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“Herbal plants used in the treatment of PCOS-A Comprehensive review”

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Abstract: Polycystic ovarian syndrome is a common endocrine-metabolic illness marked by polycystic ovaries, persistent anovulation, and hyperandrogenism, resulting in symptoms of monthly irregularity, infertility, and hirsutism. Various medicinal therapies for polycystic ovarian syndrome have been offered. However, the potential adverse effects of long-term therapies, as well as their limited effectiveness, have made complementary and alternative treatments a viable choice. According to recent estimates, the usage of complementary therapies is on the rise. Various plants like *Saraca asoka*, *Moringa olifera*, *Asparagus racemosus*, *Cimicifuga racemosa* etc., proved active in the treatment of polycystic ovarian syndrome. In this review, attempts have been made to summarize the important medicinal plants which are used in the treatment or prevention of polycystic ovarian syndrome. This article will be helpful for the upcoming researchers in their investigation of Polycystic ovarian syndrome.

1. Introduction

Polycystic ovarian syndrome (PCOS) is an endocrine condition characterized by increased androgens (male hormones) in reproductive-age females. PCOS is linked to a variety of clinical symptoms, including irregular menstruation, infertility, androgen development, hirsutism, insulin resistance, acne, weight gain, and ovarian cysts. PCOS is a condition characterized by

aberrant gonadotropin secretion, including luteinizing hormone (LH) and follicle-stimulating hormone (FSH), as well as excessive ovarian steroid secretion, which may be linked to insulin resistance.¹ Polycystic ovarian syndrome (PCOS) is a concerning gynecological endocrinopathy that has long-term negative effects on women's physical and mental well-being. PCOS affects around 5-20% of reproductive-age women, depending on the diagnostic criteria.² Polycystic

Ovary Syndrome (PCOS) is a common illness that affects both the metabolism and reproductive systems. According to the Rotterdam criteria, PCOS has a 10% prevalence, while polycystic ovaries have a 28% prevalence.³ An international symposium convened at the National Institutes of Health (NIH) in 1990 recommended that the diagnostic criteria for PCOS include the presence of ovulation and hyperandrogenemia, either biochemically, clinically (hirsutism/acne), or both.⁴ Polycystic ovary syndrome is a clinical diagnosis defined by the presence of two or more of the following symptoms: persistent oligo- or an-ovulation, androgen excess, and polycystic ovaries.⁵ In 1935, Leventhal and Stein identified a condition that would eventually be recognized as polycystic ovary (or ovarian) syndrome (PCOS).⁶ Women with PCOS are still receiving rudimentary care. As a result, it becomes an economic burden associated with health care. In addition, well-designed prospective studies are needed to predict the long-term risk of acquiring PCOS-related disorders such as type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD).⁷

PCOS is caused by a mix of hereditary and environmental factors. Obesity, a lack of physical activity, and a family history of the condition are all risk factors. Two of the following three findings are used to make a diagnosis: Ovarian cysts, no ovulation, and excessive androgen levels. Ultrasound may be able to detect cysts. Adrenal hyperplasia, hypothyroidism, and high prolactin levels in the blood are all illnesses that cause comparable symptoms. There is no cure for PCOS. Treatment may include modifications to one's lifestyle, such as weight loss and exercise. Birth control tablets may assist with period irregularity, unwanted hair growth, and acne. Metformin and anti-androgens may also be beneficial. Other common acne remedies and hair removal methods may be employed. Weight loss, clomiphene, or metformin are all used to improve fertility. Some people use in vitro fertilization (IVF) when other methods fail. PCOS is the most frequent endocrine disorder among women aged 18 to 44. Depending on how it is characterized, it

affects around 2-20% of this age range. PCOS is the most prevalent cause of infertility caused by a lack of ovulation.⁸ Polycystic Ovarian Syndrome (PCOS) is a complex and common endocrine disorder that affects individuals with ovaries, typically during their reproductive years. This condition has garnered increasing attention in recent years due to its widespread prevalence and the significant impact it can have on a person's health and well-being. PCOS is characterized by a range of symptoms and hormonal imbalances that can manifest differently in each affected individual, making it a challenging condition to diagnose and manage. PCOS is a multifaceted condition that involves a combination of hormonal, metabolic, and reproductive disturbances. It is often associated with the overproduction of androgens, which are male hormones that can lead to a variety of physical and emotional symptoms. One of the hallmark features of PCOS is the formation of small cysts on the ovaries, though not all individuals with PCOS will develop these cysts. The exact cause of PCOS remains a subject of ongoing research, but it is thought to involve a combination of genetic and environmental factors. Individuals with PCOS may experience a range of symptoms, including irregular or absent menstrual periods, fertility challenges, acne, excess facial or body hair, weight gain, and metabolic issues such as insulin resistance. Understanding and managing PCOS is essential for those affected by this condition, as it can lead to various long-term health consequences, such as an increased risk of type 2 diabetes, heart disease, and complications during pregnancy. Early diagnosis and a holistic approach to treatment, including lifestyle changes, medications, and support from healthcare professionals, can help individuals with PCOS manage their symptoms and reduce the associated health risks. In recent years, there has been a growing awareness and research into PCOS, leading to improved diagnostics and a better understanding of the condition's impact on individuals' lives. Efforts to raise awareness, provide support, and develop effective treatment strategies continue to evolve, offering hope and improved quality of life for those living with

