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Effect of Combined Oral Contraceptive Pill on FVC, FEV_1 and FEV_1/FVC%

Farhana Islam[1], Nasim Jahan[2], Nayma Sultana[3]

Abstract

Background: Combined oral contraceptive pill (COCP) is the most commonly used contraceptive method in Bangladesh. This COCP may have some effects on different organs including lungs. **Objective:** To observe the effects of combined oral contraceptive pill (COCP) on FVC, FEV_1 and FEV_1/FVC% in apparently healthy women receiving COCP. **Methods:** This cross sectional study was carried out in the Department of Physiology, Sir Salimullah Medical College (SSMC), Dhaka between July 2013 and June 2014. A total 30 apparently healthy young women, age ranged 20 to 30 years were included in this study who were combined oral contraceptive pill users (COCP-U) for at least 6 months. Thirty age and BMI matched combined oral contraceptive pill nonusers (COCP-NU) were taken as control. FVC, FEV_1 and FEV_1/FVC% of all the subjects were measured by digital spirometer. Statistical analysis was done by Independent sample 't' test. **Results**: FVC ($p<0.001$), FEV_1 ($p<0.001$) were significantly higher whereas, FEV_1/FVC% ($p<0.05$) was significantly lower in COCP-U than those of COCP-NU. Moreover, the mean serum estrogen ($p<0.001$) and progesterone ($p<0.05$) levels were also significantly higher in COCP-U in comparison to those of COCP-NU. **Conclusion:** From the result of this study it can be concluded that COCP have beneficial effects on some pulmonary function parameters.

Key words: Pulmonary function parameters, Estrogen, Progesterone.

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For Authors Affiliation, see end of text.

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Introduction

Contraception means prevention of conception. Contraceptive methods are by definition, preventive methods to help women avoid unwanted pregnancies[1]. Method of contraception has been using throughout the world for many years[2]. Bangladesh is one of the most crowded land on earth with a population of 156.8 million[3] in 143,998 km^2 area[4]. In Bangladesh 61% of married women are using contraceptive methods. The most widely used method is combined oral contraceptive pill (COCP). Among the different contraceptive methods combined oral contraceptive pill (COCP) is about 27%[5].

Combined oral contraceptive pill (COCP) contains levonorgestrel 150µgm and ethinylestradiol 30µgm. Levonorgestrel is a kind of progestogen. Ethinylestradiol is a synthetic form of estrogen[6]. Estrogen has effects on all systems of the body. It helps to prepare female for reproduction. A primary function of estrogen is to cause cellular proliferation and growth of the tissues of the reproductive organs and other tissues related to

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reproduction. Estrogen stimulates bone growth, increases protein deposition, body metabolism, causes sodium and water retention by the kidney tubules[7]. Oestrogen receptors are present in human skeletal muscles[8,9]. Estrogen influences surfactant production and alveologenesis[10]. Progesterone primarily increases ventilation during the luteal phase[11]. Furthermore, progesterone helps in smooth muscle relaxation and hyperventilation[12]. So, it has a significant bronchodilator effect[12].

For assessment of pulmonary functions forced vital capacity (FVC), forced expiratory volume in 1st second (FEV_1), ratio of forced expiratory volume in 1st second and forced vital capacities ($FEV_{1/}$ FVC%) are usually measured[7].

Forced vital capacity (FVC) is a better indicator of respiratory muscle strength. Recently significant increased value of FVC has been found in women using COCP[13,14].

Along with other pulmonary function parameters, the value of FEV_1 was increased in female using COCP for six months[13]. Hormone replacement therapy (oestrogen and progesterone) users showed higher FEV_1 value when compared to that of nonusers[14].

Different investigators observed $FEV_{1/}$ FVC% increased significantly in COCP users[13,16.] Prolonged use of COCP may cause weight gain, thrombosis, headaches, nausea breast tenderness etc[6]. Some researchers observed that estrogen plays important role in the development of asthma[21].Studies investigating the effect of COCP on pulmonary function have reported conflicting results[13,15]. So this study has been designed to observe the effect of COCP on pulmonary function in Bangladeshi women using COCP.

Methods

This cross sectional study was done in the Department of Physiology, SSMC from July 2013 to June 2014. Ethical permission was taken from the Institutional Ethics Committee (IEC) of SSMC. A total 30 apparently healthy women, combined oral contraceptive pill users (COCP-U) aged 20-30 years were taken as study group. They were selected from Family Planning Unit of SSMC. Another 30 apparently healthy age and BMI matched combined oral contraceptive pill nonuser (COCP-NU) women were also included as control for comparison. They were selected from personal contact from different area of Dhaka city. Subjects having history of pulmonary diseases, diabetes mellitus, hypertension, angina, epilepsy, cancer, metabolic disorder, history of bleeding disorder were excluded from the study. After selection and proper counseling, the risk, benefit and procedure of the study were explained in details to each subject. They were asked to attend the Department of Physiology between 9:00 AM to 2:00 PM on the day of examination. Informed written consents were taken from them. All information about personal and medical were recorded in a pre-fixed questionnaire. Then a thorough clinical examination of all the subjects were done. After taking 5minutes rest, for assessment of pulmonary function FVC, FEV_1 and FEV_1/FVC% of all the subjects were measured by using digital Auto Spirometer (MINATO AS-507).Then under aseptic precautions 5 ml of venous blood was collected from every subject for estimation of fasting serum estrogen and progesterone levels. Estimation of serum estrogen and progesterone were done by chemiluminescent method in the Microbiology laboratory of Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag Dhaka. Data were analyzed by Independent sample 't' test.

