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Polycystic Ovarian Syndrome (PCOS): A Growing Health Concern

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Annotation:
Polycystic ovarian syndrome (PCOS) is a condition characterized by irregular menstrual cycles due to the lack of regular ovulation and elevated levels of androgens (male hormones). It is an important cause of female infertility and a precursor to other serious conditions such as obesity, cardiovascular diseases, type 2 diabetes, and endometrial cancer. The diagnosis of PCOS is tough during the first two years following menarche because normal pubertal changes can mimic symptoms of PCOS. These symptoms are ovulatory infertility, irregular menstrual cycles, increased androgen effects, transient multi-follicular ovarian morphology, and relative insulin resistance. Women who have PCOS are at high risk for several serious complications, some of which can be life-threatening. Common clinical features of PCOS include irregular or heavy or no menstrual periods, acne, excess facial and body hair, difficulty in getting pregnant, and patches of thick, darker, velvety skin, and pain in the pelvis.

The diagnosis of PCOS is based on the presence of any two of the following three criteria: no ovulation, high androgen levels, and ovarian cysts. Lifestyle modifications such as regular exercise and weight reduction may improve the situation. Birth control pills can help regulate menstrual periods, reduce excess hair growth, and improve acne. Weight loss, metformin, or clomiphene can also help improve fertility. Early diagnosis and treatment of the disease help to reduce the risk of many complications. This review provides a brief overview of the major causes of PCOS and effective control strategies.

Keywords: type 2 diabetes, insulin resistance, infertility, hyperandrogenism, and hirsutism.

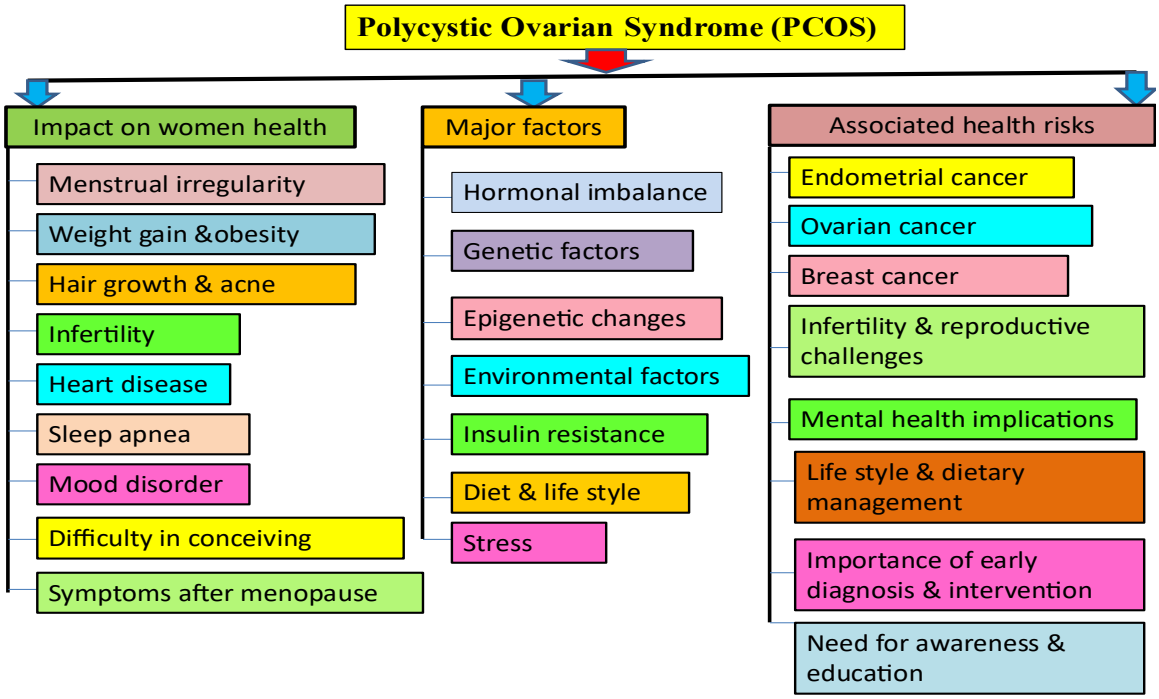

Fig.1. PCOS at a glance

1. Introduction

A disproportionate balance of reproductive hormones causes the condition called Polycystic Ovarian Syndrome (PCOS), which results in cystic ovarian follicles (1). PCOS was first described as early as 1721. In the mid-1930s, two Chicago doctors, Irving Stein and Michael Leventhal, recognized this disease. These doctors reported on women experiencing infertility, hirsutism (excessive growth of thick, dark hair in women), irregular menstrual cycles, and enlarged ovaries. The presence of multiple ovarian cysts is a defining feature of this condition. The egg's fluid-filled sac, normally filled with fluid, turns into a functional cyst, preventing the egg from being released—a process that typically lessens the chances of fertilization. As a result, the disruption of the menstrual cycle due to blocked ovulation can lead to amenorrhea (2). The syndrome has a complex mode of inheritance, where genetic variants interact with key environmental factors such as lifestyle, diet, and physical inactivity, leading to a varied expression of its symptoms (3). It is a serious health issue for women that is frequently increasing in our society. Research indicates that 5% to 10% of women aged 18 to 44 are

affected by PCOS (4). PCOS is a gynaecological disorder that primarily affects women of post-pubertal age worldwide. Remarkably, its current prevalence is approximately 1 in every 10 women (5). The elevated androgen levels can sometimes cause excessive acne, hair thinning, facial hair growth, and male-pattern scalp. For women with PCOS who wish to become pregnant, fertility medications may be necessary to trigger ovulation. In some clinical circumstances, each cyst may be between 8 and 10 mm. Women with PCOS have higher rates of endometrial cancer, cardiovascular disease, dyslipidaemia, and type 2 diabetes mellitus (6). Prevalence rates of PCOS among premenopausal women are higher than in other women of childbearing age, ranging from 6% (based on earlier, more restrictive criteria) to 20% (based on current, broader definitions (7). Most women with PCOS are overweight or obese, although not all, and they have an elevated risk of developing diabetes and obstructive sleep apnea. Although PCOS is not fully reversible, various treatments can effectively alleviate or minimize bothersome symptoms. Most women with PCOS can lead a normal life without experiencing significant complications (8). PCOS is associated with several significant comorbidities, including type 2 diabetes (T2DM), cardiovascular disease, insulin resistance, obesity, infertility, pregnancy complications, sleep disturbances, hypothyroidism, reduced mental health, and non-alcoholic fatty liver disease (NAFLD) (9). Despite certain clinical manifestations linked to hormonal imbalances, there are no definitive tests for diagnosing PCOS to date. This review delves into the reasons behind the rising number of PCOS cases and their impact on women's fertility rates, emphasizing the need to raise societal awareness about the condition. PCOS is associated with numerous health issues, including diabetes, cancer, and cardiovascular diseases, yet it can be effectively managed through lifestyle and activity modifications. By providing an in-depth understanding of the physiological mechanisms underlying PCOS and exploring effective management strategies, this comprehensive review highlights the condition's significant impact and potential pathways for intervention.

2. Advanced-Level Objectives

a) To analyze the multifactorial etiology of PCOS, including genetic, epigenetic, and environmental influences.

b) To evaluate the current molecular mechanisms underlying hyperandrogenism, insulin resistance, and chronic low-grade inflammation in PCOS.

c) To critically assess the diagnostic criteria and their limitations in diverse populations, including adolescent and postmenopausal women.

d) To explore the pathophysiological interrelationship between PCOS and comorbid conditions such as metabolic syndrome, cardiovascular disease, and endometrial hyperplasia.

e) To review the impact of gut microbiota dysbiosis and hormonal-metabolic axis disturbances in the progression of PCOS.

f) To investigate novel biomarkers for early detection and prognosis of PCOS using proteomics, metabolomics, and transcriptomics.

g) To compare the efficacy and safety profiles of conventional pharmacotherapies vs. emerging therapeutic agents, including insulin sensitizers, anti-Müllerian hormone antagonists, and selective androgen receptor modulators.

h) To assess the role of integrative and personalized approaches (e.g., nutraceuticals, lifestyle, and psychosocial interventions) in long-term management of PCOS.

i) To analyze the reproductive and fertility-related outcomes of PCOS across different phenotypes and treatment modalities, including ART outcomes.

j) To discuss on-going clinical trials, precision medicine strategies, and future research directions aimed at optimizing PCOS treatment.

3. Rising prevalence of PCOS

The World Health Organization (WHO) estimates that approximately 3.4% of all women, or about 116 million women worldwide, are affected by PCOS (10). The worldwide occurrence of PCOS is believed to range from 4% to 20%. In India, the prevalence of PCOS (polycystic ovarian syndrome) ranges from 3.7% to 22.5% (11). Several factors contribute to the increasing prevalence of PCOS, including stress, early onset of puberty, family history, lack of exercise, sedentary lifestyle, and obesity (12). To prevent long-term consequences, early screening, lifestyle changes, and prompt intervention are essential. The World Health Organization estimates that PCOS affects 8–13% of women of reproductive age, with more than half of the cases remaining undiagnosed (13). Diagnosing polycystic ovary syndrome (PCOS) in adolescents is both challenging and controversial, as the diagnostic criteria for adults overlap with normal pubertal changes, such as ovulatory dysfunction, hyperandrogenism, and polycystic ovarian morphology (PCOM) (14). Various criteria are used to diagnose PCOS. The most commonly used criteria for diagnosing PCOS are the National Institute of Health (NIH) criteria and the Rotterdam criteria (15). The original NIH and Rotterdam criteria did not distinguish between adults and adolescents. According to the Rotterdam criteria, a PCOS diagnosis requires the presence of at least two of the following: clinical and/or biochemical signs of hyperandrogenism, evidence of oligo-ovulation or anovulation, or polycystic ovarian morphology confirmed via ultrasound (9). At the same time, overdiagnosis can lead to unnecessary anxiety regarding future fertility and potential complications (16, 17, 18).

4. Impact on women health

Signs and symptoms of PCOS typically appear around puberty, though some women may not experience them until late adolescence or even early adulthood. Due to hormonal variations among women, individuals with PCOS may experience a range of symptoms, including mild to severe acne, facial hair growth, or hair loss on the scalp (19) (**Figure. 2.**).

4.1. Menstrual Irregularity: -

Women with ovarian cysts usually have fewer than six to eight menstrual periods per year. Irregular or absent menstrual periods can raise a woman's risk of endometrial overgrowth, known as endometrial hyperplasia, and may even lead to endometrial cancer. Some women have normal menses during puberty, which may become irregular if the woman becomes obese (8).

4.2. Weight gain and Obesity: -

PCOS is linked to gradual weight gain and obesity in about half of all women with the condition. In some women with PCOS, obesity begins to develop around the time of puberty (20).

4.3. Hair Growth and Acne: -

Women who have ovarian cysts typically endure excessive hair growth because it is a hormonal condition caused by high levels of the male hormone androgen (21). Overproduction of androgen may increase the sensitivity of different types of skin problems, such as acne; besides, the level of androgen increases, which may cause skin issues (22).

4.4. Infertility: -

Many women with PCOS do not release an egg from the ovary regularly; these women may take longer to conceive. If a woman with an ovarian cyst has sporadic periods, their fertility appraisal should start immediately, as the chance of becoming pregnant is low without treatment (23).