PCOS. PCOS, or polycystic ovarian syndrome, affects 6-10% of women of reproductive age and is one of the most common endocrine illnesses. PCOS definition is a dynamic and complex undertaking, not only because a combination of environmental and genetic factors influences PCOS pathophysiology and symptoms, but also because many parts of this illness remain unknown.⁹ Children may exhibit premature pubarche, and adolescents may exhibit early indications of androgenization (such as acne and hirsutism) and monthly irregularity. Although hyperandrogenic symptoms improve with menopause, postmenopausal women with PCOS are at an elevated risk for metabolic and cardiovascular comorbidities.¹⁰ Ovarian enlargement, hyperandrogenism, androgenic alopecia, hirsutism, acne, monthly irregularity, anovulation or oligo-amenorrhea, miscarriage, and infertility are all common physiological signs of this disease.¹¹ Traditional herbal remedies are naturally occurring substances that have had minimal or no industrial processing and have been utilized to cure a variety of ailments. Traditional herbal treatments are receiving a lot of interest in global health discussions. Traditional medicine has established a position in promotion, prevention, cure, and rehabilitation.¹² PCOS is connected with luteinizing hormone (LH) hypersecretion, hyperandrogenism (HA), hyperinsulinemia, menstrual dysfunction, hirsutism, infertility, pregnancy, and neonatal problems.¹³ Fatness, hyperinsulinemia, diabetes mellitus, and irregular uterine hemorrhage are all risk factors for the development of uterine cancer in women with PCOS. Depression and anxiety are more common in PCOS women than in the general population.⁶ Growing clinical and experimental evidence suggests that metabolic abnormalities in PCOS women predispose the patient to type 2 diabetes, cardiovascular disease, and reproductive organ cancers.² Traditional, and modern herbal compositions are gaining popularity in the realm of global health. It is now critical to demonstrate that herbal therapy can compete with other medical professions in terms of scientific rigor and practical application.¹⁴ PCOS, a diverse illness, affects women of

childbearing age, according to the National Institute of Health Office of Disease Prevention. The figure is around 5 million, or nearly 7% of adult females. PCOS is the most frequent endocrine condition, affecting girls between the ages of 18 and 44 years, accounting for 5-10% of females, according to study.¹⁵ PCOS, which is characterized by anovulation, oligomenorrhea, amenorrhea, hyperandrogenism, and polycystic ovaries, frequently exhibits non-reproductive metabolic abnormalities such as obesity, hyperinsulinemia, insulin resistance, and dyslipidemia, with a risk of T2DM.¹⁶ A large-scale survey done across India in 2020 revealed that approximately 16% of female respondents aged 20 to 29 years suffered with PCOS.¹⁷ PCOS is characterized by an increase in the serum levels of luteinizing hormone (LH), an increase in the LH/FSH ratio, and an increase in the amplitude and frequency of LH secretion. The current standard of care for PCOS ranges from lifestyle changes to pharmaceutical therapies. Diet, exercise, and weight loss are all related with lifestyle changes.¹⁸

In 1990, the National Institutes of Health (NIH) hosted an international conference on polycystic ovarian syndrome, at which three distinct criteria for its diagnosis were established, together with the European Society of Human Reproduction and Embryology and the American Society for Reproductive Medicine.⁷ PCOS is often diagnosed with a complete family history, proper laboratory assessment, and the exclusion of other causes of metabolic abnormalities. Several therapy techniques have been tried to treat PCOS, including dietary/lifestyle changes and the use of pharmacological drugs such as oral contraceptive tablets or antiandrogens.¹⁹ PCOS is the most common cause of anovulatory infertility and chorionic anovulation. PCOS is a frequent endocrinopathy in women of reproductive age, and it is linked to metabolic disorders and reproductive failure. Ovarian dysfunction remains the main hallmark, making this disease the leading cause of anovulatory infertility.⁸ The ECS is expressed in peripheral organs that maintain metabolic homeostasis, such as adipose tissue,

pancreas, liver, skeletal muscles, and specific digestive tract elements. The ECS plays a role in human fertility and reproduction, influencing both the female and male reproductive systems.²⁰ According to the World Health Organization (WHO), 1.55 million women aged 15 to 49 years had PCOS in 2017, an increase of 4.47% (2.86-6.37%) from 2007. In Europe, the prevalence of this condition has been found to be 5.6-8%.²¹ The various clinical symptoms of the disease indicate that many metabolic pathways play a role in PCOS development, including: insulin secretion and activity, with genes encoding for insulin receptor (IR), insulin (INS), and insulin-like growth factor (IGF) and its receptor; steroidogenesis; cytochrome P450 activity (CYP 17, CYP 11 alpha); and other metabolic and hormonal pathways, with genes encoding for the androgenic receptor (AR).²² Medical herbs may have a significant role in the treatment of PCOS. These medical herbs have a steroidogenic reaction, express estrogen receptor protein, lower androgens, boost glucose absorption, and improve PCOS patient circumstances.¹ Evidence suggests that 40% of non-pregnancy/non-postpartum women use complementary medicine, while 37% and 28% of pregnant and postpartum women, respectively, use complementary medicine.³ Systems pharmacology is characterized as a translational medicine approach that integrates computational and experimental methodologies to elucidate, validate, and apply new pharmacological concepts to the development of new medications.²³ The development of different individual illnesses is strongly associated to PCOS; they can be generically characterized as endocrine dysfunction, reproductive dysfunction, metabolic dysfunction, and biochemical dysfunction.⁵ PCOS is also linked to other metabolic issues such as insulin resistance, poor glucose tolerance, and diabetes.⁴ The Amsterdam ESHRE/ASMR-sponsored 3rd PCOS Consensus Workshop Group recognized a distinct phenotype distinguished by hyperandrogenism and persistent anovulation from those distinguished by ovarian dysfunction and polycystic morphology in 2011.⁴ Polyphenols, as naturally occurring substances, have recently gained

