

A Narrative Review on Global Epidemiology of PCOS and its Hormonal Management

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ABSTRACT

Polycystic ovarian syndrome (PCOS) is a prevalent endocrine-metabolic disorder affecting women of reproductive age, characterized by obesity, oligomenorrhea, hirsutism, and polycystic ovaries. However, there is no universally agreed-upon definition, and its clinical presentation varies. PCOS is linked to insulin resistance and excessive androgen production, often leading to irregular ovulation and elevated testosterone levels. Understanding its global epidemiology is crucial for effective resource allocation in healthcare systems, given its associations with obesity, diabetes type 2, infertility, and cardiovascular disease. While prevalence rates vary worldwide, ranging from 4% to 20%, India has reported rates between 3.7% and 22.5%, with variations attributed to diagnostic criteria discrepancies. Factors contributing to PCOS include genetic, behavioral, and environmental influences. Management typically involves hormonal therapies, lifestyle modifications such as weight loss through diet and exercise, and complementary therapies like acupuncture and Tai Chi. Challenges in hormonal management include the variable response to medications like metformin and the emergence of alternative therapies. Socioeconomic factors influence contraceptive choices and reproductive decisions, impacting PCOS management. Variations in metabolic consequences among different ethnic groups underscore the importance of personalized care. Despite increasing understanding, further research is needed to accurately assess PCOS prevalence and tailor interventions globally, aiming for holistic management to mitigate its impact on women's long-term health.

Key-words: PCOS, Epidemiology, Hormonal Management, Global Prevalence, Lifestyle Modifications

INTRODUCTION

The most common endocrine-metabolic disease affecting women of reproductive age is polycystic ovarian syndrome, or PCOS. The presence of obesity, oligomenorrhea, hirsutism, and an enlarged polycystic ovary determines the PCOS diagnosis. There is no widely agreed-upon definition of PCOS. A combination of oligomenorrhea, obesity, and hirsutism traditionally characterizes the clinical presentation. Currently, it is recognized as a diverse disorder characterized by the

excessive production of androgens that is mainly produced by the ovaries and is linked to insulin resistance.^[1]

The main factors associated with PCOS are irregular ovulation, high presence of cystic ovaries, and high testosterone levels, even with variations in signs and symptoms. The majority of females suffering from PCOS encounter difficulties in ovulation and elevated levels of androgens. Increased androgen levels are linked to hirsutism, acne, and alopecia. Around 70% of individuals with PCOS exhibit polycystic ovaries on pelvic ultrasonography.^[2]

Significance of Understanding Global Epidemiology- An endocrine disorder known as PCOS is common and affects 5–10% of women who are fertile globally. Gaining insight into its frequency aids healthcare systems in effectively distributing resources for diagnosis,

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management, and therapy. PCOS is linked to several health hazards, including obesity, endometrial cancer, diabetes type 2, infertility, and cardiovascular disease. Understanding a disease's epidemiology allows one to customise public health measures to reduce these risks and enhance overall health outcomes. [2] The frequency and manifestation of PCOS can fluctuate among various groups due to genetic, environmental, and lifestyle influences. Analyzing the epidemiology of the disease on a global scale assist in identifying these differences and customizing interventions for distinct groups. PCOS is frequently not accurately identified or misdiagnosed since it presents in many ways and lacks consistent diagnostic criteria. Gaining knowledge about its epidemiology can assist in enhancing diagnostic criteria and precision. PCOS is a primary factor contributing to female infertility. Gaining knowledge about the epidemiology of infertility aids in the identification of women who are susceptible to reproductive issues, allows for timely interventions, and enhances the overall results of reproductive health. [3]

Importance of Hormonal Management- The main treatments indicated for PCOS-afflicted overweight and obese women & teenagers to lose weight, while enhancing their glucose tolerance are calorie-restrictive diets and exercise. Hormonal contraception, such as a vaginal ring, patch, or oral contraceptive, is the main treatment for monthly abnormalities, excessive hair growth (hirsutism), and acne. [4] The Endocrine Society advises persons with polycystic ovarian syndrome who exhibit features of type 2 diabetes or poor glucose tolerance, should start using metformin if they have not shown improvement with lifestyle modifications. Clomiphene citrate is the initial treatment for infertile ladies suffering from PCOS. Metformin is advised as an adjunctive therapy for infertility to reduce the risk of ovarian hyperstimulation syndrome among women having in vitro fertilization (IVF) [5]. Fig. 1 shows the indications of PCOS.