4.5. Heart Disease: -

Obese women with insulin resistance or diabetes may have a higher risk of coronary artery disease, which in turn raises their chances of experiencing a heart attack. It is not known with certainty if women with PCOS are at increased risk for this condition (24). PCOS women also appear to have a higher incidence of sleep apnea and associated cardiovascular risk factors compared to weight-matched controls (25).

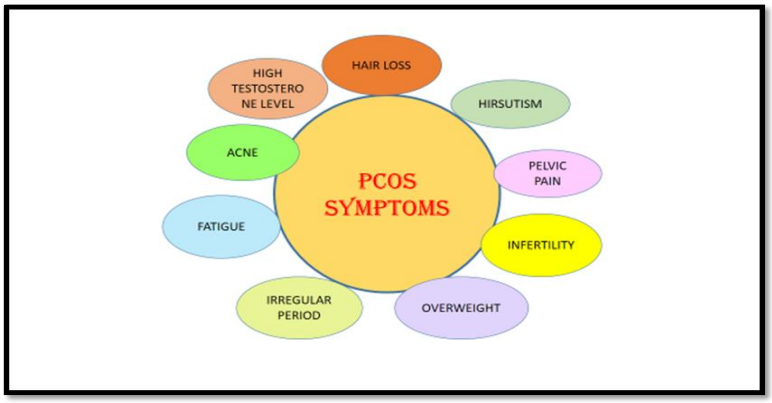

Fig. 2. Showing the complications associated with the PCOS

4.6. Sleep Apnea: -

Sleep apnea is a condition characterized by short episodes during sleep when breathing temporarily stops. People with this condition often experience fatigue and daytime drowsiness. Additionally, research suggests that untreated sleep apnea may increase the risk of insulin resistance, obesity, diabetes, and cardiovascular issues, including high blood pressure, heart attack, irregular heart rhythms, and stroke. Sleep apnea may affect up to 50% of women with PCOS. It can be diagnosed through a sleep study, and various treatment options are available (26).

4.7. Mood Disorder: -

A percentage of PCOS-affected women experience mental issues, including eating disorders, anxiety, depression, and poor physical health, and lots of mood changes (27).

4.8. Difficulty in Conceiving: -

PCOS is the most common cause of deterioration of female fertility. Lack of ovulation leads to fertility issues; therefore, even if a woman is experiencing pregnancy, this does not mean that she is ovulating. Therefore, a woman might not suspect anything amiss until she has been trying to conceive for a while (28).

4.9. Symptoms after Menopause: -

Less is known about PCOS symptoms after menopause. Studies indicate that women with PCOS may continue to have elevated androgen levels after menopause, though these levels typically return to normal around age 70. However, even postmenopausal women with declining hormone levels may still experience symptoms like excess hair growth (8).

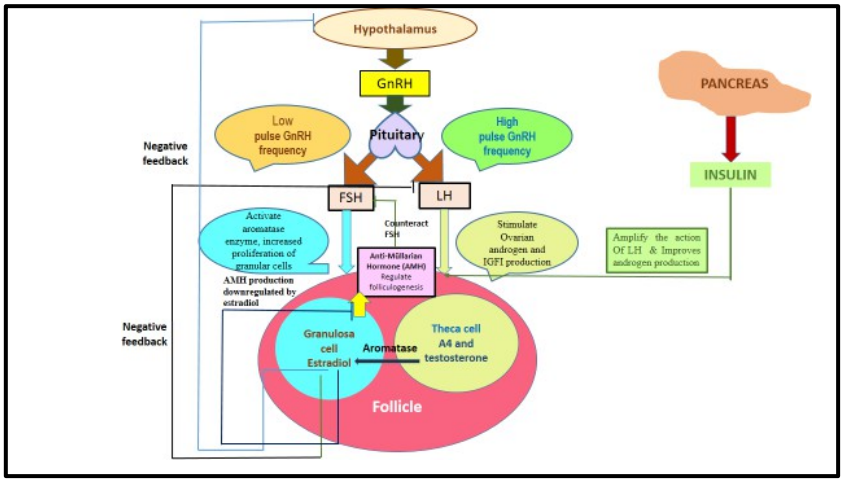

Fig. 3. A simplified overview of the master diagram illustrating the key relationships between the endocrine components that regulate normal ovarian physiology. LH: luteinizing hormone, FSH: follicle-stimulating hormone, GnRH: gonadotropin-releasing hormone, AMH: Anti-Müllerian hormone.

5. The major factors associated with PCOS

5.1. Hormonal Imbalance

In women with PCOS, hormones such as insulin, growth hormone (GH), ghrelin, liver-expressed antimicrobial peptide 2 (LEAP-2), gonadotropin-releasing hormone (GnRH), the luteinizing hormone/follicle-stimulating hormone (LH/FSH) ratio, androgens, and estrogens are all typically imbalanced (29). The delicate interplay between extra-ovarian and intra-ovarian factors regulates ovarian folliculogenesis, and any disruption to this balance may result in infertility. Disruptions in paracrine, endocrine, and metabolic processes can lead to decreased FSH secretion, elevated LH levels, hyperandrogenism, and hyperinsulinemia (30). The hypothalamic region of the brain regulates androgen production in the ovaries through specific signaling pathways. Hypothalamic neurons release pulsatile gonadotropin-releasing hormone (GnRH) into the portal blood vessels of the pituitary gland (31).

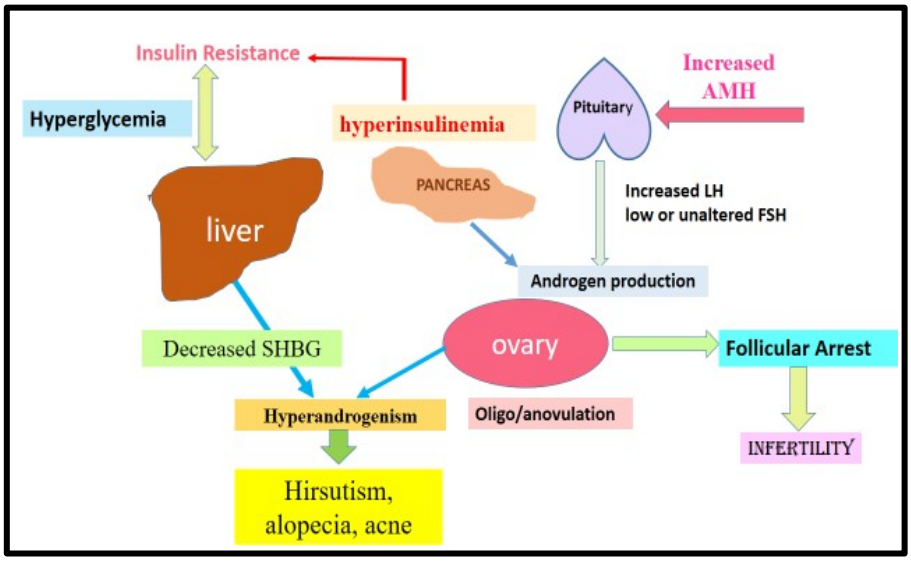

Fig. 4. A diagram showing hormonal dysregulation in PCOS.

In addition to the ovaries, androgens are synthesized in the adrenal glands, which predominantly produce DHEA (dehydroepiandrosterone) and androstenedione (A4) (32). Elevated androgen levels in PCOS partially contribute to an increased GnRH/LH pulse frequency, which can, in turn, exacerbate androgen production, creating a cycle of hormonal imbalance and dysregulation (33). Serum AMH levels have been found to correlate positively with elevated androgen levels, and women with both high androgens and PCOM tend to have the highest AMH levels among those with PCOS. Thus, high androgen levels may also play a role in increasing AMH levels (34). FSH supports the development of small antral follicles to the ovulatory stage. Meanwhile, AMH has been shown to inhibit FSH-induced aromatase activity and counteract the growth-promoting effects of FSH on granulosa cells. In PCOS, elevated AMH levels can disrupt antral follicle growth by inhibiting the effects of FSH, thereby reducing FSH-stimulated growth of pre-antral follicles (35). Women with PCOS often exhibit significantly elevated serum LH concentrations. As a result, elevated LH/FSH ratios are commonly observed. Ovarian function is also influenced by insulin, and high insulin levels can negatively impact it. In response to excessive insulin, theca cells produce large amounts of androgens, which can lead to arrested follicular maturation and an increased risk of polycystic ovarian morphology, a hallmark of PCOS (36) (**Figure. 4.**).

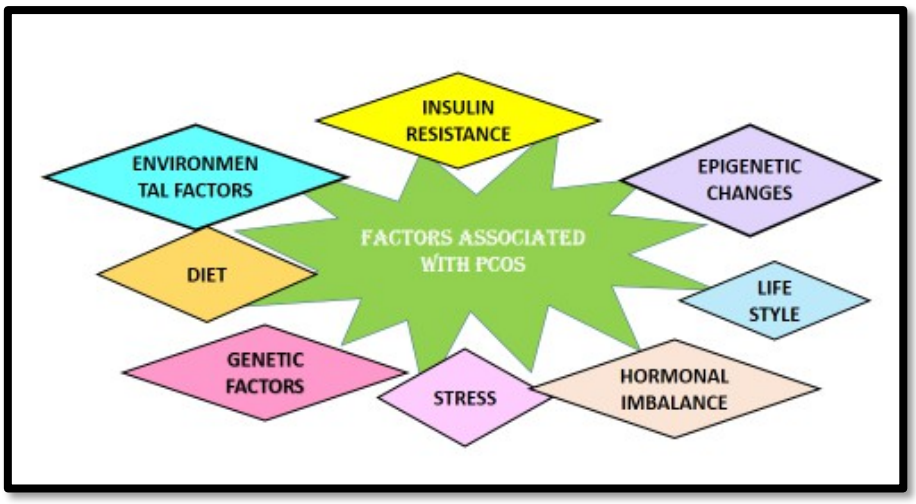

Fig. 5. Showing the major factors associated with the PCOS

5.2. Genetic Factors

Family and twin studies have shown that PCOS is inherited in an autosomal dominant pattern (37, 38). Genes associated with T2D play a highly significant role in the development of PCOS(39). Additionally, genes and genetic polymorphisms associated with T2D and obesity have been connected to hyperandrogenism, which is tied to the PCOS phenotype, highlighting a significant genetic influence (40). The genetic factors that result in PCOS are race (different races possess different characteristics), ethnicity (e.g., hirsutism is prevalent in black women having PCOS), and gene variation (e.g., CYP11a, CYP17 genes), respectively (36). To date, around 30 genes associated with PCOS risk have been identified through genome-wide association studies (GWAS). These include several genes involved in gonadotropin regulation and ovarian function, such as FSHB, FSHR, AMH, AMHR2, LHCGR, STON1, GTF2A1L, DENND1A, RAB5B, SUOX, HMGA2, C9orf3, YAP1, TOX3, RAD50, FBN3, PRDM2, KAZN, IQCA1, and CDH10. Additionally, genes related to metabolic and neural functions, including THADA, GATA4, NEIL2, ERBB2, ERBB3, ERBB4, SUMO1P1, INSR, KRR1, KCNA4, KCNH7, and FIGN3, have also been identified (41,42) (**Figure. 5.**).

