

Original article

Effects of Oral Contraceptive Pill on Serum Glucose and Phosphorus

Suriya Akhter Jahan¹, Shamima Akhter², Md. Rafiqul Hoque³, Md. Hanif Howlader⁴, Binoy Krishna Golder⁵, Prabir Kumar Saha⁶

ABSTRACT

Background: The oral contraceptive pill is very much popular and effective in birth control. Correct use of the oral contraceptive pill helps in family planning preventing unwanted pregnancy. And this pills are also used in menstrual disorders. Many biochemical parameters of women taking oral contraceptives are disturbed due to metabolic alteration induced by its hormone content.

Methods: This study carried out in the Department of Biochemistry, Mymensingh Medical College in collaboration with the Model Family Planning Clinic of Mymensingh Medical College Hospital, Mymensingh during the period from July 2019 to June 2020 to evaluate the status of serum glucose and phosphorus in oral contraceptive user women. Data were analyzed with the help of SPSS version 21.

Results: Hundred age-matched women were selected and grouped as 50 oral contraceptive user women and 50 oral contraceptive nonuser women. Mean(\pm SD) levels of serum glucose and phosphorus of oral contraceptive user women were 5.55 ± 0.34 mmol/L and 2.03 ± 0.64 mg/dl respectively. And Mean(\pm SD) levels of serum glucose and phosphorus of oral contraceptive non-user women were 5.89 ± 1.75 mmol/L and 4.02 ± 0.26 mg/dl respectively. Serum phosphorus significantly reduced in oral contraceptive users while compared with non-oral contraceptive users ($p < 0.001$).

Conclusion: Serum phosphorus level was lower in oral contraceptive user. But no difference in serum glucose level is seen between contraceptive user and non-user.

Key Words: Oral contraceptives, Serum glucose, Serum phosphorus.

INTRODUCTION

The combined oral contraceptive pill (OCP) is a major birth spacing method that is commonly practiced. The "original pill" was entered into the market in the early 1960s. Each tablet contained 100-200 mcg a synthetic estrogen and 10 mg of progestogen.¹ Among the available modern methods of contraception, about 30% couples in Bangladesh use oral contraceptive.² Oral contraceptive pill stops ovulation from ovaries and causes

anovulatory menstrual cycle. It also makes the cervical mucus thick and unfavorable to sperm migration.³ Sukhi is the most used oral contraceptive pill in Bangladesh containing estrogen and progestin.⁴ Combined estrogen-progestin oral contraceptives are most efficient and accessible convenient method of contraception among the available methods.⁵ Combined oral contraceptives show some beneficial effects like reduction the risk of developing iron deficiency

1. Dr. Suriya Akhter Jahan, Assistant Professor (Department of Biochemistry), Patuakhali Medical College, Patuakhali, Bangladesh.

2. Dr. Shamima Akhter, Associate Professor (Department of Biochemistry), Mymensingh Medical College, Mymensingh, Bangladesh.

3. Dr. Md. Rafiqul Hoque, Associate Professor (Department of Biochemistry), Kishorgonge Medical College, Kishorgonge, Bangladesh.

4. Dr. Md. Hanif Howlader, Associate Professor (Department of Biochemistry), Sher-e-Bangla Medical College, Barishal, Bangladesh.

5. Dr. Binoy Krishna Golder, Assistant Professor (Gynae), Patuakhali Medical College, Patuakhali, Bangladesh.

6. Dr. Prabir Kumar Saha, Associate Professor (Pathology) (CC), Sher E Bangla Medical College, Barishal, Bangladesh.

Correspondence: Dr. Suriya Akhter Jahan, Assistant Professor (Department of Biochemistry), Patuakhali Medical College, Patuakhali, Bangladesh. Mobile-8801919828926, Email: dr.suriya33@gmail.com

anemia, PID, benign neoplasm of breast and ovary, dysmenorrhea.⁶ They have some side effect also. The major side effects are malignancy in some organs like breast, liver, cervix, cardiovascular disorders like hypertension, myocardial infarction, hemorrhagic or ischemic strokes and venous thrombo-embolic disorder.⁷

The status of micronutrients in humans can be affected by various factors such as changes in lifestyle, environmental conditions, dietary habits, and the active components of hormonal agents.⁸ Modifications in the bioavailability or tissue-level concentration of these elements may have a noteworthy impact on health risks and the development of certain disorders.⁹ Biomedically glucose is the most important monosaccharide that cannot be hydrolyzed into simpler carbohydrate. It is a major fuel for tissue, universal fuel for fetus, ready source of energy, only food for brain.¹⁰ Sex steroids in OCP alter insulin sensitivity and affect glucose metabolism.¹¹

Phosphorus is a highly abundant element with a wide distribution and exists in both inorganic and organic phosphate forms within the human body. Phosphorus ions are crucial for normal bone mineralization and play essential roles in signal transduction, nucleotide metabolism, and enzyme regulation.¹² Serum phosphorus level might be reduced in OCP users.¹³

