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RESEARCH ARTICLE

STUDY OF EFFECT OF EXERCISE ON PEFR IN PREGNANT WOMEN

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Background: Many physiological adaptations occur during pregnancy. One such is changes in the respiratory functions and response to exercise. Many studies have been conducted on changes in peak expiratory flow rate (PEFR) in pregnancy, but there are only few studies reporting the effect of exercise on PEFR in pregnant women.
Aims and Objectives: To study the effect of exercise on PEFR in pregnant women.
Materials and Methods: PEFR was measured in 50 pregnant women in their second trimester of pregnancy in comparison with nonpregnant women (controls). PEFR was measured twice. The first reading was taken at rest and the second after moderate exercise, in the form of walking on a treadmill for 6 min at 12% slope. It was measured using RMS Medspiror.
Results: The mean age of the pregnant women was 23.1 ± 2.7 years and that of the controls was 24.3 ± 2.4 years. The mean height was 1.51 ± 0.05 m in pregnant women and 1.51 ± 0.04 m in controls. In pregnant women, PEFR at rest was lower than that in nonpregnant women. The difference was found to be statistically significant. After exercise, the PEFR decreased in both pregnant and nonpregnant women. The percentage of decrease did not change significantly between the two groups.
Conclusion: We conclude that although resting PEFR in pregnant women is less, there is not much difference in the response to exercise between the two groups. Thus, pregnant women can be encouraged to exercise regularly.

INTRODUCTION

Exercise should form a very important part of the antenatal care. There are many benefits of exercise during pregnancy for both mother and fetus.[1] It prevents the onset of maternal obesity, gestational diabetes, and pregnancy-induced hypertension. Exercise enhances the cardiopulmonary reserve, helps in smooth conduct of labor, and helps in improving weight of the baby.[2] Women are prone to respiratory distress during pregnancy due to the growing fetus. Exercise further challenges the respiratory system for more oxygen supply to the fetus. In pregnant women, the functional residual capacity and the residual volume of air are decreased as a consequence of the elevated diaphragm.[3] Lung compliance is unaffected by pregnancy. Airway conductance is increased and total pulmonary resistance is decreased.[4] Peak expiratory flow rate (PEFR) is one of the important pulmonary function tests to study the expiratory effort and also the functioning of the respiratory muscles. It is an important tool that has been used effectively and economically by many researchers to diagnose obstructive lung disorders. Normal PEFR in healthy individuals ranges from 5.5 to 7.0 L/s. It is known to decrease as the pregnancy advances.[5]

During pregnancy, a woman's body undergoes important adaptations, including biomechanical, physiological, and metabolic. Thus, the response to exercise is deeply modified in comparison to nonpregnant women. It is observed that the respiratory rate, tidal volume, and minute ventilation increase during exercise.[6] Many studies have been conducted to show the changes in the PEFR during different trimesters of pregnancy, but none reports the effect of exercise on PEFR. So this study was undertaken to compare PEFR in pregnant women and controls and to find out if there is any change in PEFR in pregnant women after exercise. If any change is observed in PEFR, we tried to determine its degree and any indicator of respiratory obstruction after moderate exercise.

MATERIALS AND METHODS

This study was conducted at the department of physiology. It was undertaken to observe the effects of exercise on the PEFR in healthy pregnant women.

This was done by comparing the effects of exercise in pregnant and nonpregnant women. The approval from the human research ethics committee of the institute was taken. Fifty pregnant women who were attending the antenatal clinic and were in the second trimester of pregnancy were selected as cases. The pregnant women aged between of 20 and 30 years, without history of illness or surgical procedure of any system, and whose hemoglobin concentration was >10 g% were selected as subjects. Those with any of the following risk factors were excluded from the study:

- Pregnancy-induced hypertension
- Incompetent cervix
- Threatened abortion
- Deep vein thrombosis
- History of intrauterine growth retardation and any other high-risk pregnancy

Fifty controls were selected from general population. The inclusion criteria were normal healthy nonpregnant women aged between 20 and 30 years with no history of any illness or surgery. All the participants gave an informed consent after the detailed procedure of the noninvasive technique was explained to them in vernacular. A detailed obstetric history about the present and past pregnancies was noted and clinical examination of all the systems was carried out.