5.3. Epigenetic Changes

Epigenetics studies molecular mechanisms that regulate gene activity without involving changes in the DNA sequence, including chromatin structure, DNA modification, nuclear architecture, and non-coding RNAs (3, 45). Both genetic and epigenetic factors play a role in the development of PCOS. Emerging evidence indicates that epigenetic modifications are closely linked to an increased susceptibility to PCOS, along with its related metabolic and reproductive dysfunctions (44). The epigenetic abnormality hypothesis suggests that exposure to a hyperandrogenic environment in utero may disrupt epigenetic reprogramming in foetal reproductive tissues, potentially leading to PCOS-like phenotypes after birth (44). Genome-wide epigenetic profiling, including histone modifications, DNA methylation, and non-coding RNAs, has been conducted in different tissues from both animal models and PCOS patients (45). Approximately 30% of the differentially expressed genes were associated with DNA methylation levels at CpG sites within or near skeletal muscle genes, indicating that DNA methylation likely influences gene expression in women with PCOS (26). In women with PCOS, hypermethylated genomic regions were primarily located on CpG island shores (within 1–2 kb of a CpG island) and at promoters with high CpG content. In contrast, hypomethylated regions were observed within gene bodies. Contrariwise, another study reported hypomethylation of both CpG islands and CpG island shores in women with PCOS (46, 47). Numerous studies on DNA methylation have been conducted specifically in ovarian granulosa cells. Targeted analyses of DNA methylation at genomic loci containing key genes in granulosa cells have identified hypomethylation in the promoters of YAP1, LHCGR (encoding the LH receptor), NCOR1, and HDAC3. This hypomethylation correlates with ovarian pathologies, including granulosa cell proliferation, LH receptor overexpression, and disrupted hormonal signalling (48, 49) (**Figure.4.**).

5.4. Environmental factors

Studies suggest that heavy metal poisoning, pesticide exposure, and endocrine-disrupting chemicals are key environmental factors negatively impacting reproductive health (50). Moreover, an unhealthy lifestyle and poor diet can accelerate the progression of PCOS, while stress may trigger anxiety, irritability, and depression (51). Multiple studies have demonstrated a positive correlation between the prevalence of PCOS and both smoking and exposure to second hand smoke (52). A population-based study in Taiwan identified a correlation between increased exposure to fine air pollutants, including SO_2, NO, and NO_2, and a higher risk of developing PCOS (113).

5.5. Insulin resistance

In patients with PCOS, anovulation is primarily caused by insulin resistance and hyperinsulinemia, while elevated androgen levels further worsen insulin resistance (34). A study indicated that anti-androgen treatment and androgen suppression enhanced insulin sensitivity in both obese and non-obese individuals with PCOS (53). Although the exact causes of metabolic abnormalities are not fully understood, disruptions in insulin secretion and signaling are thought to be the main contributing factors. This was evidenced in female rhesus monkeys exposed to excess testosterone *in vitro*, which led to harm insulin production and function (36). Reducing insulin resistance and excess adiposity are thus primary targets in managing PCOS. Vitamin D deficiency has also been observed in patients with PCOS (31). Deficiency of Vitamin D has been linked to the development of insulin resistance and impaired glucose tolerance in obese PCOS patients, as evidenced by their lower serum 25-OH-D levels compared to non-obese women with PCOS.

5.6. Diet and Life Style

Women with PCOS tend to experience higher rates of weight gain over time and have a greater prevalence of overweight and obesity, which can impair insulin resistance and, consequently, the severity of PCOS symptoms (54, 55, 56). The cause is unclear, but it may be linked to variations in intrinsic psychological and biological mechanisms or to external lifestyle factors such as diet and physical activity (57, 58). Researchers found that women with PCOS often adopt various unhealthy and potentially ineffective lifestyle habits to manage their condition. This is consistent with the findings, where participants followed diets that excluded core food groups, such as paleo, ketogenic, and elimination diets. Although certain diets, like low FODMAP and dairy-free, may be recommended for specific medical conditions (e.g., irritable bowel syndrome or food allergies), there is limited evidence supporting their effectiveness for managing PCOS (58, 59).

5.7. Stress

There is a significant connection between stress and female reproductive physiology. Psychological stress triggers an increase in cortisol secretion, reducing the production of estradiol. It affects granulosa cell functions within the follicle which results in deterioration of oocyte quality (60). For many women, the effects of PCOS can cause stress in both personal and social aspects of life. The psychological impact is significant, with depression and anxiety rates ranging from 28% to 64% (61,62). Research specifies that PCOS symptoms are a major contributor to psychological distress and negatively impact women's health-related quality of life (HRQoL) (61,62,63,64). In light of this issue, international guidelines recommend a focused examination of the psychological factors and quality of life of women with PCOS, emphasizing the need to screen for symptoms of depression and anxiety during consultations (65).

6. Associated health risks

6.1. Impaired glucose tolerance, type 2 diabetes and coronary heart disease

Polycystic ovary syndrome (PCOS) is associated with obesity, impaired glucose tolerance, and an increased risk of diabetes (66). It is also associated with several serious health conditions, including dyslipidaemia, cardiovascular disease, sleep apnea, depression, and non-alcoholic fatty liver disease (67). Studies reported that more than 20% of obese women with PCOS will have impaired glucose tolerance after the age of 30 (69). According to the International Diabetes Federation, PCOS is recognized as a non-modifiable risk factor for developing Type 2 Diabetes (T2D) (68). Evidence shows that women diagnosed with PCOS have a seven-fold higher prevalence of type 2 diabetes compared to controls, with rates of 15% versus 2%, respectively (69,70). Pancreatic beta (β)-cell dysfunction is another factor that is linked to both PCOS and T2D (71). Evidence suggests that a family history of T2D, reflecting genetic risk, is linked to an increased likelihood of T2D progression in women with PCOS. The presence of a defect in insulin action that amplifies LH-stimulated androgen secretion from theca cells has been well established. Women with a high rate of impaired glucose tolerance, suggesting that further cases of diabetes will develop later. However, studies say that the frequency of type 2 diabetes is also increased in women with PCOS who are not obese (body mass index less than 27 kg/m²**)** (72, 73, 74, 75). Women with PCOS have more risk factors for cardiovascular disease than other women of the same age, and may be at increased risk of cardiovascular events and death (50). The pancreatic β-cell fails to function properly, which is inversely correlated to SHBG (sex hormone binding globulin) concentration, leading to hyperandrogenism and chronic unopposed estrogen secretion. There are two mechanisms by which insulin resistance in PCOS contributes significantly to the higher incidence of cardiovascular disease in these women. One mechanism is the direct atherogenic action, and the other mechanism is the adverse effect of the lipoprotein profile (75). The serum plasminogen activator inhibitor-I concentrations are elevated**,** which leads to impaired fibrinolysis and therefore directly affects vascular tissue, causing changes associated with coronary heart disease. The evidence thus indicates that there is indeed an increased risk for women with PCOS of developing cardiovascular disease (77). The elevation of risk factors in young women with PCOS may therefore put them at increased risk of developing accelerated atherosclerosis resulting in myocardial infarction (78, 79, 80). In the Nurses' Health Study, menstrual cycle irregularity was associated with an increased risk of nonfatal and fatal coronary heart disease, although no data were available for confirmation of a diagnosis of PCOS (69). There seems to be a direct relationship between insulin plasma levels and blood pressure (81, 82). The prevalence of hypertension is three times higher in women with PCOS between the ages of 40 and 59 years than in controls. The incidence of preeclampsia in obese women with PCOS conceiving is four times higher than that of the general pregnant population (82).

6.2. Endometrial Cancer

Endometrial cancer (EC) is the second most commonly diagnosed cancer among women worldwide, with 417,000 new cases and 97,000 deaths reported in 2020 (83). It impacts the inner lining of the uterus and has a rising incidence worldwide (84). Meta-analyses identify PCOS as a significant risk factor, with women who have PCOS being three times more likely to develop endometrial cancer. The risk is notably higher for women under 54 compared to those who are older (85). In women with PCOS, significant risk factors for endometrial carcinoma include obesity, nulliparity, age over 50, infertility, hypertension, diabetes, chronic anovulation, and unopposed estrogen supplementation. The development of endometrial cancer (EC) is influenced by DNA damage response and repair pathways. The progression of endometrial cancer in women with PCOS may be influenced by the increased expression of genes associated with obesity (86). Some studies have found overexpression of luteinizing hormone and human chorionic gonadotropin receptors in uterine adenocarcinoma cells, suggesting that increased secretion of luteinizing hormone—a characteristic feature of PCOS—may also play a role in the development of endometrial cancer (87, 88). The higher prevalence of endometrial cancer (EC)

in women with PCOS is linked to chronic anovulation, which disrupts the normal cycle of monthly morphological changes in the endometrial structure. Moreover, impaired endometrial sensitivity to major sex steroid hormones, such as estrogen and progesterone, often manifests as progesterone resistance, further contributing to the risk (89). Women with PCOS experience ovulation irregularities, leading to infrequent or absent endometrial shedding. As a result, they are at an increased risk of developing endometrial hyperplasia and, subsequently, endometrial carcinoma (90). Insulin, androgens, and estrogens stimulate mitotic activity by increasing levels of insulin-like growth factors. These changes can enhance the risk of endometrial hyperplasia and carcinoma by promoting endometrial proliferation and increasing the potential for mutagenesis (90).

6.3. Ovarian cancer

Some studies have suggested a possible link between PCOS and an increased risk of ovarian cancer. Research on the link between ovarian cancer (OC) and PCOS has been conducted, with a significant study by Schildkraut *et al*. finding a 2.5-fold increased risk of OC in women with PCOS, which rose to a 10.5-fold higher risk in those not using oral contraceptives (91). PCOS, characterized by endocrine and metabolic imbalances, is frequently associated with oxidative stress. Targeting internal oxidative stress may offer a potential therapeutic approach**.** Reactive oxygen species (ROS) are essential in signaling processes, but excessive or prolonged ROS production is associated with the initiation and progression of cancer. Oxidative stress plays a key role in the development of ovarian cancer (OC) (92, 93). Another study examining the use of clomiphene, an ovulation-inducing medication, and its link to ovarian cancer suggests that the relative risk of ovarian cancer in women with PCOS is comparable to that of control groups. Although studies on the risk of ovarian cancer in PCOS patients are limited, research suggests that ovarian tissues in individuals with irregular menstruation show DNA hypo methylation and miRNA patterns similar to those found in ovarian cancer, indicating an increased risk of ovarian cancer in PCOS patients (94).

6.4. Breast Cancer

Data on the risk of breast cancer in women with PCOS are limited. Chronic anovulation and hyperandrogenism are key characteristics of PCOS, resulting in clinical features like amenorrhea, obesity, infertility, and hirsutism, all of which are also recognized as risk factors for breast cancer development. The causal relationship between PCOS and breast cancer (BC) remains debated, with conflicting findings from previous epidemiological studies. A Danish cohort study suggests that PCOS may increase the risk of postmenopausal breast cancer, in contrast, another retrospective cohort study indicates that it may raise the overall risk of breast cancer (94). Instead, there appears to be a positive association between PCOS and a family history of breast cancer. In a study involving 217 women, the proportion of those with a positive family history of breast cancer was significantly greater among women with PCOS compared to the control group (95). The sustained elevation of serum estrogen levels can help to explain the growth of hormone-sensitive tumors, such as breast and ovarian carcinoma**.** The mechanisms underlying the development of gynecological cancers in women with PCOS are complex and demand further investigation through large-scale, long-term studies to fortify the understanding of their association (96).