METHODS

This cross-sectional study was carried out in the Department of Biochemistry, Mymensingh Medical College in collaboration with the Model Family Planning Clinic of Mymensingh Medical College Hospital, Mymensingh during the period of July 2019 to June 2020. In this study, 350 apparently healthy married women were purposively selected from the

outpatient department of Model Family Planning Clinic of Mymensingh Medical College Hospital. Among them, 250 women of reproductive age group (20-35) years with history of taking oral contraceptive pills (sukhi) at least for 3 months duration were selected as contraceptive user group. Age matched physically healthy 100 women from the same geographic location were selected as contraceptive non-user group, who were not using any hormonal contraceptive method. Women with systemic illness like diabetes mellitus, tuberculosis, kala-azar were excluded from our study. Individuals who had a BMI exceeding 30, were using oral contraceptives other than combined estrogen-progesterone preparations or were taking medications that interfered with serum glucose or phosphorus were excluded from the study. Each study participant provided written consent after being informed, and ethical approval for the study was granted by the Ethical Committee of Mymensingh Medical College and Hospital. Height, body weight, and blood pressure measurements were taken, and the body mass index (BMI) was calculated using a standard formula. Serum glucose levels were determined using an enzymatic method involving GOD-PAP, while serum phosphorus levels were determined using a colorimetric method with a test kit. Statistical analysis was conducted with the assistance of SPSS version 21. All biochemical measurements were expressed as mean values and standard deviations, and comparison between two groups was performed using Student's unpaired t-test.

RESULTS

In our study, two groups were similar. The age and BMI of the contraceptive user group and the contraceptive non-user are shown in Table 1.

Table 1: Demographic features of the Study population.

Demographic Features	Contraceptive User Mean±SD	Non- user Mean±SD	P value
Age (Years)	28.18 ± 2.18	28.14 ±3.08	0.49
BMI (kg/m ²)	21.89 ±0.68	21.91 ±0.67	0.42

Table 2 shows the level of serum glucose and phosphorus in study population. The study revealed that mean(±SD) of serum fasting glucose levels in contraceptive user and no-user group were not different from each other. Mean(±SD) of serum phosphorus levels were 2.03±0.64 mg/dl and 4.02±0.26 mg/dl in contraceptive user and no-user group respectively. The analysis showed highly significant difference(p< 0.001) in mean serum phosphorus levels between two groups.

Table 2: Comparison of Serum glucose and Phosphorus levels of the study subjects.

Variable	Contraceptive User Mean±SD	Non- user Mean±SD	P value
Glucose (mmol/L)	5.55±0.34	5.89±1.75	0.27
Phosphorus (mg/dl)	2.03±0.64	4.02±0.26	< 0.001

DISCUSSION

While looked at the serum phosphorus level we found that the oral contraceptive pill user had almost half the level of serum phosphorus than the non-users (p<0.001).

Major human need for birth control is fulfilled by oral contraceptives with unrivalled effectiveness.¹⁴ When the pill is used properly, it is able to prevent pregnancy and various menstrual disorders effectively.¹⁵ Hormone content in oral contraceptives can changes many biochemical parameters of OCP user women due to metabolic alteration. Research has been ongoing for many decades to investigate the risks and benefits associated with various contraceptive methods. Numerous studies on contraceptives and family planning have been carried out in Bangladesh. The rural community of Bangladesh is mostly used sukhi (combined oral contraceptive) as it is distributed with free of cost.¹⁶ Prolonged use of oral contraceptives can impact various metabolic processes in the body, leading to detectable clinical abnormalities.¹⁷

The present study found no significant difference in fasting glucose levels between users and non-users of oral contraceptive pills, which is consistent with several other studies.^{18, 19}

Some authors reported that commonly used oral contraceptive have no adverse effect on glucose or insulin metabolism, according to result from a large population-based survey on US women. They pointed out that women who were currently taking OCP tended to be younger, leaner, free from any disease condition and have fewer negative factors that influence glucose metabolism than former or never users.²⁰ Steroids in contraceptive pills had no effect on regulation of blood sugar level because both fasting and post IVGTT insulin level was increased after treatment with any types of OCP.²¹

Several studies conducted on Indian and European populations have reported that serum glucose levels were higher in women

who used oral contraceptives compared to those who did not use them.^{22, 23} Adams et al. demonstrated that progestin in oral contraceptive pills reduced insulin sensitivity and caused insulin resistance.²² The steroids present in oral contraceptive pills can affect glycemic regulation by either reducing the number of insulin receptors in peripheral tissues or by altering the post-receptor response mechanism, leading to increased peripheral resistance to insulin.