Medical examination of all the subjects was carried out in the morning session (between 10.30 a.m. and 1 p.m.), and physical characteristics such as height (in cm) and weight (in kg) were recorded.

The lung function tests were performed twice—one at rest and another immediately after moderate exercise. PEFR was measured with a computerized Spirometer (RMS Medspiror) and values were recorded. Software from RMS, which gives the predicted PEFR values based on age, height, and weight, was used.

The participants were instructed and motivated before the start. They were made to sit comfortably on a stool. A noseclip was attached and the participant was asked to inspire maximally. Then, they were asked to expire with maximum force through a firmly place mouthpiece, and this was followed by a maximum forced inspiration. The highest value of PEFR from three correctly performed attempts was considered. Adequate rest was given in between the readings. The instrument displays the comparison of the parameters between the maneuvers and the highest value was considered.

Both control and cases were subjected to exercise, that is, walking on a motorized treadmill (Aerofit). They were made to walk on it for 6 min at a speed of 2.0 mph (3.2 kmph) at 12% grade slope, which accounted for moderate exercise.[7] Treadmill could be immediately stopped in case of any uneasiness. The speed is similar to walking and hence this was used in women for exercise. Besides, it is familiar and easy to use. The participants were instructed and demonstrated how to walk on a treadmill before they themselves could walk. The treadmill was started at a low speed and once the subject had gained confidence, the speed of the treadmill was increased to 3.2 kmph and they were made to walk for 6 min. They were instructed to report if they felt dizzy, palpitations or any other problems, in which case the treadmill was stopped. All the participants successfully completed the exercise regime without any complaints. Immediately after exercise, the participants were made to perform the spirometry. The readings for post-exercise PEFR were noted.

Statistical Analysis

The results are given as mean±standard deviation and range values. Between-group comparisons were performed using unpaired *t*-test and within-group comparison was performed by paired *t*-test. *p*-Value of ≤0.05 was considered statistically significant.

RESULTS

The mean age of the pregnant women 23.1 ± 2.7 years, the mean height was 1.51 ± 0.05 m, mean weight was 51.4 ± 4.65 kg, and body mass index (BMI) was 22.6 ± 2.4. The mean age of controls was 24.3 ± 2.4, mean height was 1.51 ± 0.04 m, mean weight was 52.1 ± 4.5 kg, and BMI was 21.53 ± 3.2.

The mean PEFR at rest in pregnant women was 5.21 ± 0.54 L/s (85.9% predicted) and in controls it was 6.31 ± 0.23 L/s (97.3% predicted). The difference between the two groups statistically significant ($p < 0.001$; Table 1). After exercise, the PEFR found to be decreased in both the groups. When the resting PEFR were compared to post-exercise values, the difference in the decrease in PEFR between the two groups was not found to be statistically significant ($p > 0.05$; Table 1; Figure 1).

Table 1: Changes in PEFR after exercise in pregnant women and controls

Groups	Rest PEFR (L/s)	Exercise PEFR (L/s)	Difference in PEFR after Exercise (L/s)
Pregnant women	5.21 ± 0.54	4.89 ± 0.36	0.32 ± 0.11
Controls	6.31 ± 0.23	5.98 ± 0.27	0.33 ± 0.09
p-Value	<0.001, HS	<0.001, HS	>0.05, NS

HS, highly significant; NS, not significant; PEFR, peak expiratory flow rate

Table 2: Percentage predicted value of PEFR changes to exercise in pregnant women and controls

Groups	PEFR (% Predicted)		Difference (% Predicted)
	Rest	Exercise	
Pregnant women	85.9 ± 4.23	80.05 ± 6.31	−5.85 ± 6.9
Controls	97.3 ± 2.4	91.4 ± 3.5	−5.91 ± 2.6
T	18.8	11.1	0.2
p-Value	<0.001, HS	<0.001, HS	>0.05, NS