7. Infertility and reproductive challenges

Extensive international research has consistently identified PCOS as a leading cause of female infertility, which affects family planning. Lack of ovulation can lead to fertility issues. Even if a woman becomes pregnant, it does not necessarily mean she is ovulating regularly. As a result, she may not realize there is a problem until she tries to conceive for some time without success (28). In patients with PCOS, factors such as anovulation, increased risk of spontaneous abortion, poor oocyte quality, elevated blood LH levels, and miscarriages associated with hyperinsulinemia can negatively impact fertility. Women with PCOS face a higher risk of

endometrial hyperplasia due to ovulatory dysfunction and infertility, which can reduce their chances of achieving pregnancy and having children (97, 98). Insulin resistance, a hallmark of PCOS, disrupts glucose metabolism in the endometrium, leading to progesterone resistance and impaired endometrial function. This increases the risk of miscarriages, as well as the likelihood of atypical hyperplasia and endometrial cancer (99). Moreover, Bahri Khomami *et al*. demonstrated that women with PCOS are at least twice as likely as women without the condition to experience miscarriages, pregnancy-induced hypertension, hyper glycaemia, and preeclampsia. Due to disrupted ovulatory function, women with PCOS are advised to consider oral ovulatory induction treatments, such as letrozole. Incorporating lifestyle changes alongside recommended therapies may increase ovulation frequency and serve as an alternative strategy, though it may be less effective (100).

8. Mental health Implications

The impact of PCOS goes beyond physical symptoms, as women with the condition face a higher risk of mental health issues, including depression, anxiety, bipolar disorder, obsessive-compulsive disorder, somatization, eating disorders, and diminished sexual satisfaction (101,102). It examines the increased risk of psychiatric disorders, like depression and anxiety, in women with PCOS and delves into contributing factors like obesity, body image concerns, and stress (103). Anxiety and depression are especially common among women with PCOS, with 64.1% reported to experience depressive disorders (104, 105). In addition to metabolic changes, insulin resistance and impaired secretion of gastrointestinal hormones such as ghrelin and cholecystokinin are also risk factors that may predispose individuals to the development of psychological disorders, including depression (106,107,108). Depressive and anxiety symptoms related to PCOS are associated with changes in hormonal pathways, including progesterone, deoxycorticosterone, and testosterone, which may play a role in the underlying mood swings (109). So, infertility associated with PCOS is closely linked to an increased susceptibility to anxiety and depression in patients with the condition (110). Lifestyle interventions, such as dietary changes, regular exercise, and cognitive behavioural therapy, have shown noteworthy potential for improving the mental health of women with PCOS (103)

9. Life style and dietary management

The International Evidence-Based Guideline for the Assessment and Management of PCOS emphasizes lifestyle intervention as the primary approach for early management. Traditionally, lifestyle interventions are defined as strategies aimed at improving diet or physical activity through supportive behavioural guidance (111). Weight loss and regular exercise are the most effective ways to regulate menstrual cycles, prevent the progression to type 2 diabetes, and reduce cardiovascular risk. Lifestyle can encompass various traditional, complementary, and integrative medicine (TCIM) therapies, including psychological and sleep interventions, the use of supplements, and acupuncture (112). While effective lifestyle management is essential in PCOS care, evidence of higher long-term weight gain in community populations and high dropout rates in clinical weight management programs indicates that women with PCOS often face challenges in managing diet and physical activity (54,113). A right diet with adequate exercise has shown great results in PCOS recovery. It is also important to preserve mental health by making time for hobbies such as listening to music, singing, or playing sports (114). The medical therapies includes oral contraceptive pills, insulin sensitizing drugs such as metformin, hormones (gonadotropin's), testosterone lowering drugs, weight losing drugs, antidepressants and anti- anxiety drugs are also used to control PCOS (115) (**Fig.6.**). Excess hair growth on the face and/or other parts of the body can be removed by shaving or use of depilatories, electrolysis, or laser therapy (116). There are several surgical methods that are successfully used to manage the restoration of ovulation. Various laparoscopic methods, including electrocautery, laser drilling, and multiple biopsies, have been used with the aim of creating certain focal areas of damage in the ovarian cortex and its stroma (117). Ovarian drilling is a type of laparoscopic surgery that involves making several holes in the surface of the ovaries and stroma. It is hypothesized that this treatment will reduce androgen levels by destroying the tissue that generates androgens (118).

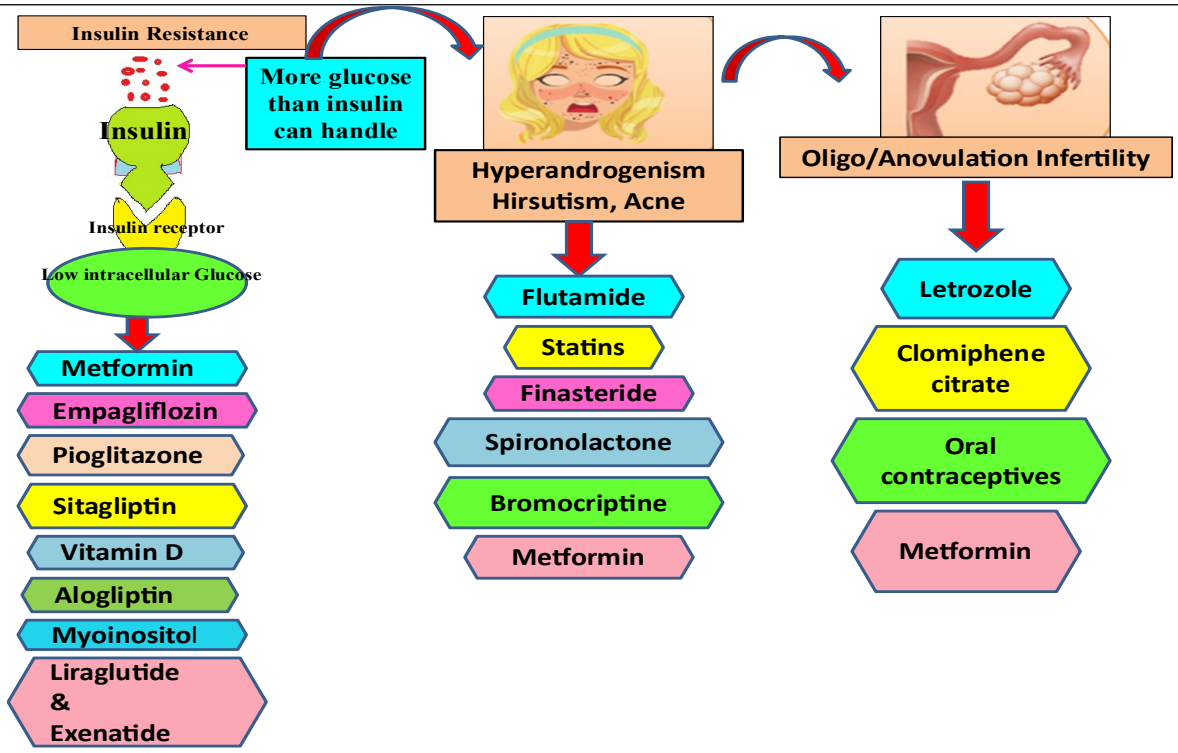

Fig.6. Pharmacotherapy of PCOS

10. Importance of early diagnosis and intervention

The diagnostic examination includes assessing androgen levels through hormonal evaluation, evaluating hirsutism using the Ferriman-Gallwey score, and examining antral follicle count and ovarian volume through ultrasonography. Insulin resistance should be evaluated using the HOMA index, calculated by multiplying fasting plasma insulin (mU/L) and glucose (mmol/L) concentrations and dividing by 22.5. Measuring biochemical markers of hyperandrogenism is especially useful in patients who lack clear clinical signs, such as hirsutism, acne vulgaris, and female pattern hair loss (FPHL) (119) (**Fig.7.**). Certain blood tests are essential for diagnosing PCOS in adolescent and adult women, helping exclude other conditions that may cause irregular menstrual cycles and hyperandrogenism. These tests include beta-human chorionic gonadotropin (for sexually active individuals), LH, FSH, thyroid function tests, prolactin, midnight salivary cortisol, and 17-hydroxyprogesterone (17-OHP) (120,121). Although pelvic ultrasound and polycystic ovarian morphology (PCOM) are included in the Rotterdam diagnostic criteria for PCOS in adult women, they are not recommended for diagnosing PCOS in adolescents, as this may lead to over diagnosis during this life stage. This is supported by prior evidence summarized in international guidelines for adolescents, along with more recent findings (16,122,123). Serum AMH is not currently recommended as a standalone test for diagnosing PCOS in women or adolescents, due to variability across studies regarding age, assay types, and diagnostic criteria. Research has shown a significant overlap in AMH values between women with and without PCOS (16,124,125). Future diagnostic approaches under consideration include 3D ultrasonographic evaluation of follicles and the potential role of anti-Müllerian hormone (AMH) levels (126,127).

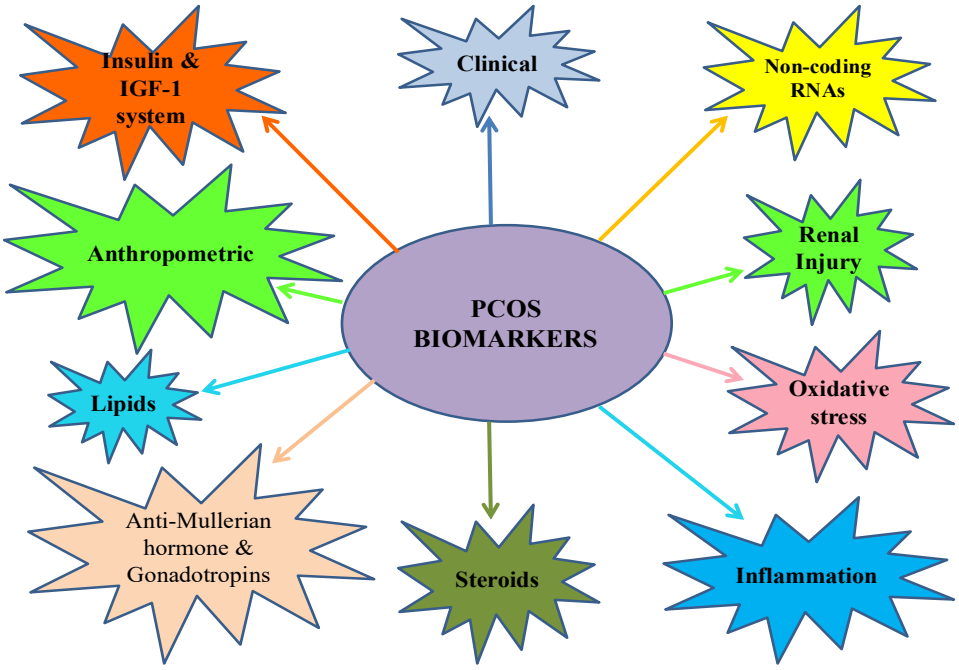

Fig.7. PCOS biomarkers

11. Need for awareness and education

Despite the broadened and more detailed diagnostic criteria, PCOS remains underdiagnosed and insufficiently studied. Women have limited awareness of PCOS and its associated complications, leading to inadequate evaluation of the condition. As a result, there is a critical need to improve women's understanding to prevent severe outcomes. The clinical symptoms of PCOS may not appear concerning to many women. In young adolescents, symptoms such as weight gain, acne, menstrual irregularities, and abnormal hair growth are often overlooked and mistaken for typical pubertal changes. As a result, the condition may go unnoticed until severe complications, such as infertility, develop, typically at the point at which many patients seek medical attention due to difficulty conceiving (128,129). It is clear that PCOS is easier to manage when diagnosed early, in contrast to the more complex management required in the later stages (130). However, awareness has been found to be insufficient among both healthcare professionals and women in the general population (129). Clinical guidelines advise diagnosing PCOS based on a thorough evaluation of the patient's clinical presentation. Raising awareness among the population will encourage women to seek medical care when needed (131).

