

Impact of Myoinositol in Polycystic Ovarian Syndrome

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How to cite this article:

Wajeeda Tabasum, Roya Rozati, Ayapati Gautam Mehdi, et al./Impact of Myoinositol in Polycystic Ovarian Syndrome/Indian Journal of Diabetes and Endocrinology, 2021;3(1):9-13.

Abstract

Polycystic ovary syndrome (PCOS) is one of the most common causes of infertility and metabolic problems among women of reproductive age. Myo inositol (MI) is administered in women with polycystic ovary syndrome (PCOS) over the last few years. It plays an important role in many metabolic pathways if the function is impact which affects the human health. Many hormonal and reproductive disorders associated with this disorder seem relieved by the supplement. The main symptom seems to be an increased androgen concentration, which in turn may contribute to different metabolic disorders which is improved in women with PCOS by supplementation of MI. Administration of MI is a safe and effective option to prevent and correct metabolic disorders in teenagers affected by PCOS. Thus, the aim of this review is to present the effectiveness of MI in the treatment for PCOS symptoms.

Keywords: Myo-inositol (MI); Polycystic ovary syndrome (PCOS); Insulin Resistance (IR).

INTRODUCTION

Myo inositol has been used to prevent and/or treat a number of metabolic disorders related to IR, such as the metabolic syndrome.¹ (Giordano D et al., 2011,² Santamaria A et al., 2012), gestational diabetes mellitus.³ (Celentano C et al., 2016,⁴ D'Anna R et al., 2015,⁵ D'Anna R et al., 2013,⁶ Santamaria A et al., 2015,⁷ Zheng X et al., 2015,) and the polycystic ovary syndrome (PCOS).⁸ (Genazzani AD et al., 2016.⁹ Unfer V et al., 2012.¹⁰ Unfer V et al., 2016)

Polycystic ovary syndrome (PCOS) is a common endocrinopathies affecting in reproductive age which affects up to 20% of women. Polycystic ovaries on ultrasound, menstrual irregularity, and hyperandrogenism which can lead to acne, alopecia, hirsutism, insulin resistance, It is associated with several other health complications such as Obesity,¹¹ (Lim SS et al., 2012,¹² Vrbikova J et al., 2009) obstetric Complications, infertility, (Palomba S, et al., 2015.) and early pregnancy loss characterize it.¹³ (L. Vizza, et al., 2016,¹⁴ Y. Suvarna et al., 2016,¹⁵ A. B. Motta et v al., 2012) cardiovascular diseases,¹⁶ (de Groot PCM et al., 2011,¹⁷ Rizzo M et al, 2009) Diabetes Mellitus Women suffering from PCOS have low fecundity with anovulation¹³ (L. Vizza et al., 2016) and, to an extent, early pregnancy loss.¹⁴ (Y. Suvarna et al., 2016) and pregnancy complications.¹⁵ (A. B. Motta et aal., 2012). Induction of ovulation would restore ovulation and pregnancy. For many years clomiphene citrate (CC) has been the standard treatment for ovulation induction for these patients

The improvement of Insulin Resistance and reduction of circulating insulin are key therapeutic

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Received on: 10.01.2022

Accepted on: 15.02.2022

targets in PCOS enhancing fertility and reducing the lifelong risk for type 2 diabetes and early cardiovascular disease. MI is now considered as a insulinsensitizing supplement which could which improves insulin signaling, reduces serum insulin, and decreases serum testosterone, thereby restoring normal ovulatory function in PCOS women.¹⁸ (Nestler JE et al., 2015.¹⁹ Facchinetti F et al., 2015.²⁰ Costantino D et al., 2009.²¹ Tang T et al., 2009)

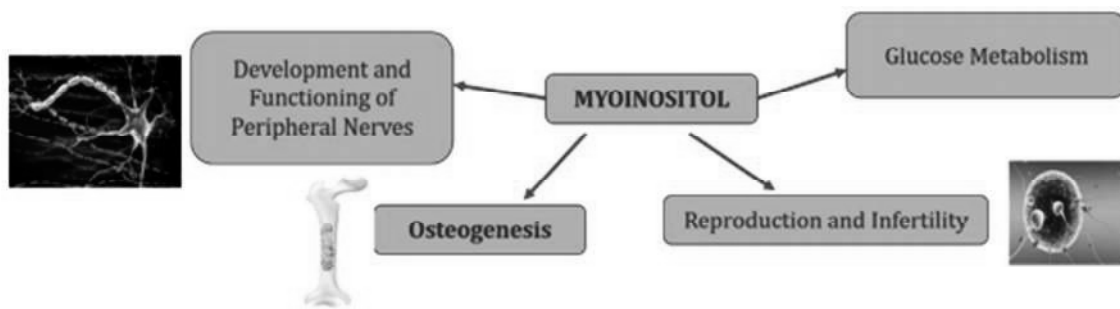
ROLE OF MYOINOSITOL

Myo inositol (MI) and DCI are isoforms of inositol and belong to the vitamin B complex. Myo inositol is widely distributed in nature, whereas DCI, the product of epimerization of C1 hydroxyl group of

MI, is relatively rare.²² (Yoshida K et al., 2006)

Myoinositols play an Important role in cellular morphogenesis and cytogenesis. It helps in the synthesis of lipids, creation of cell membranes & cell growth. It Regulates, secretion of some exocrine glands such as pancreas & ovaries via signal transduction pathways.

