

## Relationship Of FEF<sub>25-75</sub>, Pefr And SVC With Estrogen And Progesterone Level In Postmenopausal Women

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### Abstract

**Background:** Deterioration of lung function is common in women after menopause, which may be related to very low estrogen and progesterone level. **Objective:** To observe FEF<sub>25-75</sub>, PEFR and SVC (slow vital capacity) values in apparently healthy postmenopausal women to find out their relationships with serum estrogen and progesterone. **Methods:** This study was carried out in the Department of Physiology in BSMMU, Dhaka in the year 2007. 30 healthy postmenopausal women aged 45 to 60 years and 30 healthy premenopausal women aged 20 to 30 years during their different phases of menstrual cycle were studied. Postmenopausal women were residents of Dhaka city and premenopausal subjects were medical students. FEF<sub>25-75</sub>, PEFR and SVC of all subjects were measured by a digital micro spirometer. Their estrogen and progesterone levels were estimated by Micro particle Enzyme Immunoassay (MEIA) method. Data were analyzed by Pearson's correlation coefficient test, one way ANOVA and unpaired 't' test **Results:** The mean percentage of predicted values of FEF<sub>25-75</sub> and PEFR were lower in postmenopausal women compared to those of follicular and luteal phases of premenopausal women but it was not significant. Measured values of SVC was Significantly (p<.001) lower in postmenopausal women compared to those of follicular and luteal phases of premenopausal women. Again Mean serum estrogen and progesterone levels were significantly (p<.001) lower in post menopausal women compared to those of follicular and luteal phases of premenopausal women. In post menopausal women, FEF<sub>25-75</sub> was positively, PEFR and SVC were negatively correlated with progesterone level. PEFR and SVC showed positive correlation and FEF<sub>25-75</sub> showed negative correlation with serum estrogen level. All these correlations were statistically non significant. In premenopausal women FEF<sub>25-75</sub> and PEFR showed positive correlation and SVC showed negative correlation with serum progesterone level. The relationships were statistically significant in luteal phase but nonsignificant in follicular phase. FEF<sub>25-75</sub>, PEFR and SVC were positively correlated with serum estrogen level in luteal phase but FEF<sub>25-75</sub> and PEFR negatively correlated and SVC positively correlated with estrogen level in follicular phase. **Conclusion:** The outcome of this study shows FEF<sub>25-75</sub>, PEFR and SVC may be reduced in postmenopausal women which in turn may be associated with their low progesterone and estrogen levels.

**Key words:** Menopause, Lung function, Estrogen, Progesterone.

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### Introduction

**A** new hormonal pattern is established at menopause which is characterized by high levels of FSH, LH and very low

levels of estrogen and progesterone<sup>1</sup>. In postmenopausal women, in addition to recognized complications, lung functions are also affected.<sup>2</sup> Several studies reported about

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hyperventilation and bronchial relaxation associated with high progesterone during luteal phase.<sup>3-4</sup> Sex hormones play an important role in women's lung health<sup>5</sup>. It has also been observed that there is a close relationship between female sex hormones and lung function in postmenopausal women<sup>6</sup>. There is evidence that FEF<sub>25-75</sub> and PEFR were significantly lower in postmenopausal women compared to premenopausal women. Again decreased FEF<sub>25-75</sub> and PEFR in postmenopausal women are improved following hormone replacement therapy (HRT)<sup>9-12</sup>. Large percentage of postmenopausal women in our country draw poor attentions of existing health care services and suffers from poor lung functions related complications. In postmenopausal women, relationship between low level of estrogen and progesterone and the changes in FEF<sub>25-75</sub> and PEFR have been explored by several investigators of different countries<sup>10-12</sup>. But no published data on these parameters are available in our country. On the other hand no published data is available on SVC in postmenopausal women. Therefore, the present study attempted to observe the FEF<sub>25-75</sub>, PEFR and SVC in pre and postmenopausal women and to evaluate their relationship with serum estrogen and progesterone levels in these groups of women.