12. Emerging Trials and Therapies

- GLP-1 receptor agonists (e.g., liraglutide)
- Gut microbiota modulation
- Anti-inflammatory agents
- Nutraceuticals: curcumin, omega-3, vitamin D
- Modernized trials and therapeutic approaches are discussed in **Table 1. And Table.2**
- Challenges in the treatment of PCOS and challenges of polycystic ovarian syndrome (PCOS) have also been analyzed in **Table 3. and Table.4.**

Table.1. Clinical Trials on PCOS Treatment

Trial Title / ID	Intervention	Study Design	Target Population	Primary Outcome	Status / Year
Letrozole vs. Clomiphene Citrate for Ovulation Induction (PPCOS	Letrozole vs. Clomiphene	Randomized Controlled Trial (RCT)	Women with PCOS & infertility	Ovulation & live birth rate	Completed (NEJM, 2014)

II)					
Metformin and Life style vs. Life style Alone	Metformin + diet/exercise vs. diet/exercise	RCT	Overweight PCOS women	Weight loss, insulin sensitivity	Completed (J Clin Endocrinol Metab, 2006)
Inositol in PCOS (NCT03422289)	Myo-inositol & D-chiro-inositol	Double-blind RCT	Women with PCOS (Rotterdam criteria)	Menstrual cycle regularity	Completed (2020)
Vitamin D Supplementation in PCOS (NCT03617207)	Vitamin D 4000 IU/day	Placebo-controlled RCT	Vitamin D-deficient PCOS women	Insulin resistance (HOMA-IR)	Completed (2022)
Berberine vs. Metformin (NCT01138930)	Berberine 0.5 g TID vs. Metformin	Open-label RCT	Obese women with PCOS	Insulin resistance, lipid profile	Completed (2012, Chin J Endocrinol Metab)
Liraglutide in Obese PCOS Women (NCT02908829)	Liraglutide 1.8 mg/day SC	Double-blind RCT	Obese PCOS patients	Weight reduction, menstrual regularity	Completed (2021)
Resveratrol for Hyperandrogenism (NCT01720459)	Resveratrol 1500 mg/day	Placebo-controlled RCT	Hyperandrogenic PCOS women	Testosterone levels, insulin sensitivity	Completed (J Clin Endocrinol Metab, 2016)
Probiotics and Prebiotics in PCOS (NCT03000424)	Lactobacillus + inulin	Double-blind RCT	PCOS with gut dysbiosis	Hormonal levels, inflammation	Completed (2020)
Anti-Müllerian Hormone Antagonist Study	AMH Antibody (experimental)	Early-phase Clinical Trial	PCOS model (animal/human trials ongoing)	Folliculogenesis restoration	Preclinical / Phase I
Letrozole + Metformin vs. Letrozole Alone	Letrozole + Metformin	Multicentered RCT	Infertile PCOS women	Ovulation rate, pregnancy rate	Completed (Fertility & Sterility, 2019)

Table.2. Current Therapeutic Strategies

Treatment	Indication	Mechanism
Life style modification	Obesity, IR	Diet, exercise improve ovulation & insulin sensitivity
Oral contraceptives	Menstrual irregularity, hirsutism	Suppress LH and androgen production
Metformin	Insulin resistance, T2DM risk	Improves insulin sensitivity, restores ovulation
Anti-androgens (e.g., spironolactone)	Hirsutism, acne	Block androgen receptors
Ovulation induction (Letrozole/Clomiphene)	Infertility	Stimulate follicular development
Inositol's (Myo/D-Chiro)	Metabolic & ovulatory dysfunction	Insulin sensitizers

Table.3. Challenges in the Treatment of PCOS

Challenge	Explanation
1. Lack of Curative Treatment	PCOS has no permanent cure. Management is symptomatic and often requires lifelong interventions.
2. Heterogeneous Presentation	Wide variability in symptoms (reproductive, metabolic, dermatological, psychological) makes standard treatment difficult.
3. Drug Resistance	Some patients show poor response to first-line therapies (e.g., clomiphene citrate for ovulation induction).
4. Side Effects of Medications	Hormonal contraceptives and anti-androgens can cause mood changes, weight gain, liver dysfunction, or thrombotic risks.
5. Lifestyle Modifications Are Hard to Sustain	Diet, exercise, and weight loss are effective but difficult to maintain long-term due to metabolic imbalances.
6. Insulin Resistance Management	Insulin-sensitizing agents like metformin are not effective in all cases and may cause gastrointestinal discomfort.
7. Limited Fertility Options	Advanced treatments (IVF, laparoscopic ovarian drilling) are expensive and not accessible to all.
8. Psychological Support is Inadequate	Anxiety, depression, and body image issues are often ignored in PCOS treatment plans.
9. Lack of Personalized Therapy	One-size-fits-all approaches are ineffective; individual hormonal and metabolic profiles often need tailored interventions.
10. Inconsistent Guidelines	Different diagnostic criteria (Rotterdam, NIH, AE-PCOS) lead to confusion in treatment approaches.
11. Poor Patient Compliance	Due to chronic nature, complex regimens, and lack of immediate results, many patients abandon treatment.
12. Cultural/Social Barriers	In some cultures, stigma around infertility or cosmetic symptoms leads to delayed treatment-seeking.

Table.4. Table: Challenges of Polycystic Ovarian Syndrome (PCOS)

S. No.	Challenge	Description
1	Diagnostic Difficulty	Symptoms overlap with other disorders; multiple diagnostic criteria used.
2	Heterogeneous Symptoms	Variability in presentation (menstrual, metabolic, dermatologic, psychological).
3	Lack of Curative Treatment	Current therapies manage symptoms but do not eliminate the root cause.
4	Insulin Resistance	Central to PCOS; increases risk of type 2 diabetes and cardiovascular diseases.
5	Fertility Issues	Ovulation problems lead to difficulty conceiving and emotional distress.
6	Mental Health Concerns	High prevalence of anxiety, depression, low self-esteem, and body image issues.
7	Obesity and Weight Gain	Common in PCOS and worsens hormonal imbalance and insulin resistance.
8	Long-term Health Risks	Risk of endometrial cancer, metabolic syndrome, and heart disease.
9	Inconsistent Guidelines	Multiple diagnostic criteria (NIH, Rotterdam, AE-PCOS) complicate management.
10	Stigma and Social Pressure	Infertility, acne, and hirsutism carry social stigma in many cultures.
11	Limited Awareness and Education	Many individuals and even healthcare providers lack sufficient knowledge.
12	Delayed Diagnosis	PCOS is often undiagnosed or diagnosed late due to subtle or ignored symptoms.

13. Discussion

PCOS is a markedly understudied condition, though it affects 11-13% women globally**.** It is characterized by insulin resistance and hyperandrogenism. It is also linked to obesity, hyperinsulinemia, and a heightened risk of cardiovascular diseases (132). In addition to its physiological effects, PCOS is linked to anxiety, depression, eating disorders, psychosexual dysfunction, and negative body image, all of which collectively reduce patients' health-related quality of life. Over the past three years, the global prevalence of PCOS has been estimated to range from 2.2% to 48%, affecting countries like India, Australia, the USA, and China (133,134). PCOS is a leading cause of female infertility due to ovulatory dysfunction, and it also increases the risk of other health complications such as type 2 diabetes, endometrial cancer, breast cancer, and ovarian cancer. The global burden of PCOS is further compounded by challenges in diagnosis and management, as the syndrome can present with varied clinical manifestations and requires a multidisciplinary approach for effective treatment (135). The increasing prevalence of PCOS among young women and adolescents remains puzzling, as its underlying etiological factors are not well understood. A survey conducted in India reported a PCOS prevalence rate of 6% to 46.8% based on the Rotterdam criteria (136). The search for new therapeutic options to treat PCOS in adolescents is ongoing. While novel approaches show promise, ensuring their safety in this patient population is of utmost importance (137). Trent *et al.* reported that N-acetyl cysteine improved metabolic parameters, such as insulin resistance, and hormonal parameters, including testosterone levels, in young women with PCOS (138). Vitamin D supplementation is believed to potentially improve insulin sensitivity and promote menstrual regularity (139). Women with polycystic ovary syndrome (PCOS) are at higher risk for certain problems or complications during pregnancy. Complications of pregnancy commonly associated with PCOS could be a reason for these risks. Gonadotropins, such as recombinant FSH and human menopausal gonadotropin (HMG), are considered the second-line treatment for ovulatory infertile women with PCOS (140). Laparoscopic surgery is a second-line surgical option for inducing ovulation in women with PCOS who are resistant to or do not respond to clomiphene (141). In vitro fertilization (IVF) is recommended as a third-line treatment option for infertility in women with PCOS who have no associated complications (142). The management of PCOS in all cases begins with lifestyle modifications, including weight loss and increased physical activity. It is estimated that 40–70% of adolescents with PCOS are either overweight or obese (143). Thus, it is essential to promote positive lifestyle changes in all patients from the outset and to maintain these healthy habits as an adjunct if additional therapy is required. Moderate to vigorous physical activity for at least 30–60 minutes daily is recommended. Weight loss can help reduce body mass index (BMI=kg/m2) and facial hair growth (FHG), while regular physical activity has a beneficial impact on menstrual cycle regulation (144). Researchers are studying whether treatment with insulin-sensitizing drugs such as metformin can prevent or reduce the risk of pregnancy problems in women with PCOS. Besides oral drugs, there are many other herbal formulations that can also be used to treat PCOS and the complications related to PCOS. Insights into its underlying mechanisms provide potential therapeutic targets, such as strategies to restore hormonal balance and improve reproductive outcomes. Early identification and targeted management strategies are crucial for mitigating the long-term consequences of PCOS and related conditions, ultimately improving reproductive health safety and overall well-being.

Conclusion

Polycystic ovary syndrome (PCOS) is a common endocrine metabolic disorder marked by the dysregulation of the hypothalamic-pituitary-ovarian (HPO) axis results in chronic anovulation, irregular menstrual cycles, and the accumulation of small follicles in the ovaries. This disrupted hormonal environment, characterized by excessive androgen secretion and insulin resistance, contributes to ovulatory dysfunction, infertility, and the metabolic disturbances seen in PCOS. Understanding the complexities of PCOS is essential for effective management and intervention.