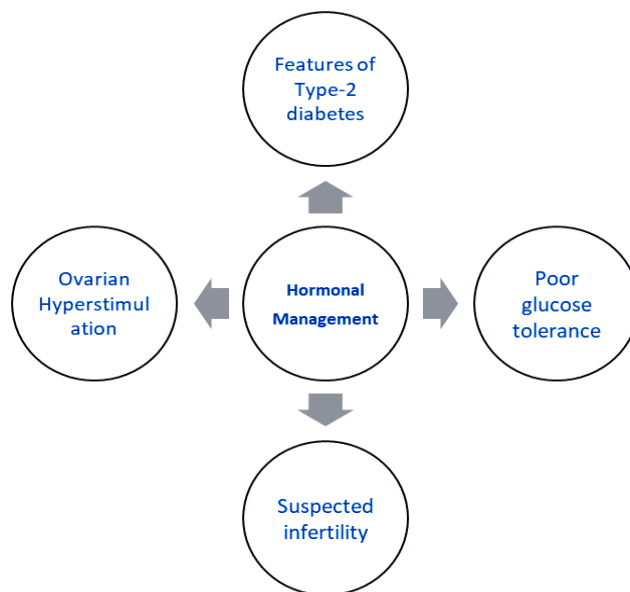


Fig. 1: Indications of hormonal management in PCOS

Global Epidemiology of PCOS

Prevalence Rates Worldwide- PCOS is acknowledged as a significant condition that impacts both reproduction and metabolism due to its effects on the ovaries. Approximately 40% of women with PCOS experience insulin resistance, which increases their susceptibility to developing type 2 diabetes (T2DM). The worldwide occurrence of PCOS is believed to range from 4% to 20%.

The World Health Organization (WHO) estimates that 3.4% of all women, or around 116 million women globally, suffer from PCOS. In India, the percentage of people with PCOS (polycystic ovary syndrome) varies between 3.7 to 22.5%. [6]

There is a lack of information regarding the frequency of PCOS in India. The National Health Portal of India reported a prevalence rate of 22.5% for PCOS in Maharashtra. A prior study conducted in South India,

which involved adolescents, reported an occurrence rate of 9.13%. Nevertheless, the PCOS diagnostic criteria varied throughout the research. [6]

Regional Variations and Trends- The proportions of people with PCOS who are Chinese girls differ depending on the area. Specifically, in comparison with the central (14.24%) & western (13.35%) areas, the prevalence rates for PCOS are substantially lower within the eastern regions (7.82%). Due to the limited number of published research on the high frequency of PCOS in India, a subgroup analysis using geographical areas could not be carried out. [7,9]

Factors Contributing to the Rise in Prevalence- There is still much to learn about the genesis of PCOS. Nevertheless, prior research indicates that PCOS may be associated with genetic, behavioral, and environmental factors. These factors encompass early onset of puberty, obesity, preterm fetal development, stress, Absence of exercise, and a family past with PCOS in close relatives, among other things. Furthermore, it was determined that gene polymorphisms related to cytochrome P450 enzymes, specifically the steroidogenic enzyme, could play a part in developing PCOS [8]. Fig. 2 shows the factors contributing to PCOS.