### Methods

This cross-sectional study was carried out in the Department of Physiology in BSMMU, between January to December 2007. Protocol of this study was approved by ethical review committee of the department. 30 healthy postmenopausal women, aged 45-60 years (group B) and 30 premenopausal women, aged 20-30 years (group A) were enrolled. All the postmenopausal women were residents of different areas in Dhaka city and premenopausal women were students of a non-government medical college, Dhaka. The postmenopausal subjects were assessed once and premenopausal women were assessed 2 times during follicular and luteal phase of menstrual

cycle. The premenopausal subjects were suggested to visit twice within 9<sup>th</sup>-14<sup>th</sup> days and 16<sup>th</sup>-23<sup>th</sup> days after the beginning of last menstrual period. Subjects with history of chronic obstructive lung diseases, smoking, hypertension, cardiovascular diseases, diabetes mellitus, BMI > 22.9 kg/m<sup>2</sup>, menstrual abnormalities, history of hormone replacement therapy, psychiatric disorders, head trauma with concussion and alcohol users were excluded. Before examination, the aims, objectives and benefits of the study were explained to all the subjects and their informed written consent were taken. Detail personal, medical and family history were taken. Thorough physical examinations of each subject were done. All these information were recorded in a prefixed questionnaire. For assessing lung function, FEF<sub>25-75</sub>, PEFR and SVC were measured at normal room temperature by using computer based digital Spirometer in the lung function laboratory of the Physiology department, BSMMU. 5ml blood was collected under aseptic precaution for estimation of estrogen and progesterone level. Serum estrogen and progesterone level were assessed by Micro particle Enzyme Immunoassay (MEIA) method in the laboratory of the Biochemistry department, BSMMU. Data analysis was done by using SPSS windows package version 12. unpaired t' test and Pearson's correlation coefficient test was performed for statistical significance.

### Results

Mean serum estrogen level was significantly lower in group B compared to group A<sub>2</sub> and that of A<sub>3</sub> but it was higher in group A<sub>2</sub> than that of group A<sub>3</sub> but not significant. Again mean serum progesterone level in group B was significantly lower than that of A<sub>3</sub> but not than that of A<sub>2</sub>. The value of progesterone was significantly (p<0001) higher in group A<sub>3</sub> than that of A<sub>2</sub> (Table I).

**Table I:** Mean± SD Serum estrogen and progesterone levels in different groups (n= 60)

Groups	Estrogen (Pgm/ml)	Progesterone (ngm/ml)
A <sub>2</sub> (n=30)	155 ± 69.03	0.85± 0.60
A <sub>3</sub>	138.20 ± 56.73	11.12± 3.92
B(n=30)	21.93 ± 10.46	0.20± 0.15

Statistical analysis

Groups	p values	
A <sub>2</sub> vsA <sub>3</sub>	0.204 <sup>ns</sup>	0.000***
B vs A <sub>2</sub>	0.000***	0.275 <sup>ns</sup>
B vs A <sub>3</sub>	0.000***	0.000***

In group B, mean measured value of SVC was significantly(p<0001) lower and the mean of the percentage of predicted values of FEF<sub>25-75</sub> and PEFR were lower but not significant than those of group A<sub>2</sub> and A<sub>3</sub> (Table II).

FEF 25-75 was positively correlated with serum progesterone level in group A2, A3 and B but it was statistically significant (p<0.01) only in group A3.

PEFR showed positive correlation with serum progesterone level in group A2, A3 but correlates negatively in group B and it was significant in group A3. SVC was negatively correlated in group A2 and B but positively and significantly correlated in group A3.

**Table II:** Mean percentage of predicted values of FEF<sub>25-75</sub>, PEFR and Measured value (Litre) of SVC in different groups (n=60)

Groups	FEF <sub>25-75</sub> %	PEFR%	SVC (L)
A <sub>2</sub>	87.34 ± 10.86	64.24 ± 8.18	1.91±0.29
A <sub>3</sub>	86.99 ± 12.54	66.08 ± 7.94	2.05 ± 0.89
B	84.48 ± 14.99	63.81 ± 7.94	1.57±0.30

Statistical Analysis

Groups	P values		
A <sub>2</sub> vsA <sub>3</sub>	0.923 <sup>ns</sup>	0.338 <sup>ns</sup>	0.001**
B vs A <sub>2</sub>	0.420 <sup>ns</sup>	0.823 <sup>ns</sup>	0.002**
B vs A <sub>3</sub>	0.478 <sup>ns</sup>	0.238 <sup>ns</sup>	0.001**

A<sub>2</sub>= follicular phase A<sub>3</sub> = luteal phase

B= Postmenopause (study group)

\*\*\*= p<0.001

FEF<sub>25-75</sub> was positively correlated with serum estrogen level in group A3 but negatively correlated in group A2 and B whereas PEFR showed positive correlation in group A3 and B but negatively correlated in group A2. The relationship were statistically non significant.