Insights into its underlying mechanisms provide potential therapeutic targets, such as strategies to restore hormonal balance and improve reproductive outcomes. Early identification and targeted management strategies are crucial for mitigating the long-term consequences of PCOS and related conditions, ultimately improving reproductive fitness and welfare. Polycystic ovary syndrome (PCOS), which affects 5-20% of women in this demographic, presents challenges in diagnosis and management, increasing the risk of infertility and other health complications. Addressing these challenges necessitates increased awareness, education, and early detection efforts, along with continued research and initiatives that consider broader socio-economic and cultural factors. In brief, accurate recognition and suitable treatment of hormone level alterations associated with PCOS are vital for preventing both short- and long-term medical effects. A comprehensive and integrated approach involving healthcare providers, policymakers, researchers, and advocacy organizations is indispensable for reducing the global impact of PCOS and enhancing the general health and security of those affected.

Authors Contribution

Authors have equally bequeathed.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Abbreviations

AE-PCOS: Androgen Excess and Polycystic Ovary Syndrome

AMH: Anti-Müllerian hormone

AMHR2: Anti-Müllerian Hormone Receptor type 2

BC: Breast Cancer

BMI: Body Mass Index

CpG: 5-C-phosphate-G-3

DHEA: Dehydroepiandrosterone

DNA: Deoxyribonucleic Acid

EC: Endometrial Cancer

FHG: Facial Hair Growth

FODMAP: Fermentable Oligosaccharides, Disaccharides, Monosaccharide's, and Polyols

FPHL: Female Pattern Hair Loss

FSH: Follicle-Stimulating Hormone

GH: Growth Hormone

GLP-1 receptor: Glucagon-Like Peptide-1 receptor

GnRH: Gonadotropin-Releasing Hormone

GWAS: Genome-Wide Association Studies

HDAC3: Histone Deacetylase 3

HMG: Human Menopausal Gonadotropin

HOMA index: Homeostasis Model Assessment index

HPO: Hypothalamic-Pituitary-Ovarian

HRQoL: Health-Related Quality of Life

17-OHP: 17-hydroxyprogesterone

25-OH-D: 25-hydroxyvitamin D

IR: Insulin Resistance

IVF: *In Vitro* Fertilization

LH: Luteinizing Hormone

LHCGR: Luteinizing Hormone/Choriogonadotropin Receptor

LEAP-2: Liver-Expressed Antimicrobial Peptide 2

miRNA: micro–Ribonucleic Acid

NAFLD: Non-Alcoholic Fatty Liver Disease

NCOR1: Nuclear Receptor Corepressor 1

NIH: National Institute of Health

NO: Nitric oxide

NO_2: Nitrogen dioxide

OC: Ovarian Cancer

PCOM: Polycystic Ovarian Morphology

PCOS: Polycystic Ovarian Syndrome

RCT: Randomized Controlled Trial

RNA: Ribonucleic Acid

ROS: Reactive Oxygen Species

SHBG: Sex Hormone Binding Globulin

SO_2: Sulphur dioxide

T2DM: Type 2 Diabetes mellitus

T2D: Type 2 Diabetes

TCIM: Traditional, Complementary, and Integrative Medicine

THADA: Thyroid Adenoma Associated

USA: United States of America

WHO: World Health Organization

YAP1: Yes-Associated Protein 1

Cited References

1. Dennett CC, Simon J. The role of polycystic ovary syndrome in reproductive and metabolic health: Overview and approaches for treatment. Diabetes Spectr 2015; 28(2): 116-120.
2. Chaudhuri A. Polycystic ovary syndrome: Causes, symptoms, pathophysiology, and remedies. Obesity Med 2023; 39: 100480.
3. Shuxia Li, Dongyi Zhu, Duan H, Tan. The epigenomics of polycystic ovarian syndrome: Gynecol Endocrinol 2016; 32(12):942-946.

4. Rausch ME, Legro RS, Barnhart HX, Schlaff WD, Carr BR, Diamond MP, et al. Predictors of pregnancy in Women with polycystic ovary syndrome: J Clin Endocrinol Metab 2009; 94(9): 3458-3466.

5. Dey R, Bhattacharya K, Basak AK, Paul N, Bandyopadhyay R, Choudhari GR, et al . Inflammatory Perspectives of Polycystic Ovary Syndrome: Middle East Fertil Soc J 2023; 28: 33.

6. McFarland C. Treating polycystic ovary syndrome and infertility: MCN Am J Matern Child Nurs 2012; 37(2): 116-121.

7. Escobar-Morreale HF. Polycystic ovary syndrome: Definition, etiology, diagnosis and treatment: Nat Rev Endocrinol 2018; 14: 270-84.

8. Chouhan AS, Dadhich R. Advance research on polycystic ovary syndrome (PCOS): JMWH 2022; 106:2–5.

9. Emanuel R, Josh Roberts, Docherty P, Helen Lunt, Rebecca E. Moller C. A review of the hormones involved in the endocrine dysfunctions of polycystic ovary syndrome and their interactions. Front Endocrinol 2022; Volume 13.

10. Farhana A, Shi J. A Narrative Review on Global Epidemiology of PCOS and its Hormonal Management. SSR Inst. Int. J. Life Sci. 2024; 2581-8732.

11. Gill H, Tiwari P, Dabadghao P. Prevalence of polycystic ovary syndrome in young women from North India-A community based study. IJEM 2012; 16: 389–392.

12. Vidya 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.

13. WHO Fact Sheet, June 2023. Available online: https://www.who.int/news-room/fact-sheets/detail/polycystic-ovary-syndrome.

14. Teede HJ, Neven ACH, Pena A. Evolution of evidence-based diagnostic criteria in adolescents with polycystic ovary syndrome. Hum Reprod 2024; 39(5):876–877.

15. Chang, S, Dunaif, A. Diagnosis of Polycystic Ovary Syndrome: Which Criteria to Use and When? Endocrinol Metab Clin North Am 2021; 50: 11–23.

16. Peña AS, Witchel SF, Hoeger KM, et al. Adolescent polycystic ovary syndrome according to the international evidence-based guideline. BMC Med 2020; 18(1):72

17. Tay CT, Hart RJ, Hickey M, et al. Updated adolescent diagnostic criteria for polycystic ovary syndrome: impact on prevalence and longitudinal body mass index trajectories from birth to adulthood. BMC Med 2020; 18(1):389

18. Witchel SF, Teede HJ, Peña AS. Curtailing PCOS. Pediatr Res 2020; 87(2):353–361.

19. Green E, Cree-Green M, Cai N, Pyle L, Ringham B, Brown MS, Et al. Insulin Resistance in youth without diabetes is not related to muscle mitochondrial dysfunction. J Clin Endocrinol Metab 2017; 102(5):1652–1660.

20. Hoeger K. Obesity and weight loss in polycystic ovary syndrome. Obstet Gynecol Clin North Am 2001; 28: 85–87.

21. Azziz R. The evaluation and management of hirsutism. Obstet Gynecol 2003; 101: 995–1007.

22. Ehrmann DA, Rosenfield RL, Brigell FD, Sheikh Z. Detection of functional ovarian hyperandrogenism in women with androgen excess. N Engl J Med 1992; 327:157–162.

23. Cunha A, Póvoa AM. Infertility management in women with polycystic ovary syndrome: a review. Porto Biomed J 2021; 6: 116.

24. Yusuf S, Hawken S,Ounpuu S, et al. Risk Factors Associated with Myocardial Infraction: Case – Control Study. Lancet 2004; 364: 937 – 952.

25. Agarwal A, Aponte – Mellado A, Premkumar BJ, Shaman A, Gupta S . The effects of oxidative stress on female reproduction-A review: Reprod Biol Endocrinol 2012; 10:49.

26. Nilsson E, et al. Transcriptional and epigenetic changes influencing skeletal muscle metabolism in women with polycystic ovary syndrome. J Clin Endocrinal Metab 2018; 103: 4465–4477.

27. Mansson M, Holte J, Landin-Wilhelmsen K, Dahlgren E, Johansson A, Landén M, et al. Women with polycystic ovary syndrome are often Depressed or anxious – A case control Study. Psycho neuroendocrinology 2008; 33: 1132–1138.

28. Hussain A, Chandel RK, Ganie MA, Dar MA, Rather YH, Wani ZA, et al. Prevalence of psychiatric disorders in patients with a diagnosis of polycystic ovary syndrome in Kashmir. Indian J Psychol Med 2015; 37: 66–70.

29. Yang and Chen .Hormonal changes in PCOS.J Endocrinol 2024; 261(1).

30. De Leo V, Musacchio MC, Cappelli V, Massaro MG, Morgante G and Petraglia F. Genetic, Hormonal and metabolic aspects of PCOS: An update. Reproductive Biol Endocrinol 2016; 14(1): 38.

31. Thomson RL, Spedding S and Buckley JD. Vitamin D in the aetiology and management of polycystic Ovary syndrome: Clin Endocrinol 2012; 77: 343-350.

32. Yildizhan R, Kurdoglu M, Adali E, Kolusari A, Yildizhan B, Sahin HG, et al. Serum 25-hydroxy Vitamin D concentrations in obese and non-obese Women with polycystic ovary syndrome. Arch Gynecol Obstet 2009; 280: 559-563.

33. Kumar P, Sait S. Luteinizing hormone and its Dilemma in ovulation induction. J Human Reproduct Sci 2011; 4(1): 2.

34. Chang RJ, Nakamura RM, Judd HL and Kaplan SA. Insulin resistance in non-obese patients with polycystic ovarian disease. J Clin Endocrinol Metabolism 1983; 57(2): 356-359.

35. Campbell RE, Coolen LM, Hoffman GE, Hrabovszky E. Highlights of neuroanatomical discoveries of the mammalian gonadotropin-releasing hormone system. J Neuroendocrinol 2022; 34(5):e13115.

36. Bienenfeld A, Azarchi S, Lo Sicco K, Marchbein S, Shapiro J, Nagler AR. Androgens in women: Androgen-mediated skin disease and patient evaluation. J Am Acad Dermatol 2019; 80(6):1497–1506.

37. McCartney CR, Campbell RE, Marshall JC, Moenter SM. The role of gonadotropin-releasing hormone neurons in polycystic ovary syndrome. J Neuroendocrinol 2022; 34(5):e13093.

38. Pellatt L, Rice S, Mason HD. Anti-müllerian hormone and polycystic ovary syndrome: A mountain too high? Reproduction 2010; 139(5):825–833.

39. Emanuel RBHK, Roberts J, Docherty PD, Lunt H, Campbell RE, Möller K. A review of the hormones involved in the endocrine dysfunctions of polycystic ovary syndrome and their interactions. Front Endocrinol 2022; 13:1-20.

40. Abdalla, MA, Deshmukh H, Atkin S, Sathyapalan T. A review of therapeutic options for managing the metabolic aspects of polycystic ovary syndrome. Ther Adv Endocrinol Metab 2020; 11: 2042018820938305.

41. Day F, Karaderi T, Jones MR, Meun C, et al. Large-scale genome-wide meta-analysis of polycystic ovary syndrome suggests shared genetic architecture for different diagnosis criteria. PLOS Genet 2018; 4, e1007813.

