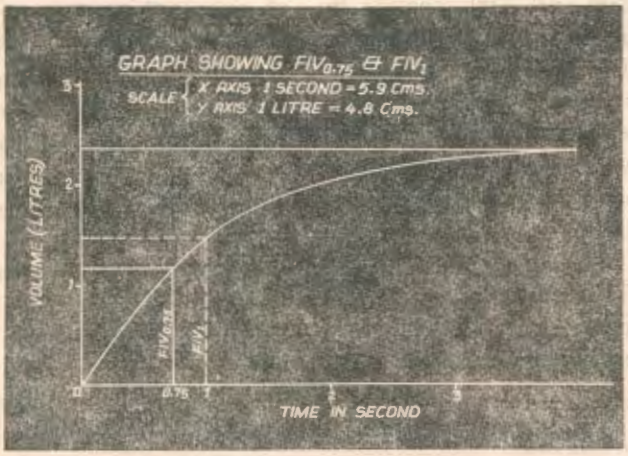

Fig. 2. Forced inspirogram.

TABLE I

Showing the mean values and S.D. of VC, $FEV_{0\cdot75}$, $FEV_{1\cdot00}$, $FIV_{0\cdot75}$ and $FIV_{1\cdot00}$ of control, first trimester, second trimester and third trimester subjects

Parameters	Control	First Trimester	Second Trimester	Third Trimester
VC (ml.)	2472.00 ±322.12	2310.00 ±342.78	2130.00 ±452.30	2016.00 ±379.07
$FEV_{0\cdot75}$(%)	72.60 ± 12.69	58.75 ± 19.82	58.11 ± 18.25	57.10 ± 21.08
$FEV_{1\cdot00}$(%)	89.68 ± 08.41	75.68 ± 19.39	77.75 ± 17.95	75.29 ± 20.27
$FIV_{0\cdot75}$(%)	67.29 ± 16.72	68.63 ± 22.22	72.30 ± 19.02	68 ± 13 ± 18.80
$FIV_{1\cdot00}$(%)	85.59 ± 12.92	86.71 ± 16.50	91.97 ± 12.00	84.94 ± 17.47

The progressive decrease in VC may be due to progressive increase in obstructing effect of enlarged uterus by pushing the diaphragm up.

Rubin *et al* (1956), Bernard *et al* (1967), Shelat (1969) and Devan *et al* (1974) also have observed decrease in VC during pregnancy while Root and Root (1923), Landt and Banjamin (1936), Widlund (1972), Ihrman (1960), Gazioglu *et al* (1975), Pandya *et al* (1972) and Knuttgen and Emerson (1974) found gradual increase in VC during pregnancy. On the otherhand Cugell *et al* (1953), Humphrey (1969), Rechard *et al* (1964), Prouse and Gaensler (1965), Cyril (1972) and Grace *et al* (1977) reported that VC remains stable during pregnancy.

FEV 0.75 and FEV 1.00 significantly decrease from control to first trimester. It may be either due to cytotrophoblastic cells and syncytial trophoblasts which

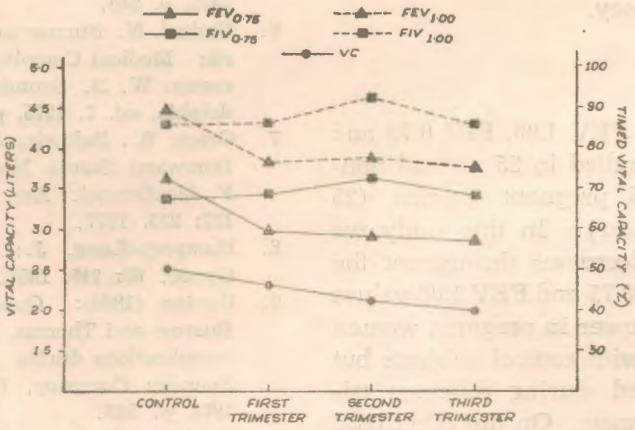

Fig. 3. Graph showing the mean values of VC, FEV 0.75, FEV 1.00, FIV 0.75 and FIV 1.00 of control, first trimester, second trimester and third trimester subjects.

traverse through the uterine sinuses and reach the alveoli of maternal lungs which cause sudden attacks of dyspnea and respiratory embarassment in pregnant women (Pandya 1972), or due to nausea, vomitting, morning sickness and other psychological changes which usually occurs during early pregnancy (Shelat 1969). But during pregnancy FEV 0.75 and FEV 1.00 remains steady which can be explained by the fact that the restricted movement of the lungs because of upward displacement of diaphragm by gravid uterus is to a great extent compensated by increase in transverse and anteroposterior diameter of thoracic cage.

FIV 0.75 and FIV 1.00 remains within its normal range in control subjects and in pregnant subjects of various trimesters. No data regarding FIV during pregnancy is available for the comparison.

Cugell *et al* (1953), Rubin *et al* (1956), Rechard *et al* (1964), Prouse and Gaensler (1965), Knuttgen and Emerson (1974), Cyril (1972), Gerard and Thomas (1975) and Grace *et al* (1977) reported that TVC remains within its normal range during pregnancy, whereas Shelat (1969) suggested a decrease in FEV during first trimester of pregnancy.

Summary

VC, FEV 0.75, FEV 1.00, FIV 0.75 and FIV 1.00 were studied in 25 normal nonpregnant and 75 pregnant women (25 from each trimester). In this study we found that VC decreases throughout the pregnancy. FEV 0.75 and FEV 1.00 values are significantly lower in pregnant women when compared with control subjects but remain unchanged during different trimesters of pregnancy. On the otherhand FIV 0.75 and FIV 1.00 remain within its normal range throughout the pregnancy.

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