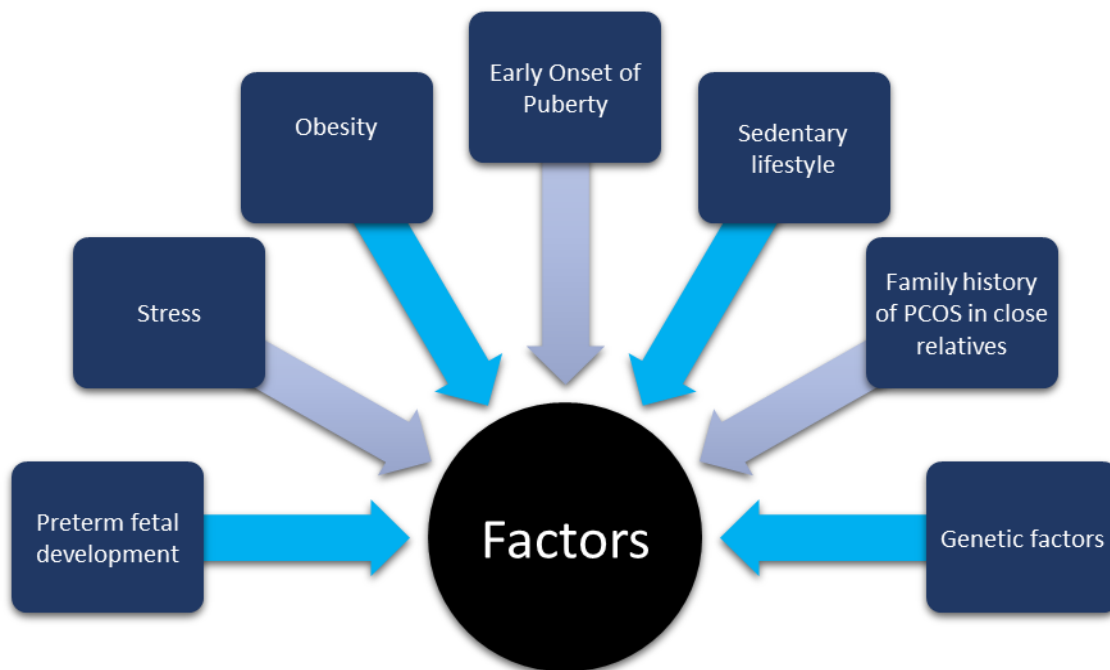


Fig. 2: Factors contributing to the prevalence of PCOS

Impact of PCOS on Health Systems and Society- With the increasing prevalence of chronic diseases, experts have acknowledged that these conditions alone are inadequate in fully understanding the disease experience. Assessing patient-reported results, including life quality measured by the health system (HRQOL), has been a significant research focus. HRQOL is acknowledged as a subjective assessment of overall well-being that encompasses multiple dimensions and is influenced by time and context. There are many advantages to gathering information from HRQOL.[9] For instance, the evaluation of treatment effectiveness in clinical trials, the identification of requirements and allocation of finances for patients by healthcare officials,

the monitoring of patient's status, and the formulation of treatment decisions for busy practitioners. Polycystic ovarian PCOS is the most prevalent endocrine condition affecting fertile people. The symptoms commonly connected to PCOS, including irregular menstrual cycles, excessive hair growth (hirsutism), lack of ovulation (anovulation), and acne, can have a significant detrimental effect on an individual's quality of life. These symptoms can also contribute to mental disorders, including depression, difficulties in relationships and social integration, and problems with sexual function. [10]

Hormonal Management of PCOS

Overview of Current Treatment Approaches- The subsequent step involves using letrozole for optimal

ovulation stimulation, followed by Clomid citrate. Gonadotropins were the subsequent course of treatment for women who did not respond to initial oral ovulatory medicine. Assisted Reproductive Technology (ART) can be advantageous for expectant mothers who don't take ovulation inducers or who are dealing with other fertility problems. ^[10] Metformin, when used alongside Gonadotropin, or CC, and in addition to IVF ICSI, continues to be the most optimal choice for individuals with hyperinsulinemia or RI. While vitamin D and inositol may have potential health benefits, additional research and professional guidance are necessary. The effectiveness of alternative treatments lacks definitive evidence. While insulin sensitizers like metformin have traditionally been utilized for managing metabolic dysfunction in PCOS, recent medications such as SGLT2 inhibitors and incretin mimetics have demonstrated superior efficacy in lowering weight and cardiovascular risk. ^[11]