42. Gorsic LK, Kosova G, Werstein B, Sisk R, Legro RS, Hayes MG, Teixeira J, Dunaif A, Urbanek M. Pathogenic anti-mullerian hormone variants in polycystic ovary syndrome. J Clin Endocrinol Metab 2017; 102: 2862–2872.

43. Victorin ES, Deng Q. Epigenetic inheritance of polycystic ovary syndrome: challenges and opportunities for treatment. Nat Rev Endocrinol 2021; 17: 521–533.

44. Li Z, Huang H. Epigenetic abnormality: a possible mechanism underlying the foetal origin of polycystic ovary syndrome. Med Hypotheses 2008; 70: 638–642.

45. Victorin ES, Deng Q. Epigenetic inheritance of polycystic ovary syndrome: challenges and opportunities for treatment Nature Reviews. Endocrinol. Sept 2021; Volume 17.

46. Yu, Y Y, Sun C , Liu Y, Li Y, Wang L, Zhang W. Genome wide screen of ovary specific DNA methylation in polycystic ovary syndrome Fertil Steril 2015; 104: 145–153.

47. Wang, XX, Wei J, Jiao J, Jiang S, Yu D, Li D. Genome-wide DNA methylation and gene expression patterns provide insight into polycystic ovary syndrome development. Oncotarget 2014; 5: 6603–6610.

48. Qu F, Wang FF, Yin R, Ding G, El-Prince M, Gao Q, Shi B, Pan HH, Huang Y, Jin M, Leung PCK, Sheng J, Huang H. A molecular mechanism underlying ovarian dysfunction of polycystic ovary, hyper androgenemia induces epigenetic alterations in the granulosa cells. J Mol Med 2012; 90: 911–923.

49. Wang P, Zhao H, Li T, Zhang W, Wu K, Li M, Bian Y, Liu H, Ning Y, Li G, Chen Z. Hypo methylation of the LH/choriogonadotropin receptor promoter region is a Potential mechanism underlying susceptibility to polycystic ovary syndrome. Endocrinol 2014; 155: 1445–1452.

50. Kandaraki E, Chatzigeorgiou A, Livadas S, Palioura EEconomou F, Koutsilieris M, Palimeri S, et al. Endocrine disruptor sand polycystic ovary syndrome (PCOS), Elevated serum levels of bisphenol in women with PCOS. J Clin Endocrinol Metab 2011; 96(3): 480-484.

51. Lydic M, Juturu V. Dietary approaches and Alternative therapies for polycystic ovary syndrome. Curr Nutrition Food Sci 2008; 4: 265-281.

52. Zhang B, Zhou W, Shi Y, Zhang J, Cui L and Chen ZJ. Life style and environmental contributions to Ovulatory dysfunction in women of polycystic ovary Syndrome. BMC Endocrine Disorders 2020; 20(1): 19.

53. Dunaif A, Segal KR, Futterweit W and Dobrjansky A. Profound peripheral insulin resistance, Independent of obesity, in polycystic ovary syndrome. Diabetes 1989; 38(9): 1165-117

54. Teede HJ, Joham AE, Paul E, Moran LJ, Loxton D, Jolley D, et al. Longitudinal weight gain in women identified with polycystic ovary syndrome - results of an observational study in young women. Obesity 2013; 21(8):1526–1532.

55. Lim SS, Davies M, Norman RJ, Moran L. Overweight, obesity and central obesity in women with polycystic ovary syndrome: a systematic review and meta-analysis. Hum Reprod Update. 2012; 18(6): 618–637.

56. Lim S, Norman RJ, Davies M, Moran L. The effect of obesity on polycystic ovary syndrome: a systematic review and meta-analysis. Obes Rev. 2013; 14(2): 95–109.

57. Moran C, Garcia-Hernandez E, Barahona E, Gonzalez S, Bermudez JA. Relationship between insulin resistance and gonadotropin dissociation in obese and non-obese women with polycystic ovary syndrome. Fertil Steril 2003; 80(6):1466–1472.

58. Moran LJ, Ko H, Misso M, Marsh K, Noakes M, Talbot M, et al. Dietary composition in the treatment of polycystic ovary syndrome: a systematic review to inform evidence-based guidelines. J Acad Nutr Diet 2013; 113(4):520–545.

59. Moran LJ, Brown WJ, McNaughton SA, Joham AE, Teede HJ. Weight management practices associated with PCOS and their relationships with diet and physical activity. Hum Reprod 2017; 32: 669–678.

60. Prasad S, Tiwari M, Pandey AN, Shrivastav TG, Chaube SK. Impact of stress on oocyte quality and reproductive outcome. J Biomed Sci 2016; 23:36.

61. Sanchez N, Jones H. Less than a wife": a study of polycystic ovary syndrome content in teen and women's digital magazines. J Med Internet Res 2016; 18:89–189.

62. Bhattacharya SM, Jha A. Prevalence and risk of depressive disorders in women with polycystic ovary syndrome (PCOS). Fertil Steril 2018; 94: 357–359.

63. Podfigurna-Stopa A, Luisi S, Regini C, et al. Mood disorders and quality of life in polycystic ovary syndrome. Gynecol Endocrinol 2016; 31: 431–434.

64. El Hayek S, Bitar L, Hamdar LH, et al. Poly cystic ovarian syndrome: an updated overview. Front Physiol 2016; 7: 124–224.

65. The Amsterdam EA-Sr PCWG. Consensus on women's health aspects of polycystic ovary syndrome (PCOS). Hum Reprod 2012; 27:14–24.

66. Zhiqin Bu, Kuok K, Jie Meng, Rui Wang, Bie Xu, Hanwang Zhang. Reprod Biol Endocrinol. 2012;

67. Wang T, Sha L, Li Y, Wang Z, Zhu L, Li K , et al. Microbiota inflammation axis in rats. Front Endocrinol 2020; 11:284.

68. Sathyapalan T, Atkin SL. Evidence for statin therapy in polycystic Ovarian Syndrome. Ther adv Endocrinol Metab 2011; 1: 15-22.

69. Solomon CG, Hu FB, Dunaif A, Rich-Edwards JE, Stampfer MJ, Willett WC, et al. Menstrual cycle irregularity and risk For future cardiovascular disease. J Clin Endocrinol Metab 2002; 87:2013–2017.

70. Gopal M, Duntley S, Uhles M, Attarian H. The role of obesity in the increased prevalence of obstructive sleep apnea Syndrome in patients with polycystic ovarian Syndrome: Sleep Med. 2002; 3: 401–404.

71. Dey P. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. Int J Reprod Contracept Obstet Gynecol. 2018; 7(7):2586-2589.

72. Legro RS, Kunselman AR, Dodson WC, Dunaif A. Prevalence and predictors of risk for type 2 diabetes mellitus and impaired glucose tolerance in polycystic ovary syndrome: a Prospective, controlled study in 254 affected women. J Clin Endocrinol Metab 1999; 84: 165–169.

73. Dunaif A, Finegood DT. Beta–cell dysfunction independent of obesity and glucose intolerance in the polycystic ovary Syndrome. J Clin Endocrinol Metab 1996; 81: 942–947.

74. Ehrmann DA, Barnes RB, Rosenfield RL, Cavaghan MK, Imperial J. Prevalence of impaired glucose tolerance and diabetes in women with polycystic ovary syndrome. Diabetes Care 1999; 22: 141–146.

75. Pierpoint T, McKeigue PM, Isaacs AJ, Wild SH, Jacobs HS. Mortality of women with polycystic ovary syndrome at Long term follow up. J Clin Epidemiol 1999; 51: 779–786.

76. Wild RA, Carmina E, Diamanti-Kandarakis E, et al. Assessment of cardiovascular risk and prevention Of cardiovascular disease in women with the polycystic ovary Syndrome: a consensus statement by the Androgen Excess And Polycystic Ovary Syndrome (AE-PCOS) Society. J Clin Endocrinol Metab 2010; 95(5): 2038-2049.

77. Wild RA. Long term health consequences of PCOS: Hum Reprod Update 2002; 8: 231–241.

78. Dahlgren E, Janson PO, Johansson S, Lapidus L, Oden A. Polycystic ovary syndrome and risk for myocardial infarction. Evaluated from a risk factor model based on a Prospective population study of women: Acta Obstet Gynecol Scand 1992; 71: 599–604.

79. Legro RS, Kunselman AR, Dunaif A. Prevalence and predictors of dyslipidemia in women with polycystic ovary Syndrome. Am J Med 2001; 111: 607–613.

80. Talbott E, Guzick D, Clerici A, Berga S, Detre K, Weimer K, et Al. Coronary heart disease risk factors in women with poly Cystic ovary syndrome. Arterioscler Thromb Vasc Biol 1995; 15: 821–826.

81. Reaven GM, Lithell H, Landsberg L. Hypertension and associated metabolic abnormalities-the role of insulin resistance and sympathoadrenal system. New Engl J Med 1996:334–374.

82. Cheang KI, Nestler JE, Futterweit W. Risk of cardiovascular Events in mothers with polycystic ovary syndrome. Endocr Pract 2008; 14: 1084–1094.

83. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021; 71:209–49.

84. Karishma R, Sahar Q. Identification of Key Genes Associated with Polycystic Ovarian Syndrome and Endometrial and Ovarian Cancer through Bioinformatics. J Hum Reprod Sci 2024; 17(2):81-93.

85. Barry JA, Azizia MM, Hardiman PJ. Risk of endometrial, ovarian and breast cancer in women with polycystic ovary syndrome: A systematic review and meta-analysis. Hum Reprod Update 2014; 20: 748–758.

86. Nagashima M, Miwa N, Hirasawa H, Katagiri Y, Takamatsu K, Morita M. Genome-wide DNA methylation analysis in obese women predicts an epigenetic signature for future endometrial cancer. Sci Rep 2019; 9: 6469.

87. Hardiman P, Pillay OS, Atiomo W. Polycystic ovary syndrome and endometrial carcinoma. Lancet 2003; 361:1810–1812.

88. Fanta M. Is polycystic ovary syndrome, a state of relative estrogen excess, a real risk factor for estrogen-dependant malignancies? Gynecol Endocrinol 2013; 29:145–147.

89. Khalenko Vladislava Valerievna, Rosa Anna Guiglia, Marta Alioto. Are women with PCOS more at risk for endometrial cancer? What approach for such patients? Acta Biomed 2023; 94(3):1-2.

90. Balen A, Rajkhowa R. Health consequences of polycystic Ovary syndrome. In: Balen A, editor. Reproductive endocrinology for the MRCOG and beyond. 1st ed. London: RCOG Press; 2003. Pp. 99

91. Bhoomi Arora, Vinod Arora, Snehal Patel: Journal of Pharmacy Research 2014; 8(7): 884-892.

92. Mosgaard BJ, Lidegaard O, Kjaer SK, Schou G, Andersen AN. Infertility, fertility drugs and invasive ovarian cancer; a Case control study: Fertil Steril 1997;67:1005–1012.

93. Mosgaard BJ, Lidegaard O, Kjaer SK, Schou G, Andersen AN. Ovarian stimulation and borderline ovarian tumors: a Case control study. Fertil Steril. 1998; 70:1049–1055.