HS, highly significant; NS, not significant; PEFR, peak expiratory flow rate

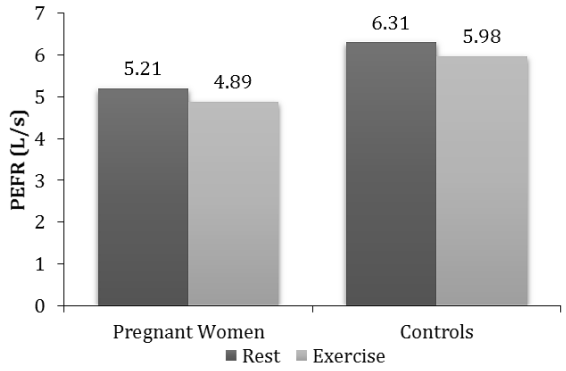

Figure 1: Comparison of PEFR (in L/s) at rest and after moderate exercise between pregnant women and controls

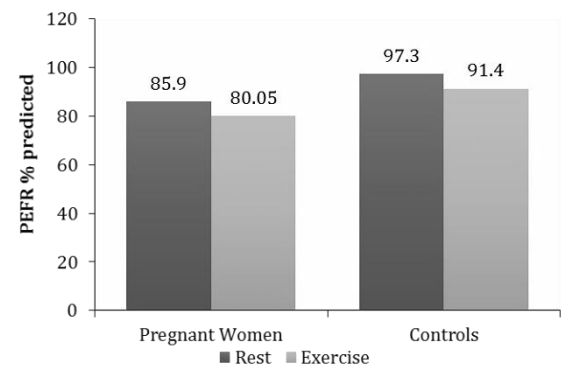

Figure 2: Percentage changes in the PEFR after exercise

Table 1 and Figure 1 summarize the PEFR response to acute moderate exercise in pregnant women and controls. PEFR at rest and after the exercise was compared. PEFR in pregnant women was found to be significantly lower than that in controls both at rest and after exercise. Post-exercise decrease in PEFR in pregnant women was not significantly different from that in controls.

Table 2 and Figure 2 summarize the PEFR in percentage predicted in pregnant women and controls. Decrease in percentage predicted PEFR in pregnant women was not significantly different than controls.

DISCUSSION

PEFR is an important pulmonary function test that has been used effectively and economically by many researchers. In our study, the resting PEFR in pregnant women was less than that in controls. The difference was statistically significant. A study by Puranik et al.[8] showed that during pregnancy there is a significant decrease in PEFR, which is due to lesser force of contraction of main expiratory muscle and internal intercostals. Inadequate nutrition due to morning sickness and altered eating habits may also result in muscular weakness, leading to decreased PEFR. Similar findings were reported by Singhal and Saxena[9] and Harirah et al.[10] A descending trend in PEFR at different trimesters was observed by Chaitra and Maitri.[11] The decrease in the mean PEFR may be attributed to lesser force of contraction of expiratory muscles (i.e., anterior abdominal muscles) or to mechanical effect of enlarging gravid uterus, decreasing the vertical diameter by restricting the diaphragmatic movement.

After exercise, a decrease in PEFR was observed in both the groups. The percentage decrease in PEFR in pregnant women was no different than controls. A decrease in PEFR after exercise was also observed by Sheethal et al.[12] Their study on bronchial liability during and after exercise in women showed about 3% decrease in PEFR after exercise. This can be attributed to increase in bronchoconstriction, which is induced after exercise. Airway conductance after graded exercise was measured in normal participants by Kagawa and Kerr.[13] They showed a post-exercise decrease in airway conductance. An earlier study by Burr et al.[14] to measure PEFR before and after exercise has shown a lesser decline in PEFR in women after a bout of exercise when compared to men. Women are less prone to airway obstruction. In our study, PEFR in pregnant women remained well within the normal range throughout the procedure at rest and also after exercise.

CONCLUSION

There was a significant decrease in PEFR in pregnant women at rest when compared to controls, and it further decreased after exercise. But the percentage decrease in PEFR in pregnant women after exercise

did not differ from that in controls. There were no symptoms or signs of any distress in any of the participants. PEFR in pregnant women was less than that in controls but was well within the normal range, suggesting no respiratory compromise. Thus, pregnant women should be encouraged to follow a regular exercise regime because of its benefits. One limitation of this study is that it is restricted to a small population. In future, it can be conducted in a large population to modulate the exercise protocols in pregnant women and to safeguard the health of both the mother and the baby.

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