prominence as a therapy method in PCOS with high treatment success and little side effects.²⁴ We used a network pharmacology strategy in this study to conduct a multilevel analysis to assess the connection between motherwort and PCOS. Network pharmacology is a novel approach to studying drug-disease interactions.²⁵ Metformin, clomiphene, letrozole, and spironolactone are currently used to treat the symptoms of PCOS. However, when consumed for an extended period of time, these substances can cause severe responses.²⁶

1.1 Risk Factors⁵

- Family history of PCOS
- Family history of diabetes
- Family history of infertility
- Obesity
- Fast food diet habits
- Lack of physical exercise

Stress etc.; Despite these some other risk factors are shown in Figure 1.

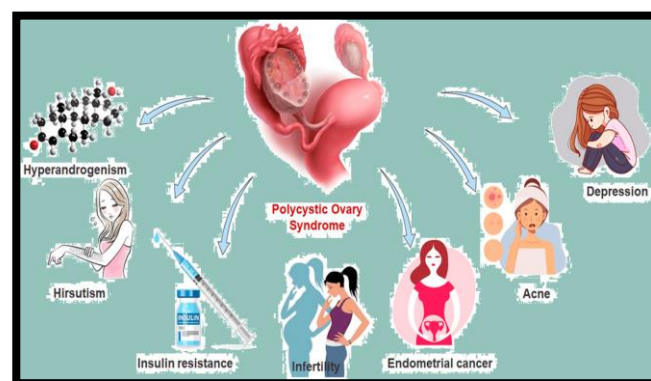


Figure 1: Risk Factors of Polycystic ovarian syndrome

1.2 Pathophysiology of PCOS

FSH stimulates granulosa cell conversion of testosterone to oestrogen by increasing aromatase enzyme and promoting follicular growth. LH initiates oocyte maturation by promoting the formation of theca cells. PCOS increases LH levels while decreasing FSH levels, causing more androgen to be produced and a lower level of aromatase enzyme with immature follicle

formation⁵. PCOS is a complicated condition that involves genetic/environmental variables as well as endocrine aspects such as abnormal gonadotropin secretion, uncontrolled ovarian steroidogenesis, abnormal insulin signaling, and excessive oxidative stress. The first biochemical aberration discovered in PCOS women was dysregulated gonadotropin production, with a predominance of luteinizing hormone (LH) over follicle stimulating hormone (FSH).⁴ Normal follicular growth requires less intraovarian androgen. FSH stimulates granulosa cell conversion of testosterone to oestrogen by increasing aromatase enzyme and promoting follicular growth. LH initiates oocyte maturation by stimulating the formation of theca cells.⁵ Polycystic Ovary Syndrome (PCOS) is a complex endocrine disorder that affects individuals with ovaries, primarily in their reproductive years. The pathophysiology of PCOS is not completely understood, and it is likely influenced by a combination of genetic, hormonal, and environmental factors. It's important to note that PCOS can present differently in different individuals, and not all features may be present in every case. The primary characteristics of PCOS include:

- **Hyperandrogenism:** Elevated levels of androgens (male sex hormones such as testosterone) are a central feature of PCOS. This can lead to the development of male-pattern hair growth (hirsutism), acne, and male-pattern baldness (androgenic alopecia).
- **Ovulatory Dysfunction:** Women with PCOS often have irregular or absent menstrual cycles due to problems with ovulation. This leads to difficulties in achieving pregnancy.
- **Polycystic Ovaries:** On ultrasound examination, the ovaries may appear enlarged and contain multiple small follicles, often described as "cysts." These are actually immature follicles that have not developed properly.

The pathophysiology of PCOS involves several key mechanisms:

- **Insulin Resistance:** Many individuals with PCOS have insulin resistance, which means their cells do not respond effectively to insulin. To compensate, the body produces more insulin, leading to higher insulin levels in the blood. Insulin resistance can contribute to weight gain and metabolic disturbances such as increased risk of type 2 diabetes.
- **Hyperinsulinemia:** Elevated insulin levels stimulate the ovaries to produce more androgens, worsening hyperandrogenism. Insulin also affects the liver, leading to increased production of sex hormone-binding globulin (SHBG), which can decrease the availability of free testosterone.
- **Hormonal Imbalance:** The exact cause of the hormonal imbalance in PCOS is not fully understood, but it involves a dysregulation of the hypothalamic-pituitary-ovarian (HPO) axis. High levels of luteinizing hormone (LH) relative to follicle-stimulating hormone (FSH) are common in PCOS. This imbalance can disrupt normal follicle development and ovulation.
- **Inflammation:** Chronic low-grade inflammation has been associated with PCOS and may contribute to insulin resistance and metabolic problems. Adipose tissue (fat) can produce inflammatory substances that further exacerbate the condition.
- **Genetics:** There is a genetic component to PCOS, as it tends to run in families. Specific genetic variations are being studied for their role in the development of PCOS.