Our study found a significant decrease in serum phosphorus levels among women who use oral contraceptives compared to those who do not. The development of secondary hyperparathyroidism was observed in patients taking oral contraceptive pills, and the decrease in serum phosphorus levels was proportional to the duration of OCP use.²⁴ The inhibitory effect of estrogen on the calcium mobilization effect of parathyroid hormone (PTH) or vitamin D can result in secondary hyperparathyroidism, leading to the excretion of a large amount of phosphate through urine and ultimately causing hypophosphatemia.²⁵

CONCLUSION

The study found that serum phosphorus levels in contraceptive users were nearly half of those in non-users, while there was no significant difference in serum glucose levels between women who use oral contraceptives and those who do not. It is recommended that further studies with larger populations be conducted to investigate any alterations in other biochemical parameters and to conduct organ function tests.

REFERENCES

1. Park K. Park's Textbook of Preventive & Social Medicine. 23rd edn. M/S. Banarsidas Bhanot: Jabalpur (India); 2015.
2. Reatfield PK & Kamal N. Population and Family Planning in Bangladesh. J Pak Med Assoc 2013; 63(4): 73-82.
3. Kumar, Pratap & Malhotra N. Jeffcoate's Principle of Gynaecology. 7th edn. Jaypee Brothers Medical Publishers (Pvt.) Ltd., India; 2008. P 798-809.
4. Hollander D. Bangladeshi women weight a variety of factors when choosing a contraceptive. Int Fam Plan Perspect 2003; 29: 1-3.
5. Christin-Maitre S. History of oral contraceptive drugs and their use worldwide. Best practice & research Clinical endocrinology & metabolism. 2013 Feb 1;27(1):3-12.
6. Ory HW. The non-contraceptive health benefits from oral contraceptive use. Fam Plann Perspect 1982; 14: 182-4.
7. Obisesan KA, Adenaike FA, Okunola MA. Effects of oral contraceptives on serum total protein, albumin, globulin and cholesterol levels in Ibandan, Nigeria. WAJM 2002; 21(3).
8. Fallah S, Sani FV, Furoozrai M. Effect of contraceptive pill on the selenium and zinc status of healthy subjects. Contracept 2009; 80: 40-3.
9. Olaniyan DA, Tailor S. Vitamin & antioxidant: The body fluid is not water. Nig Med J 2004; 16:20-31.
10. Rodwell VW, Bender DA, Botham KM, Kennelly PJ, Weil PA. Harper's Illustrated Biochemistry. 30th edn. McGraw Hill Education. New York; 2015.
11. Godsland IF. The Influence of female sex steroids on glucose metabolism and insulin action. J Int Med 1996; 738: 1-60.
12. Berndt TJ, Schiavi S, Kumar R. Phosphatonins and the regulation of

Phosphet. *Annu Rev Physiol* 2007; 69: 341-59.

13. Hameed A, Areej T, Majeed T & Asraf M. Effect of oral and injectable contraceptives on serum calcium, magnesium and phosphorus. *J Ayub Med Coll* 2001; 13(3): 24-5.

14. Elgee NJ. Medical Aspects of Oral Contraceptive. *Ann Int Med* 1970; 72: 409-18.

15. Suhl L, Sylvial & Yeager FB. Update on Oral Contraceptive Pills. *Am Fam Physician* 1999; 60(7): 2073-84.

16. Amin R, Choudhury SR, Mariam AG & McCarthy J. Family planning in Bangladesh. *Int Fam Plann Persp* 1987; 13: 13-6.

17. Ramos D, Stanczyk & Roy. Metabolic and endocrinological effects of steroidal contraception. Accessed 14th April 2020.

18. Wynn V & Doar J. Some effects of oral contraceptives on carbohydrate metabolism. *The Lancet* 1969; 294 (7624): 761-6.

19. Klipping C & Marr J. Effects of two combined oral contraceptives containing ethinyl estradiol combined with either drospirenone or desogestrel on lipids, hemostatic parameters and carbohydrate metabolism. *Contraception* 2005; 71(6): 409-16.

20. Maureen H & Catherine C. Oral contraceptive do not affect glucose metabolism. *Am J Obstetric Gynecol* 2000; 183: 389-95.

21. Vermeulen A & Thiery M. Effect of oral contraceptives on carbohydrate metabolism. *Diabetologia* 1970; 6: 519-23.

22. Adams PW, Godsland IF, Wynn V, Melros J & Oakley NW. Comparison of effects of different combined oral-contraceptive formulations on carbohydrate and lipid metabolism. *The Lancet* 1979; 1: 1045-9.

23. Godsland IF, Crook D, Simpson R, et al. The effects of different formulations of oral

contraceptive agents on lipid and carbohydrate metabolism. *The New Eng J Med* 1990; 323: 1375-81.

24. Akinloye O, Adebayo TO, Oguntibeju O, Oparinde, et al. Effects of contraceptives on serum trace elements, calcium and phosphorus levels. *West Indian Med J* 2011; 60(3): 308-15.

25. Moses AM & Notmann DD. Secondary hyperparathyroidism caused by OCP. *Arch Intern Med* 1982; 142 (1):128-9.