Hormonal Therapies

Oral Contraceptives- Oral contraceptives (OCs) primarily function in the management of PCOS, or polycystic ovarian syndrome, by regulating menstrual cycles. These medications also decrease the presence of excessive hair growth (hirsutism) and acne by reducing the levels of testosterone. Estrogen and progestogen combinations are frequently used oral contraceptives (OCs) for the management of polycystic ovarian syndrome-related hirsutism and acne (PCOS). Theoretically, these drugs are more effective than previous formulations in addressing symptoms related to androgens. The majority of women with hirsutism experience clinical improvement after undergoing six months of OC therapy. ^[12]

Anti-androgens- Spironolactone, finasteride, and flutamide are antiandrogens that alleviate hirsutism and acne issues among those suffering from PCOS, or polycystic ovarian syndrome. People with high lipid levels, a common occurrence in PCOS, may benefit from these antigens. Spironolactone, administered at a dosage of Due to its superior safety profile, the most commonly recommended antiandrogen is 25–100 mg twice day profile, widespread availability, and affordable price. ^[13]

Insulin Sensitizers- Individuals with PCOS experience changes in insulin secretion and function. The impact of

hyperinsulinemia and insulin resistance on testosterone levels in patients with PCOS has been extensively studied. Insulin regulates ovarian function, and elevated insulin levels can harm the ovaries. Excessive insulin triggers muscle cells to create large amounts of androgens, which slows down the development of follicles and leads to the distinctive polycystic ovarian shape seen in PCOS. Acanthosis nigricans has traditionally been employed as an indicator of insulin resistance. PCOS individuals with insulin resistance are at an increased risk of developing chronic health conditions such as cardiovascular disease and type 2 diabetes, both of which have the potential to be life-threatening. Therefore, it is crucial to employ drugs and lifestyle changes to address insulin resistance as part of PCOS treatment. ^[14]

Gonadotropin-Releasing Hormone Agonists- Treatment with gonadotropins for women diagnosed with anovulatory PCOS. Patients who have not responded to initial oral ovulation stimulation medications should consider using Aromatase inhibitors and selective estrogen receptor modulators as a second-line treatment option. ^[15]

A summary of the above explanation is presented below in Table 1.

Table 1: Summary of the hormonal therapies available in PCOS

Therapies	Function	Medications
Oral Contraceptives	Regulate menstrual cycles, reduce excessive hair growth (hirsutism), and acne by lowering testosterone	Estrogen and progestogen combinations
Anti-androgens	Alleviate hirsutism and acne, beneficial for high lipid levels in PCOS	Spironolactone, finasteride, flutamide
Insulin Sensitizers	Address insulin resistance and hyperinsulinemia, regulate ovarian function	Metformin, pioglitazone
Gonadotropin-	Induce ovulation	Aromatase

Releasing	in anovulatory PCOS, second-line treatment option	inhibitors, selective estrogen receptor modulators
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stimulation of ovulation and the restoration of regular menstruation.^[16]

Electroacupuncture- As acupuncture becomes more widely employed In Western nations, acupuncture in the form of EA is being increasingly utilized for treating PCOS. Electroacupuncture (EA) is the application of electric current in conjunction with acupuncture to enhance the stimulation effect. The process can be explained as follows: EA exerts its influence on the hypothalamic-pituitary-ovarian axis (HPOA) by either directly regulating the release of the hormone that releases gonadotropin or increasing the pituitary's sensitivity to gonadotropin. This indirect regulation leads to the control of follicle-stimulating hormone (FSH) secretion, ultimately enhancing follicle and embryo quality.^[17]