It's important to recognize that PCOS is a heterogeneous condition, and not all individuals will have the same set of symptoms or experience the same underlying mechanisms. Treatment for PCOS often involves managing the individual's specific symptoms and addressing the associated health risks, such as insulin resistance and cardiovascular disease. Lifestyle changes, such as

weight management, dietary modifications, and exercise, are often recommended, along with medications to regulate menstrual cycles, reduce androgen levels, and improve insulin sensitivity.

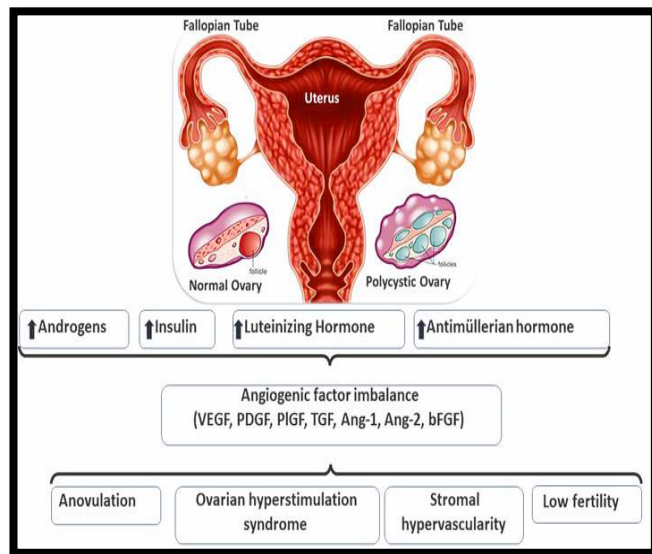


Figure 2: Pathophysiology of PCOS.

Gonadotropins such as LH and FSH hormones, as well as Estrogen, Progesterone, and Testosterone, all have a part in the pathogenesis of PCOS. Excessive prenatal exposure to maternal androgen is thought to contribute to the development of PCOS in the fetus.⁷ Leptin, which regulates energy balance, has been shown to be raised in PCOS patients, therefore having a vital role in infertility, metabolic disorder, insulin resistance, and cardiovascular complications. Ghrelin and Omentin-1, both produced by the central nervous system and visceral adipose tissue, are linked to insulin resistance and obesity in PCOS patients. In PCOS patients, a rise in LDL cholesterol and a reduction in HDL cholesterol levels are related with an increased risk of cardiovascular disease. Various²⁴

➤ **Androgen**

The ovary of teenager with PCOS produces androgens in excess (hyperandrogenism), such as testosterone, which hinders ovarian follicle growth. The ovum and sperm meet for fertilization, and the lack of a completely formed ovum is the cause of PCOS patients' infertility.¹⁹

➤ **Insulin**

Hyperinsulinemia is defined as elevated insulin levels in the blood, which occurs when insulin synthesis exceeds insulin clearance.¹⁹ Excessive ovarian androgen production results from both intrinsic ovarian mechanisms, such as altered steroidogenesis, and external ovarian causes, such as hyperinsulinemia. Androgen exposure results in the characteristic ovarian phenotype of larger ovaries with string-of-pearl morphology and theca interstitial hyperplasia; comparable morphology has been observed in women with congenital adrenal hyperplasia and female-to-male transgender individuals. The skewed interactions between the endocrine, paracrine, and autocrine systems involved in follicular formation may produce ovarian dysregulation in PCOS. Pregranulosa cells form a protective shell around meiotically arrested oocytes in primordial follicles, which form during pregnancy. Follicle morphology in prepubertal and early pubertal ovaries is poorly characterized. The ovarian tissue of prepubertal and early pubertal females differs in terms of follicle morphology and development potential.¹⁴

1.3 Symptoms and Signs of PCOS

- Irregular or absence of periods
- Acne
- Excess body hair (hirsutism)
- Weight gain or difficulty losing weight
- Pain in Pelvic region
- Elevated Luteinizing Hormone (LH) and decreased Follicle stimulating hormone (FSH)
- Infertility (difficulty becoming pregnant)¹²
- Darkening of skin
- Enlarged cyst in ovaries
- Mood swings¹⁹

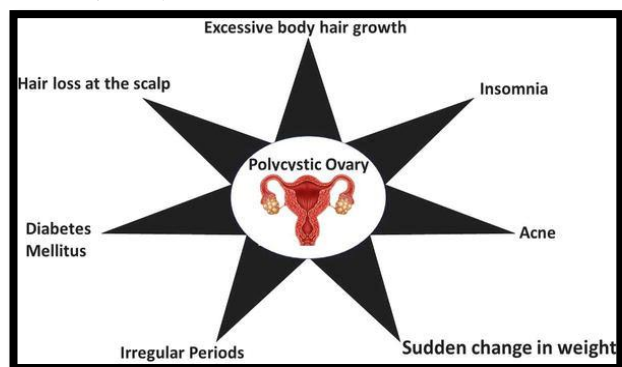


Figure 3: Symptoms of PCOS.