Myoinositol Regulates calcium metabolism. It is involved in the release of cortical granules, Inhibition of polyspermy, Completion of meiosis and Activation of the cell cycle results in embryonic development.²³ (Papaleo 2009). It helps in calcium metabolism and oogenesis. At ovarian level it has been shown that MI based second messenger is involved in both glucose uptake and FSH signaling.



Picture 1: Depicts Importance of Myoinositol.

Role of Inositols in Ovulatory Function and Fertility In PCOS

MI treatment in patients with PCOS improved ovarian function and fertility.²⁴ [Raffone E et al., 2010], decreased the severity of hyperandrogenism, acne and hirsutism.²⁵ (Zacche MM et al., 2009.²⁶ Ciotta LII et al., 2010) and positively affected metabolic and hormonal parameters deeply involved in the reproductive axis function and ovulation.²⁷ (Artini

PG et al., 2013). For these reasons, it became a novel method to improve spontaneous ovulation.²⁸ (GerliS et al., 2007) or ovulation induction. MI improves response to clomiphene citrate in infertile women, restores ovulation, and increases clinical pregnancy and live birth rate.²⁹ (Kamenov Z et al., 2015) quality of oocytes in IVF cycles.³⁰ (Unfer et al., 2011). MI would be helpful in adolescents with PCOS to prevent reproductive disorders in future.



Picture 2: Depicts the Benefits of myo-inositol on for human health.

Effect of Myo-Inositol on Polycystic Ovarian Syndrome

PCOS Symptom	Inositol	Effect
Androgen excess	MI	-Total and free Testosterone level reduction. (Costantino, D et al., 2009) ²⁰ -Free Testosterone decrease; E2, SHBG increase. (Benelli, E et al., 2016) ³¹ -Testosterone level reduction. (Artini PGet al., 2013) ²⁷
Ovulation and fertility disorders; ovaries dysfunction		-Better development of mouse embryos. (Chiu, T.T.Y et al., 1992) ³² -Restored spontaneous ovulation; elevated rate of fertilization/pregnancy. (Nestler, J.E et al., 1999) ³³ -Increased FSH sensitivity, better fertilization rates and embryo quality; reduced LH:FSH ratio. (Artini PG et al., 2013) ²⁷ -Restored spontaneous ovarian activity and fertility. (Papaleo, E et al., 2007) ³⁵ -Higher ovulation frequency, shorter time to first ovulation. (Gerli S et al.,2007) ²⁸ Improved Menstrual cycle and Ovulation rate
Metabolic abnormalities		-Improved glucose-to-insulin ratio and HOMA index. (Artini PG et al., 2013) ²⁷ -Increased circulating HDL level, weight loss, and leptin reduction. (Gerli S et al.,2007) ²⁸ Improved insulin sensitivity Reduced BMI

Resistance to Myoinositol in PCOS Patients

Despite the very good effect of MI on metabolic, hormonal, and reproductive parameters of PCOS patients, 25% to 75% of them could be resistant to this treatment. The reason for this resistance is still unclear but could be related to the state of obesity, insulin resistance, and hyperandrogenemia or differences in compound bioavailability.

In one of the study published most of the patients resistant to MI were obese.²⁹ (Kamenov Z. et al. 2015) did not show increased plasma levels of MI.³⁶ (Oliva M et al. 2018). These MI resistant patients were treated in Combination of cc and myoinositol in non-ovulating or nonpregnant patients could be useful to achieve the goal of ovulation/pregnancy in Obese patients.

In patients who did not show increased plasma levels of MI were treated with a combination of MI and α lactalbumin, their plasma levels at the end of the treatment significantly improved compared to the baseline and were similar to the patients who responded positively to the treatment with MI alone.

DISCUSSION

Polycystic ovary syndrome is one of the most common endocrine disorders affecting women. MI is generally well tolerated across the range of therapeutic dosages.³⁷ (Carlomagno G et al., 2011), with the exception of minor side effects reported at higher concentration.

Myoinositol act as a mediator of insulin action,

evidence has shown that myoinositol, may improve the hormonal profile, oxidative abnormalities and metabolic factors among PCOS women, probably due to amelioration of insulin resistance.³⁸ (Unfer V, et al.,2017) and helps in reduction of hyperandrogenism.³⁹ (Monastra G et al., 2017). Lifestyle modifications, including diet control and physical exercises, seem to be extremely important and should be the first-line of treatment in overweight patients with PCOS.⁴⁰ (Orio, F. et al., 2010) Some studies have shown promising results in women receiving myoinositol.⁴¹ (Zheng X et al., 2017.⁴² Showell MG et al., 2018) whereas Cochrane review published in 2018 could not draw any benefits of myoinositol among infertile PCOS women.⁴³ (Larner J et al., 2010). Few studies suggest that the effectiveness of MI in the treatment of hirsutism and other cutaneous disorders in young women with PCOS.^{44,45} (Minozzi M et al., 2008 and 2011)

CONCLUSION

MI may prove useful in the treatment of PCOS patients undergoing ovulation induction, both for its insulin-lowering activity and its intracellular role in oocyte maturation. Myoinositol might be used alone as an insulin sensitizer to improve metabolic, hormonal and reproductive outcome in infertile PCOS women. MI showed promising results as a safe approach for the prevention and treatment of Gestational Diabetes Mellitus. myoinositol, the combination used could be beneficial for improving metabolic, hormonal, and reproductive aspects of PCOS.

Author Contributions: WT. and RR. designed the research. WT. performed the literature search, interpreted the data, and drafted the manuscript. WT., RR., A.G.M., H.M., and T.N.A. performed the literature search and made a critical revision of the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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