Tai Chi, Yoga, Qigoga- Tai Chi is a distinctive kind of Chinese exercise that seamlessly integrates physical movement and controlled breathing, allowing individuals to experience a pleasant state of mind during their workout. The primary emphasis of Tai Chi is focused attention and deliberate, unhurried motions. Thus, it is appropriate for those of advanced age who have a frail physical condition and enduring illnesses. Research has demonstrated that Tai Chi is efficacious in addressing chronic conditions such as obesity, cardiovascular disease, diabetes, and psychosocial disorders resulting from PCOS.^[18]

Yoga, an ancient practice of comprehensive mind-body healing, is a gentle exercise that promotes equilibrium in all dimensions of life, including physical, psychological, mental, emotional, and spiritual well-being. It is employed for the treatment of various ailments, including hypertension, asthma, low back pain, arthritis, pain, stress management, and PCOS.^[19]

Despite its existence for millennia, Qigong has not achieved widespread adoption. Due to the association between PCOS and conditions such as obesity and cardiovascular disease, it is hypothesized that Qigong may have a positive impact on the treatment of PCOS.^[20]

Challenges and Considerations in Hormonal Management- Metformin does not elicit a response in all individuals with PCOS. The study revealed that the combination of inositol and for women with PCOS,

Lifestyle Modifications and Complementary Therapies

Lifestyle modifications- A majority of individuals with PCOS are overweight or obese. Therefore, it is highly suggested for PCOS patients to focus on weight reduction. This can be achieved with a well-balanced diet and regular exercise, enhancing their metabolism, increasing insulin sensitivity, and facilitating safe weight loss. PCOS patients exhibit hormonal abnormalities, elevated blood cholesterol levels, and obesity. Comprehending that exercising alone will never be enough to facilitate weight loss is vital. Prioritizing a nutritious diet is of more significance.^[14] Multiple studies have shown that individuals who are overweight can successfully shed weight. Additionally, females with PCOS and infertility often experience irregular ovulation and have a heightened response to medicines that induce ovulation. As a result, they have greater chances of pregnancy and live births. Research indicates that achieving a weight loss of up to 5% of one's baseline weight can positively restore regular menstruation and enhance the response to ovulation and reproductive drugs.^[13]

Complementary therapies- In healthcare systems, alternative medicine (CAM), a non-Western medicine-related non-conventional therapy, has been widely used throughout. Multiple studies have demonstrated that the utilization of CAM, including Qigong, Tai Chi, yoga, Chinese herbal medicine, and acupuncture, can successfully treat PCOS and reduce its incidence of negative side effects.^[16]

Acupuncture is a therapeutic technique that involves inserting a needle into a specific area of the patient's body at a certain angle. This is done to treat various disorders by performing maneuvers, including rising, pushing, and twisting. Acupuncture has been effective in treating PCOS in several trials. Based on a review of a limited number of evidence-based research, it has been found that acupuncture can help alleviate symptoms connected to PCOS. These symptoms include the

metformin is effective in improving insulin resistance and normal menstrual cycles who are experiencing infertility. [21] Additional agents that can be modified metabolically, such as traditional insulin sensitizers (thiazolidinediones) and non-traditional drugs that improve insulin sensitivity, Glucagon-like-peptide 1 receptor antagonist (GLP-1RA), acarbose, and sodium-glucose cotransporter (SGLT2) inhibitor are other therapies that are beneficial for PCOS patients. According to a study, using metformin and GLP-1RA together improved the resolution of prediabetes for overweight/obese PCOS patients individuals. [22]