1.4 Causes of PCOS-

- Genetic predisposition
- Strong stimulation in adrenals in childhood
- Raised insulin levels
- Contraceptive pills
- Hormonal imbalance
- Stress¹²
- Accumulation of Toxin
- Inflammation to uterus and ovaries¹⁴

1.5 Associated Disease-

- Cardiovascular disorders
- Diabetes mellitus
- Obesity
- Metabolic syndrome
- Endometrial carcinoma¹²

1.6 Treatment

Many herbs, such as ashwagandha, shatavari, nirgundi, lodhra, ashoka, and others, have been used for human body maintenance for decades. These herbs contain alkaloids, cardiac glycosides, anthraquinones, flavonoids, mucilages, and enzymes that have a variety of pharmacological activities. These herbs can be used alone or in combination to treat PCOS. Some of the botanicals and commercially available formulations are covered here.¹⁴ The treatment of Polycystic Ovary Syndrome (PCOS) is aimed at managing the individual's specific symptoms and addressing the associated health risks. The treatment approach may vary depending on the patient's goals, such as regulating menstrual

cycles, improving fertility, reducing androgen levels, managing insulin resistance, and alleviating cosmetic concerns. Here are some common treatment options for PCOS:

i. Lifestyle Modifications:

- **Weight Management:** For overweight or obese individuals with PCOS, weight loss through a combination of a balanced diet and regular exercise is often the first line of treatment. Even a modest weight reduction can lead to improvements in hormonal balance and insulin sensitivity.
- **Dietary Changes:** A well-balanced diet, low in processed carbohydrates and sugars, can help manage insulin resistance and promote weight loss. Some individuals with PCOS may benefit from a low-glycemic index or low-carbohydrate diet.
- **Regular Exercise:** Physical activity can help improve insulin sensitivity and assist with weight management. A combination of aerobic and strength-training exercises is often recommended.

ii. Medications:

- **Oral Contraceptives:** Birth control pills are commonly prescribed to regulate menstrual cycles and reduce androgen-related symptoms such as acne and hirsutism.
- **Anti-Androgen Medications:** Drugs like spironolactone or flutamide may be used to reduce excess hair growth (hirsutism) and acne by blocking the effects of androgens.
- **Metformin:** This medication is typically used to treat type 2 diabetes, but it can also be prescribed for PCOS to improve insulin sensitivity. It may be especially helpful for individuals with insulin resistance and those who want to improve fertility.
- **Ovulation-Inducing Medications:** Women trying to conceive may be prescribed medications such as

clomiphene citrate or letrozole to induce ovulation.

- **Gonadotropin Injections:** If ovulation-inducing medications are ineffective, gonadotropin injections may be considered, often under the care of a fertility specialist.

iii. Surgery:

In some cases, a surgical procedure called ovarian drilling may be considered to induce ovulation. This involves using a laser or small needles to puncture the ovaries.

iv. Management of Cosmetic Concerns:

Cosmetic concerns like acne and hirsutism can be managed with topical treatments (e.g., creams or ointments) or cosmetic procedures (e.g., laser hair removal or electrolysis).

v. Management of Associated Health Risks:

Regular health screenings for conditions associated with PCOS, such as diabetes and cardiovascular disease, are important. Management may include medications or lifestyle changes.

vi. Mental Health Support:

PCOS can be associated with increased rates of anxiety and depression. It's essential to address the psychological and emotional aspects of PCOS and seek therapy or counseling if needed.

The specific treatment plan for PCOS should be tailored to the individual's needs and goals. It's crucial to work closely with a healthcare provider, such as an endocrinologist or gynecologist, who can assess the patient's unique situation and provide personalized guidance and treatment options. Additionally, lifestyle changes, including a healthy diet and regular exercise, are often recommended as a fundamental part of managing PCOS.

vii. Yoga:

Some asana are suggested to treat PCOS, these are used to improve functioning of endocrine gland and boost the health of uterus and ovaries practicing these asana is important.²⁷

There are many more therapies available for the treatment of PCOS are summarized below in Table 1.

Table 1 List of medicinal systems and their procedure for the treatment of PCOS.²⁷

S. No.	Therapy	Procedure
1.	Ayurvedic Therapy	Ayurveda provides a number of unique and personalized therapies to help reduce and eradicate PCOS symptoms. Ayurvedic treatment includes nutrition, herbal medicine, and lifestyle adjustments. PCOS, according to Ayurveda, is made up of doshadhatu and up dhatu, and it does not correlate the condition of a single disease, but rather symptoms similar to those of yonivyapad (arajaska, lohitakshayav, hyapuspaghni, and jatiharini).
2.	Triidosha	Vatta -Menstrual irregularities are deplorable & Shatavari is used to treat pain follicular impact, hormonal influence, maturity, and satapushpa is employed as an alternative to menstrual irregularity analgesic. Pitta -Hirsutism, acne, cardiovascular disease, and heart problems. Manjistha and Ashoka were previously used to cure hirsutism, while neem and Kutki was once used to treat acne. Kapha -Weight gain, cyst formation, and depression are all symptoms of this condition. Chandra Prabha, Shatavari, Manjistha, Shatapushpa, and Guggul are examples of herbal medicine.
3.	Panchakarma	Vamana (emesis therapy)- It aids in the elimination of excess Kaphadosha in weight loss therapy. Virechana (puration therapy)- It regulates hormones by eliminating heat from the small intestine and liver, lowering pitta. Basti (enema)- Both Uttara and rectal Basti can help ladies with vaginal and uterine problems. The reproductive system is cleansed and nourished with Basti. Olation (massage) and Fomentation (sweat producing)- Aid in the cleansing and purification of the body. Nasya -It regulates the menstrual cycle by stimulating the limbic system and the