Results

Mean percentage of predicted values of FVC and FEV_1 were significantly ($p < 0.05$) higher and FEV_1/FVC% was significantly ($p < 0.05$) lower in COCP-U, than those of COCP-NU (Table I). Serum estrogen ($p < 0.001$) and progesterone ($p < 0.05$) levels were significantly higher in COCP-U than those of COCP-NU (Table II).

Table I: Percentage of predicted value of FVC, FEV_1 and FEV_1/FVC% in both groups (n=60)

Parameters	COCP-NU (n=30)	COCP -U (n=30)
FVC%	82.53 ± 3.64	92.23 ± 2.50***
FEV_1%	83.60 ± 3.58	90.07 ± 2.98***
FEV_1/FVC%	86.97 ± 3.25*	84.97 ± 3.17

Values are mean ± SD. Statistical analysis was done by independent sample t-test.
COCP-U = Combined oral contraceptive pill users COCP- NU = Combined oral contraceptive pill nonuser.
(*** $p < 0.001$; * $p < 0.05$) n = Total number of subjects

Table II: Serum estrogen and progesterone levels in both groups (n=60)

Parameter	COCP -NU (n=30)	COCP -U (n=30)
Serum estrogen (pg/ml)	47.04 ± 6.72	59.52 ± 10.42***
Serum progesterone (ng/ml)	2.37 ± 0.66	3.32 ± 2.34*

Values are mean ± SD. Statistical analysis was done by independent sample t-test. COCP-U = Combined oral contraceptive pill users COCP- NU = Combined oral contraceptive pill nonuser . (*** $p < 0.001$; * $p < 0.05$) n = Total number of subjects

Discussion

In this study, the value of pulmonary function parameters in healthy control group were within normal limit and were almost similar to that of various investigators from different countries[13,16].

In this study, mean percentage of predicted values of FVC and FEV_1 were significantly higher but FEV_1/FVC% was significantly lower in COCP-U than those of COCP-NU. Serum estrogen and progesterone concentrations were significantly higher in COCP-U than those of COCP-NU. These findings are similar with those of some other researchers[13].

The beneficial effect of COCP on pulmonary function have been noted from the above finding in COCP-U . There are some postulated mechanism regarding these changes in lung functions of COCP-U.

Progesterone by activating $\hat{a}_2$ adrenergic receptors reduces constriction of the airways, relaxes the bronchial smooth muscle and ultimately improves the pulmonary function[17]. It has been suggested that high level of progesterone directly stimulates respiratory centre by increasing its sensitivity to CO_2 and thereby causes hyperventilation[18]. Progesterone stimulates respiratory center through central nervous system (CNS) steroid receptor mediated mechanism [22] and induces hyperventilation through both the central medullary and peripheral chemoreceptors[11]. Several investigators of different countries have suggested that improvement in pulmonary function in COCP-U may be due to the effect of exogenous estrogen on strengthening respiratory muscle[19]. Again, some researchers reported that estrogen also influences surfactant production and alveologenesis[10,20]. Estrogen receptors were identified in the nuclei of connective tissue and of the smooth muscle cells of the lung and thereby plays role in maintaining the connective tissue by increasing the synthesis or decreasing the breakdown of collagen. These findings suggest that estrogen restores the collagen metabolism and increases the turnover of connective tissues of the lung[25].

Combination of Estrogen and progesterone improve musculoskeletal integrity and thereby increase the total lung capacities[15]. Estrogen increases the number of progesterone receptors, so combined effect of estrogen and progesterone synergistically increases pulmonary function[23]. Again, estrogen and progesterone both are associated with relaxation of airway smooth muscle[24]. In the present study lung function parameters were improved in COCP-U, as evidenced by measured value of FVC, FEV_1 and

FEV_1/FVC% may be due to higher concencration of estrogen and progesterone in combined oral contraceptive pill.

Conclusion

From this study, it may be concluded that combined oral contraceptive pill (COCP) have beneficial effect on some aspects of pulmonary functions.

Conflict of interest : None

Author Affiliation

1. Farhana Islam, Lecturer, Dept. of Physiology, Sir Salimullah Medical College, E-mail: adnanrakib@yahoo.com, Tel: 01817014481
2. Nasim Jahan, Professor, Dept. of Physiology, Sir Salimullah Medical College, Dhaka
3. Nayma Sultana, Professor, Dept. of Physiology, Sir Salimullah Medical College, Dhaka

**For correspondence*

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