94. Rossing MA, Daling JR, Weiss NS, Moore DE, Self SG. Ovarian tumors in a cohort of infertile women: N Engl J Med. 1994; 331:771–776.

95. Chittenden BG, Fullerton G, Maheshwari A, Bhattacharya S. Polycystic ovary syndrome and the risk of gynaecological Cancer: a systematic review. Reprod Biomed Online 2009; 19:398–405.

96. Atiomo W, El Mahdi E, Hardiman P. Familial associations in PCOS: Fertil Steril. 2003; 80:143–145.

97. Inhorn MC, Patrizio P. Infertility around the globe: new thinking on gender, reproductive technologies and global movements in the21st century. Hum Reprod Update 2015; 21:411–26.

98. Homan G, Davies M, Norman R. The impact of lifestyle factors on reproductive performance in the general population and those undergoing infertility treatments: a review. Hum Reprod Update.2007; 13: 209–23.

99. Matsuyama S, Whiteside S, Li SY. Implantation and decidualization in PCOS- Unravelling the Complexities of Pregnancy. Int J Mol Sci 2024; 25(2): 1203.

100. Mohd AD, Mudasir M, Zulfkar Q, Irfat A, Afshana Q. Unravelling PCOS: Exploring its causes and diagnostic challenges. Open Health 2024; 5: 20230026.

101. Brutocao C, Zaiem F, Alsawas M, Morrow AS, Murad MH, Javed A. Psychiatric disorders in women with polycystic ovary syndrome: a systematic review and meta-analysis. Endocrin 2018; 62: 318–325.

102. Himelein MJ, Thatcher SS. Polycystic ovary syndrome and mental health: a review. Obstet Gynecol Surv 2006; 61: 723–732.

103. Haya A, Lara A, Mouna B, Joudy S, Zafer A, Hasan N, Basem Z. Polycystic ovary syndrome and its multidimensional impacts on women's mental health: A narrative review. Medicine 2024; 103(25):38647.

104. Blay SL, Aguiar JVA, Passos IC. Polycystic ovary syndrome and mental disorders: a systematic review and exploratory meta-analysis. Neuro psychatr Dis Treat 2016; 12: 2895–2903.

105. Moghadam ZB, Fereidooni B, Saffari M, Montazeri A. Polycystic ovary syndrome and its impact on Iranian women's quality of life: a population-based study. BMC Womens Health 2018; 18: 164.

106. Schoretsanitis G, Gastaldon C, Kalaitzopoulos DR, Ochsenbein-Koelble N, Barbui C, Seifritz E. Polycystic ovary syndrome and postpartum depression: A systematic review and meta-analysis of observational studies. J Affect Disord 2022 Feb 15; 299: 463-469.

107. Ye Y, Zhou CC, Hu HQ, Fukuzawa I, Zhang HL. Underlying mechanisms of acupuncture therapy on polycystic ovary syndrome: Evidences from animal and clinical studies. Front Endocrinol (Lausanne) 2022; 13: 1035929.

108. Facio-Lince García A, Pérez-Palacio MI, Molina-Valencia JL, Martínez-Sánchez LM. Polycystic ovary syndrome and metabolic complications: beyond androgen excess. J Obstet Gynaecol 2015; 80(6): 515–519.

109. Standeven LR, Olson E, Leistikow N, Payne JL, Osborne LM, Hantsoo L. Polycystic Ovary Syndrome, Affective Symptoms, and Neuroactive Steroids: a Focus on Allopregnanolone. Curr Psychiatry Rep 2021; 23(6):36.

110. Azevedo JA, Fonseca PEO, Bié SMG, Ferreira SB. Development of mental disorders in patients with polycystic ovary syndrome. Gynecol Res Obstet 2024; 10(1): 001-006

111. Teede HJ, Misso ML, Costello MF, et al. Recommendations from the international Evidence-based guideline for the assessment and management of polycystic ovary syndrome: Hum Reprod 2018; 33(9):1602–1618.

112. Cowan S, Lim S, Alycia C, Pirotta S, Thomson R, Gibson-Helm M, Blackmore R, et al. Lifestyle management in polycystic ovary syndrome–beyond diet and physical activity: BMC Endocr Disord 2023; 23: 14.

113. Lim SS, Hutchison SK, Van Ryswyk E, Norman RJ, Teede HJ, Moran, LJ. Lifestyle changes in women with polycystic ovary syndrome. Cochrane Database Syst Rev 2019; 16(2): CD007506.

114. Norman RJ, Davies MJ, Lord J, Moran LJ. The role of lifestyle modification in polycystic ovary syndrome. Trends Endocrinol Metab 2002; 13: 251–257.

115. Zhan C, Zhao M, Li Z, Song Y. Follicle-Stimulating Hormone Positively Associates with Metabolic Factors in Perimenopausal women. International Journal Nov 2020; doi.org/10.1155/2020/7024321.

116. Dumont A, Robin G, Catteau-Jonard S, Dewailly D. Role of Anti-Müllerian Hormone in pathophysiology, diagnosis and treatment of Polycystic Ovary Syndrome: a review. Reproductive Biology and Endocrinology 2015; 13: 137.

117. Management and treatment. Jeans (2019) Hailes for Women's Health.

118. Hussain AI, Anwar F, Shahid Md, Basra SMA. Chemical Composition, and Antioxidant And Antimicrobial Activities of Essential Oil of Spearmint (*Mentha spicata* L.) from Pakistan. J Essent. Oil Res 2008; 22 (1), 78–84.

119. Lizneva D, Gavrilova-Jordan L, Walker W, Azziz R. Androgen excess: Investigations and management. Best Pract. Res. Clin. Obstet. Gynaecol 2006; 37: 98–118.

120. Pignatelli D. Non-classic adrenal hyperplasia due to the deficiency of 21-hydroxylase and its relation to polycystic ovarian syndrome. Front Horm. Res 2013; 40: 158–170.

121. Esquivel-Zuniga MR, Kirschner CK, McCartney CR, Burt Solorzano CM. Non-PCOS Hyperandrogenic Disorders in Adolescents. Semin. Reprod Med 2022; 40: 42–52.

122. Teede HJ, Misso ML, Costello MF, Dokras A, Laven J, Moran L, Piltonen T, Norman RJ. Recommendations from the international evidence-based guideline for the assessment and management of polycystic ovary syndrome. Hum Reprod 2018; 33: 1602–1618.

123. Witchel SF, Oberfield S, Rosenfiel RL, Codner E, Bonny A, Ibanez L, Pena A, Horikawa R, Gomez-Lobo V, Joel, D, et al. The Diagnosis of Polycystic Ovary Syndrome during Adolescence: Horm Res Paediatr 2015; 83: 376–389.

124. Teede H, Misso M, Tassone EC, Dewailly D, Ng EH, Azziz R, Norman RJ, Andersen M, Franks S. and Hoeger K, et al. Anti-Müllerian Hormone in PCOS: A Review Informing International Guidelines. Trends Endocrinol Metab 2019; 30: 467–478.

125. Witchel SF, Oberfield S, Rosenfield RL, Codner E, Bonny A, Ibanez L, Pena A, Horikawa R, Gomez-Lobo V, Joel D. et al. The Diagnosis of Polycystic Ovary Syndrome during Adolescence. Horm Res Paediatr 2015; 83: 376–389.

126. Homburg R, Ray A, Bhide P, Gudi A, Shah A, Timms P, Grayson K. The relationship of serum anti-Mullerian hormone with polycystic ovarian morphology and polycystic ovary syndrome, a prospective cohort study. Hum Reprod. 2013; 28: 1077–1083.

127. Lam PM, Raine-Fenning N. The role of three-dimensional ultrasonography in polycystic ovary syndrome. Hum Reprod 2006; 21: 2209–15.

128. Witchel SF, Oberfeld SE, Peña AS. Polycystic ovary syndrome: pathophysiology, presentation, and treatment with emphasis on adolescent girls. J Endoc Soc 2019; 3(8):1545–1573.

129. Piltonen TT, Ruokojärvi M, Karro H, Kujanpää L, Morin-Papunen L, Tapanainen JS, et al. Awareness of polycystic ovary syndrome among obstetrician-gynecologists and endocrinologists in Northern Europe. PLoS ONE. 2019; 14(12):1-12.

130. Akshay Gade, Rutuja Sawant, Shreya Parkar, Prajakta Kegade. Polycystic ovary syndrome: An Overview, Diagnosis and Treatment of PCOS. Asian J Pharm Tech 2020; 10(4):265-272.

131. Zaitoun B, Kubaisi AA, Qattan NA, Alassouli Y, Mohammad A, Alameeri H, Mohammed G. Polycystic ovarian syndrome awareness among females in the UAE- a cross-sectional study Zaitoun et al. BMC Women's Health 2023; 23:181.

132. Glendining KA, Campbell RE. Recent advances in emerging PCOS therapies. Curr Opin Pharmacol 2023; 68: 102345.

133. Deswal R, Narwal V, Dang A, Pundir CS. The prevalence of polycystic ovary syndrome: A brief systematic review. J Hum Reprod Sci 2020; 13: 261–271.

134. Chatterjee M, Bandyopadhyay S. Assessment of the prevalence of polycystic ovary syndrome among the college students: A case-control from Kolkata. J Mahatma Gandhi Inst Med Sci 2020; 25: 28.

135. Urbanek M. The genetics of the polycystic Ovarian Syndrome: Nat Clin Pract Endocrinol Metab 2007; 3: 103 –111.

136. Supreet K, Jai GV, Gurmeet S. Syndrome in a rural medical college and hospital –A survey-based research. J Pharm Negat Results 2022; 13: 4058–4073.

137. Peña, AS, Witchel SF, Hoeger KM, Oberfield SE, Vogiatzi MG, Misso M, Garad R, Dabadghao P, Teede H. Adolescent polycystic ovary syndrome according to the international evidence-based guideline. BMC Med 2020; 18: 72.

138. Trent M, Gordon CM. Diagnosis and Management of Polycystic Ovary Syndrome in Adolescents. Pediatrics 2020; 145: S210–S218.

139. Fitzgerald S, Divasta A, Gooding H. An update on PCOS in adolescents. Curr Opin Pediatr 2018; 30: 459–465.

140. Melo AS, Ferriani RA, Navarro PA. Treatment of infertility in women with polycystic ovary syndrome: approach to clinical practice. Clinics 2015; 70 (11): 765–769.

141. Seow KM, Juan CC, Hwang JL, Ho LT. 2008 Seminars in reproductive medicine. In: Laparoscopic surgery in polycystic ovary syndrome: reproductive and metabolic effects, Vol. 26. © Thieme Medical Publishers, 101–110.

142. Thessaloniki ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group, 2008 Mar 1.Consensus on infertility treatment related to polycystic ovary syndrome. Hum Reprod 23 (3), 462–477.

143. Witchel SF, Teede HJ, Peña AS. Curtailing PCOS Pediatr Res 2020; 87: 353–361.

144. Abdolahian S, Tehrani FR, Amiri M, Ghodsi D, Yarandi RB, Jafari M, Majd HA, Nahidi F. Effect of lifestyle modifications on anthropometric, clinical, and biochemical parameters in adolescent girls with polycystic ovary syndrome: A systematic review and meta-analysis. BMC Endocr Disord 2020; 20: 71.