		olfactory nerve, which govern the hypothalamic release of Gonadotropin Releasing Hormone (GnRH).
4.	Aartaava-kshaya	Artava kshaya is a disease induced by vayu and kapha imbalances, resulting in increased menstrual flow and pain. Rakta is metabolized by Dhatwangi and Bhutangi, resulting in the creation of Upadhatu from Rasa within a month. It is a type of menstrual cycle disease. Aartava is an Upadhatu that emerges from Rasa once a month. PCOS can be classified based on Dosha, Dhatu, and Upadhatu involvement.
5.	Natural cures from ayurveda	Ayurvedic medicine is a holistic approach to healing. Treatment of hormonal imbalances, avoidance of high cholesterol, and treatment of obesity Insulin resistance treatment Herbs used in PCOS therapy are-liquorice, aloe vera, flax seed, fennel, cinnamon, chaste berry, black cohosh, green tea, amla, sesame, pumpkin, tulsi, curcumin.
6.	Unani therapy	The Unani system comprises remedies derived from ancient plants, animals, and minerals. Based on cellular and hormonal principles, the causes of infertility in PCOS and obese women differ in the allopathic and Unani systems. Your menstrual cycle, nutrition, sleep, bowel motions, physical activity, mental/emotional state, medications, and addiction will all be discussed with your doctor. In this method, the drugs of choice are Withania somnifera (Ashwagandha) and Tribulus Terrestris Linn. (Kharekhask). The Golden Unani concept is used as a preventative approach. Islahe jigar/ Elimination of existing causes (metabolic correction)
7.	Siddha therapy	The siddha system's menstruation physiology contains vaatham, kapham, and pitham. Vaatham promotes follicular maturation and migration, as well as ovum rupture and release. Pitham explains the nature of hormones that aid in follicle rupture (transformation energy). Kapham is beneficial to the reproductive system. PCOS arises when Kapham's blockage of Vaatham and Pitham impedes mobility

		and change. The typical menstrual cycle is governed by Vaatham and Kapham. Amenorrhoea is caused by a hormonal imbalance caused by a clogged channel. Amenorrhoea, dysmenorrhoea, and constipation are caused by a decrease in Vaatham. Obesity is induced by an excess of Pitham and Vaatham in the body.
8.	Homeopathic therapy	Homeopathy addresses the underlying cause of disease rather than just the symptoms. Homeopathic treatments have no side effects when administered correctly. There are approximately 150 highly effective homeopathic treatments for PCOS. Because PCOS involves multiple organs and complex systems, treating it holistically is the best option. Homeopathic treatments might help to normalize the menstrual cycle and induce ovulation. Homeopathic remedies are suited to an individual's personality, habits, needs, and individuality. Some great homeopathic remedies for PCOS include: Lycopodium—excessively long menstrual cycle with right stomach pain Pulsatilla- menstruation is irregular or absent for months at a time in light, sensitive women. Menstruation in Thuja-worried women is light, black, clotted, and painful. Sepia- late and infrequent menstruation, with bearing down discomfort exacerbated by the slightest amount of movement. Heavy menstruation with dragging in the back that is relieved by moving.
9.	Allopathic therapy	There is no PCOS cure available anywhere in the universe. Clomiphene citrate and metformin are the most widely used and successful allopathic treatments nowadays.
10.	Surgical treatment	Laparoscopic ovarian drilling (laser, electrocautery, multiple biopsy) Women who are resistant to clomiphene The mechanism remains a mystery. It could be because of stroma destruction (the production of androgen). Oophorectomy (ovarian removal) (rarely performed) When you are unable to bear children and your symptoms are severe, Ovarian wedge resection (rarely performed)

2. Need for Herbal plants used in PCOS

❖ Herbs That Increase Ovulatory Cycles

Prolactin fluctuations and hormonal imbalances will have a substantial impact on ovulatory cycles. Reduced prolactin levels and improved hormonal balance improve ovulatory cycles and the treatment of PCOS. Vitex and turmeric are two herbs that can help with PCOS by enhancing ovulatory cycles.

❖ **Herbs with Anti-Androgen Properties**

Elevated androgen levels in the blood are also one of the key causes of PCOS. PCOS is treated with medicines that have anti-androgen action. Herbs with anti-androgenic properties, such as *Glycyrrhiza glabra*, *Linum usitatissimum*, *Mentha spicata*, *Cocus nucifera*, and *Punica granatum*, may be effective in the treatment of PCOS.