SVC was positively correlated with serum estrogen level in group A2, A3 and B. The relationship was statistically significant in group A3 only.(Table III)

**Table III:** Relationships of serum estrogen and progesterone level with lung function parameters in different groups (n=60)

Parameters	Group A2		Group A3		Group B	
	Estrogen	progesterone	Estrogen	progesterone	Estrogen	progesterone
	r value	r value	r value	r value	r value	r value
FEF <sub>25-75</sub>	-0.073 <sup>ns</sup>	+0.307 <sup>ns</sup>	+0.132 <sup>ns</sup>	+0.369*	-0.070 <sup>ns</sup>	+0.192 <sup>ns</sup>
PEFR	-0.011 <sup>ns</sup>	+0.131 <sup>ns</sup>	+0.324 <sup>ns</sup>	+0.369*	+0.050 <sup>ns</sup>	-0.033 <sup>ns</sup>
SVC	+0.137 <sup>ns</sup>	-0.06 <sup>ns</sup>	+0.435*	+0.38*	+0.141 <sup>ns</sup>	-0.124 <sup>ns</sup>

\*=p<0.05

## Discussion

In this study, serum estrogen and serum progesterone level was significantly lower in postmenopausal women compared to premenopausal women.

In postmenopausal women, serum progesterone level was significantly lower compared to its value during luteal phase in premenopausal women. This finding was in agreement with some other investigators<sup>15-17</sup>. In postmenopausal women, serum estrogen level was significantly lower than those during both follicular and luteal phases in premenopausal women. This observation was in agreement with those<sup>18</sup> who have demonstrated significantly lower estrogen level in postmenopausal women in comparison to that of follicular phase of menstrual cycle. However no such data is available to compare luteal phase. In this study, lower value of FEF<sub>25-75</sub> and PEFR in postmenopausal women could not be compared due lack of data availability of published data. The mean measured value of SVC was significantly lower in postmenopausal women than those of different phases of menstrual cycle in premenopausal women.

In postmenopausal women, FEF<sub>25-75</sub> was positively correlated with estrogen but negatively with progesterone. Again PEFR and FEF<sub>25-75</sub> both were negatively correlated with progesterone. SVC was positively correlated with serum estrogen level in postmenopausal women and premenopausal women. On the other hand SVC was negatively correlated with serum progesterone level in postmenopausal women and follicular phase of premenopausal women but positively correlate in luteal phase of premenopausal women. Various mechanisms have been proposed for these observed changes in lung function in postmenopausal women. During menopause the ovaries become less functional and produce lower amounts of estrogen and progesterone<sup>1</sup>. Some investigators suggested that Progesterone induces hyperventilation through both the central

medullary and peripheral chemoreceptors<sup>6</sup>. Again, estrogen and progesterone have been associated with relaxation of airway smooth muscle in human model and thereby induce a relaxation of bronchial muscle<sup>19</sup> and bronchi are widened<sup>20</sup>. The bronchial epithelium and smooth muscle contain  $\alpha_2$  adrenergic receptors and the  $\alpha_2$  receptors mediate bronchodilatation and increase secretion<sup>2</sup>. Progesterone have a beneficial effects on the upper airway function and breathing is supported by pharyngeal dilator muscle activity<sup>21</sup>. All these effects are contributed by estrogen and progesterone to increase lung function. Estrogen increases the number of progesterone receptors, therefore, combining effect of estrogen with progesterone increases lung function<sup>22</sup>. Adult women have less bone mass density and after menopause they initially lose it more rapidly<sup>23</sup>. The cause of the bone loss after menopause is primarily due to estrogen deficiency<sup>24</sup>. As there is decrease level of estrogen in post menopausal women it also decreases the bone mass density in the bones of thoracic cage and thus compresses the bones of thoracic cage<sup>2</sup>. Due to deformities of bones of the thoracic cage there is decrease in intrathoracic space which is related to decreased lung function<sup>25</sup>. Various investigators suggested that estrogen and progesterone cause increase in muscle strength and induce skeletal myoblast growth<sup>26</sup>. Decrease estrogen and progesterone levels decrease strength of respiratory muscle. However, the exact mechanisms involved for lower lung function in postmenopausal women of the present study cannot be elucidated from this type of study. According to the suggestions made by different investigators<sup>10-11</sup>, lower percentage of predicted values of FEF<sub>25-75</sub>, PEFR and SVC in postmenopausal women in comparison to premenopausal women during follicular and luteal phase are most likely due to decreased level of progesterone and estrogen as observed in this study. Reduced levels of estrogen and progesterone would cause increased

compression of thoracic spine, decreased relaxation of bronchial smooth muscle and decreased muscular strength, and as a result there is decreased levels of FEF<sub>25-75</sub>, PEFR and SVC.

### Conclusion

It may be concluded that reduced lung function in postmenopausal women may be related to their low estrogen and progesterone level.

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