Inter-section of Epidemiology and Hormonal Management-

Socioeconomic factors have a significant impact on the selection and utilization of contraceptives, the occurrence of unexpected pregnancies, and the choice to either proceed with or terminate an unintended pregnancy. As a result, an intricate connection exists between these factors and the process of making reproductive decisions. Moreover, different types of contraception exhibit varying levels of effectiveness. In a 2006 nationwide survey conducted in Canada, it was shown that 15% of sexually active women had never utilized contraception, while less than 5% of women had opted for long-acting, very effective reversible contraceptive techniques, such as intrauterine devices or injections, which have the lowest risks of failure. [23]

There are variations worldwide in the occurrence of negative metabolic consequences linked to PCOS among women from diverse racial and cultural backgrounds. A recent systematic review included 30 studies that assessed and contrasted the metabolic results in PCOS-afflicted women from various ethnic backgrounds across the globe. Women Those with PCOS who are of South Asian, Indian, or Norwegian heritage are more likely to develop metabolic syndrome (MetSyn). However, compared to White women, US Black women are more likely to acquire hypertension, while Hispanic & Mexican women are more likely to develop insulin resistance. [24,25]

CONCLUSIONS

Over time, the worldwide incidence of PCOS has increased. The heightened susceptibility to concurrent metabolic diseases can significantly impact the long-term

well-being of PCOS-afflicted women. Thanks to developments in genetics, epigenetics, gut microbiota, and corticolimbic brain response variables, researchers have made significant strides in understanding the etiology of PCOS. In India, the estimated prevalence ranged from 3.7 to 22.5%. The frequency of PCOS varied based on the criteria employed, which likely accounts for the disparity in prevalence rates observed across studies. To accurately determine the prevalence of this condition in India, it is crucial to conduct extensive community-based research across different geographic regions, using internationally recognized criteria due to the significant variation in the country's population. A healthy diet, frequent exercise, and other lifestyle changes are all part of managing and treating PCOS, administering drugs that target the related symptoms and co-existing medical conditions.

CONTRIBUTION OF AUTHORS

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REFERENCES

- [1] Azziz R, Dumesic DA, Goodarzi MO. Polycystic ovary syndrome: An ancient disorder? *Fertil Steril.*, 2011; 95: 1544–48.
- [2] Panda PK, Rane R, Ravichandran R, Singh S, Panchal H. Genetics of PCOS: A systematic bioinformatics approach to unveil the proteins responsible for PCOS. *Genom Data.*, 2016; 8: 52–60.
- [3] Franks S, McCarthy MI, Hardy K. Development of polycystic ovary syndrome: Involvement of genetic and environmental factors. *Int J Androl.*, 2006; 29: 278–85.
- [4] Goodarzi MO, Dumesic DA, Chazenbalk G, Azziz R. Polycystic ovary syndrome: Etiology, pathogenesis and diagnosis. *Nat Rev Endocrinol.*, 2011;7: 219–31.