❖ **Herbs That Restore Glucose Sensitivity, Estrus Cyclicity and Enzyme Activity**

One of the most common symptoms of PCOS in women is decreased insulin sensitivity and high blood glucose levels. PCOS treatment includes medications that improve insulin sensitivity. Herbs with similar mechanisms, such as *Cinnamomum cassia* and *Aloe vera*, can lower blood glucose while also regulating the estrus cycle and may be beneficial.

❖ **Herbs That Promote FSH and Decrease LH Secretions**

A typical consequence of PCOS is high LH levels and low FSH levels. Drugs that can increase FSH levels while decreasing LH concentrations are effective in the treatment of PCOS. Herbs with such effects as *Foeniculum vulgare*, *Panax ginseng*, and *Cimicifuga racemosa* are useful for the treatment of PCOS.

❖ **Effective Ovulation Induction Agents**

Infertility or recurrent pregnancy termination due to the patient's lack of carrying capacity is the most common consequence of PCOS. PCOS treatment includes ovulatory stimulant medications. Herbs that have the same function and induce ovulation as *Zingiber officinalis* and

Tribulus terrestris may be useful in the treatment of PCOS.¹⁷

The use of herbal plants and natural remedies in the management of Polycystic Ovary Syndrome (PCOS) has gained attention and popularity due to its potential to address some of the symptoms and underlying factors associated with the condition. While herbal remedies should not be seen as a sole replacement for medical treatments, they can be a valuable complementary approach for some individuals with PCOS.

2.1 Reasons for the use of herbal plants in PCOS

- **Hormonal Balance:** Many herbal plants have been traditionally used for their ability to regulate hormones, which is a key aspect of PCOS management. For example, chasteberry (*Vitex agnus-castus*) is believed to help balance the menstrual cycle by regulating the production of certain hormones.
- **Insulin Sensitivity:** Insulin resistance is a common issue in PCOS, and some herbs, such as cinnamon, fenugreek, and berberine, are believed to improve insulin sensitivity and help manage blood sugar levels, which can be beneficial for individuals with PCOS.
- **Weight Management:** Weight gain and difficulty in losing weight are common challenges in PCOS. Certain herbal remedies, like green tea and ginger, may help support weight management efforts when combined with a healthy diet and exercise.
- **Reducing Inflammation:** Chronic inflammation is associated with PCOS and its symptoms. Turmeric, with its anti-inflammatory properties, is often considered a helpful herb for managing inflammation in the body.
- **Improving Fertility:** Some herbal plants, such as maca root and black cohosh, are thought to enhance fertility in individuals with PCOS by promoting ovulation and regulating the menstrual cycle.

- **Stress Reduction:** Stress can exacerbate PCOS symptoms, and herbal remedies like adaptogenic herbs (e.g., ashwagandha and rhodiola) may help reduce stress and improve overall well-being.
- **Minimal Side Effects:** Herbal remedies are generally perceived as having fewer side effects compared to some pharmaceutical medications, making them an attractive option for individuals seeking natural alternatives.

Table 2. List of herbal Plants used in PCOS

S. No.	Scientific Name	Family	Plant name	Plant part used	Benefits	Reference
1.	<i>Saraca asoka</i>	<i>Fabaceae</i>	Ashoka tree	Seed, bark, flowers	May act against cancer	26
2.	<i>Cinnamomum zeylanicum</i>	<i>Lauraceae</i>	Cinnamon	Stem, bark	Reduce the cholesterol level, bp and inflammation	26
3.	<i>Tephrosia purpurea</i>	<i>Fabaceae</i>	Wild indigo	Seed	Used for infections such as common cold, swine flu, malaria, typhoid	26
4.	<i>Moringa olifera</i>	<i>Moringaceae</i>	Horse radish tree	Root, stem, leaves, fruits	Prevent the growth of colon, lung, stomach cancer cells	26
5.	<i>Trigonella foenum-graecum</i>	<i>Fabaceae</i>	Fenugreek	Seeds, leaves	Reduce the risk of heart and blood pressure conditions, pain relief	26
6.	<i>Sesamum indicum</i>	<i>Pedaliaceae</i>	Sesame	Seeds	May aid blood sugar control, combat arthritis pain and	26

					lower cholesterol	
7.	<i>Saccharum officinarum</i>	<i>Poaceae</i>	Sugarcane	Root, Stem	Store energy in the form of healthy fats	26
8.	<i>Azadirachta indica</i>	<i>Melastomaceae</i>	Neem tree	Fruit, Bark, Leaves, Flower	Efficacious against a variety of skin disease, septic sores, infected burns	26
9.	<i>Zingiber officinale</i>	<i>Zingiberaceae</i>	Ginger	Rhizome	Relieve nausea and vomiting and aid digestion	26
10.	<i>Inula racemosa</i>	<i>Asteraceae</i>	Pushkarmool	Rhizomes, root	It may have anti-fungal, analgesic, anti-bacterial, anti-oxidant, anti-allergic properties	26
11.	<i>Cinnamomum tamala</i>	<i>Lauraceae</i>	Indian cassia, Tejpatta	Seeds	Used for diabetes, cough, common cold, rheumatoid arthritis	26
12.	<i>Mesua ferrea</i>	<i>Calophyllaceae</i>	Ironwood tree	Flowers	It is hemostatic that stops bleeding and is also an anti-inflammatory	26
13.	<i>Nelumbo nucifera</i>	<i>Nelumbaceae</i>	Sacred lotus	Flowers, rhizome	Act as anti-oxidant properties and anti-bacterial agent	26

14.	<i>Myristica fragrans</i>	<i>Myristicaceae</i>	Nutmeg	Leaves, fruit	Which help protect against serious conditions such as cancer, heart disease and liver disease	26
15.	<i>Pterocarpus marsupium</i>	<i>Fabaceae</i>	Malabar kino	Bark, leaves	Helps to control blood sugar level and also act as blood purifier	26
16.	<i>Ficus religiosa</i>	<i>Moraceae</i>	Peepal tree	Bark, Root, Leaves	Helpful for cough, asthma, toothache, haematuria (blood in urine), migraine, eye troubles	26
17.	<i>Hedychium spicatum</i>	<i>Zingiberaceae</i>	Spike ginger lily	Root	Used to treat indigestion, liver treatment, skin problems, stomach ulcers	26
18.	<i>Rubia cordifolia</i>	<i>Rubiaceae</i>	Indian madder	Root	It reduce and heal redness, joint pain, swelling, arthritis	26
19.	<i>Panax ginseng</i>	<i>Araliaceae</i>	Ginseng	Leaf, stem	May boost energy, lower blood sugar level, reduce stress, treat diabetes, manage sexual dysfunction in men	5

20.	<i>Tribulus terrestris</i>	<i>Zygophyllaceae</i>	Puncture vine	Leaves, fruits	Treatment of urinary affection, polyuria, piles dysuria, heart disease	5
21.	<i>Gymnema sylvestris</i>	<i>Asclepiadaceae</i>	Gymnema	Leaves, extract contain gymnemic acid	Improves cholesterol and triglyceride levels, reducing heart disease risk	5
22.	<i>Punica granatum</i>	<i>Punicaceae</i>	Pomegranate	Extract from the seeds	Good source of fiber, may help to improve workouts, heart health and kidney health	5
23.	<i>Aloe barbadensis</i>	<i>Liliaceae</i>	Aloe	The green part of leaf	Very hydrating and provides extra lubrication to the body that helps it to remove buildup chemicals	5
24.	<i>Symlocos racemosa</i>	<i>Symlocaceae</i>	Lodhra (Iodh)	Root, bark, leaves	Helps in quick healing of wound, decreases swelling and brings back the normal texture of skin	5
25.	<i>Linum usitatissimum</i>	<i>Linaceae</i>	Flaxseed	Seeds	Helps regulate blood sugar, promote weight loss and prevent constipation	5

26.	<i>Curcuma longa</i>	<i>Zingiberaceae</i>	Turmeric	Stems (rhizomes)	Reduce insulin resistance, lower blood sugar level and increase your HDL or good cholesterol level	5
27.	<i>Glycyrrhiza glabra</i>	<i>Leguminosae</i>	Liquorice	Roots	Helps in maintaining the levels of male hormones	5
28.	<i>Cocus nucifera</i>	<i>Arecaceae</i>	Cocunut	Stem and its derivatives	Help regulate your blood sugar and insulin secretion level	5
29.	<i>Nigella sativa</i>	<i>Ranunculaceae</i>	Kalaunji/Black cumin	A fruit with seeds	Regulating menstrual cycles, enhancing fertility, balancing hormones	15
30.	<i>Asparagus racemosus</i>	<i>Asparagaceae</i>	Shatavari	Dried roots	Stops the formation of new cysts and also prevents the remission of the disease	15
31.	<i>Tinospora cordifolia</i>	<i>Menispermaceae</i>	Guduchi	Root, stem, leaves	Helps in revitalizing body tissues and lowering insulin resistance	15
32.	<i>Ocimum sanctum</i>	<i>Lamiaceae</i>	Tulsi	Leaves, stem, flower, root, seeds	Control androgens leading to excessive facial hair growth and acne, lower	15

					blood sugar levels	
33.	<i>Withania somnifera</i>	<i>Solanaceae</i>	Ashwagandha	Root	Reduce androgens levels	14
34.	<i>Vitex agnus-castus</i>	<i>Lamiaceae</i>	Nirgundi(chasteberry)	Root, leaves, flowers, fruits, bark	Acts against insulin resistance of the body, decrease androgen levels and has similar activity of estrogen	14
35.	<i>Cimicifuga racemosa</i>	<i>Buttercup</i>	Black cohosh	Root and rhizome	Helps to maintain hormone balance, regulate the cycle and blood flow	14

3. Conclusion- PCOS (polycystic ovarian syndrome) is one of the most frequent female reproductive illnesses. PCOS therapies are primarily aimed at normalizing the ovary's functioning. Medications are used to control menstrual cycles, induce ovulation, and treat insulin resistance, hyperandrogenism, and obesity-related PCOS. Varied medicines are used to treat PCOS with varied symptoms; however successful therapy for PCOS remains a challenge. Some medicinal herbs that have been evaluated have multiple potential therapeutic effects in polycystic ovarian syndrome, insulin resistance, hyperandrogenism, oligo/amenorrhea, and obesity. As a result, further pre-clinical and clinical research is needed to investigate the efficacy of herbal medications in PCOS. This review aids in understanding the efficacy of medicinal plants in the treatment and management of polycystic ovarian syndrome.

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