- [5] Akre S, Sharma K, Chakole S, Wanjari MB. Recent advances in the management of polycystic ovary syndrome: A review article. *Cureus*, 2022; 14: 8.
- [6] Gill H, Tiwari P, Dabadghao P. Prevalence of polycystic ovary syndrome in young women from North India: A community-based study. *Indian J Endocrinol Metab.*, 2012; 16: S389–92.
- [7] Nidhi R, Padmalatha V, Nagarathna R, et al. Prevalence of polycystic ovarian syndrome in Indian adolescents. *J Pediatr Adolesc Gynecol.*, 2011; 24: 223–27.
- [8] Vidya Bharathi R, Swetha S, Neerajaa J, Varsha Madhavica J, Janani DM, Rekha SN, et al. An epidemiological survey: Effect of predisposing factors for PCOS in Indian urban and rural population. *Middle East Fertil Soc J.*, 2017; 22: 313–16.
- [9] Bharali MD, Rajendran R, Goswami J, Singal K, Rajendran V. Prevalence of Polycystic Ovarian Syndrome in India: A Systematic Review and Meta-Analysis. *Cureus*, 2022; 14(12): 55-69.
- [10] Bazarganipour F, Taghavi SA, Montazeri A, Ahmadi F, Chaman R, Khosravi A. The impact of polycystic ovary syndrome on the health-related quality of life: A systematic review and meta-analysis. *Iran J Reprod Med.*, 2015; 13(2): 61-70.
- [11] Trent M, Gordon CM. Diagnosis and Management of Polycystic Ovary Syndrome in Adolescents. *Pediatrics*, 2020; 145(2): 210–18.
- [12] Melo A, Reis R, Ferriani R, Vieira C. Hormonal contraception in women with polycystic ovary syndrome: choices, challenges, and non-contraceptive benefits. *J Contracept*, 2017; 8: 13–23.
- [13] Pasquali R. Contemporary approaches to the management of polycystic ovary syndrome. *Ther Adv Endocrinol Metab.*, 2018; 9(4): 123–34.
- [14] Hu J, Shi W, Xu J, Liu S, Hu S, Fu W, et al. Complementary and Alternative Medicine for the Treatment of Abnormal Endometrial Conditions in Women with PCOS: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Evid Based Complement Alternat Med.*, 2021; 18(7): 1–17.
- [15] Palomba S, Falbo A, La Sala GB. Metformin and gonadotropins for ovulation induction in patients with polycystic ovary syndrome: a systematic review with meta-analysis of randomized controlled trials. *Reprod Biol Endocrinol.*, 2014; 12(1): 3.
- [16] Zhang H, Li D, Li R, Huo Z, Qiao J. Treat. Polycystic Ovary Syndr *Acupunct Med.*, 2018; 36(4): 269–70.
- [17] Efficacy of electroacupuncture in regulating the imbalance of AMH and FSH to improve follicle development and hyperandrogenism in PCOS rats. *Biomed Pharmacother.*, 2019; 113 (67): 108-23.
- [18] Zhou Z, Zhou R, Zhu Y, Li K, Luo Y, et al. Effects of tai chi on physiology, balance and quality of life in patients with type 2 diabetes: A systematic review and meta-analysis. *J Rehabil Med.*, 2019; 7(6): 12-28.
- [19] Nidhi R, Padmalatha V, Nagarathna R, Amritanshu R. Effects of a Holistic Yoga Program on Endocrine Parameters in Adolescents with Polycystic Ovarian Syndrome: A Randomized Controlled Trial. *J Altern Complement Med.*, 2013; 19(2): 153–60.
- [20] Putiri A, Close J, Lilly H, Guillaume N, Sun GC. Qigong Exercises for the Management of Type 2 Diabetes Mellitus. *Medicines*, 2017; 4(3): 59-70.
- [21] Che Y, Yu J, Li YS, Zhu YC, Tao T. Polycystic Ovary Syndrome: Challenges and Possible Solutions. *J. Clin. Med.*, 2023; 12(4): 21-36.
- [22] Liu Q, Tang B, Zhu Z, Kraft P, Deng Q, Stener-Victorin E, et al. A genome-wide cross-trait analysis identifies shared loci and causal relationships of type 2 diabetes and glycaemic traits with polycystic ovary syndrome. *Diabetologia.*, 2022; 6(12): 22-39.
- [23] Ganie M, Vasudevan V, Wani I, Baba M, Arif T, Rashid A. Epidemiology, pathogenesis, genetics & management of polycystic ovary syndrome in India. *Indian J Med Res.*, 2019; 150(4): 315-33.
- [24] Gill H, Tiwari P, Dabadghao P. Prevalence of polycystic ovary syndrome in young women from North India: A Community-based study. *Indian J Endocrinol Metab.*, 2012; 12(2): 389-92.
- [25] Nidhi R, Padmalatha V, Nagarathna R, Amritanshu R. Prevalence of Polycystic Ovarian Syndrome in Indian Adolescents. *J. Pediatr Adolesc Gynecol.*, 2011; 24(4): 223–27.

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