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ROLE OF HERBS IN THE TREATMENT OF POLYCYSTIC OVARIAN SYNDROME

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Abstract

One of the most significant gynecological problems affecting women of reproductive age is polycystic ovarian syndrome (PCOS), a neuroendocrine metabolic disorder marked by irregular menstrual cycles. The secretory rate and complicated metabolism of estrogens and androgens are impaired in persons with PCOS. However, the limits of allopathic medications and the effective therapeutic effects of natural drugs draw PCOS patients to natural remedies. Ovulatory hyperandrogenism, which affects roughly 20–25% of women of reproductive age and is associated with a polycystic ovary shape, is believed to be one of the main reasons of infertility in women. Women with PCOS are more likely to experience elevated insulin levels, irregular periods, hypertension, and metabolic abnormalities. To treat PCOS, herbal remedies such as aloe vera, Tulasi, fennel, flax seeds, pumpkin seeds, and cinnamon are employed. Reduced insulin resistance, decreased ovarian weight, increased ovulation, and decreased hyperandrogenism are all brought on by herbal extracts that include phytoestrogens.

Keywords: Polycystic ovarian syndrome, infertility, insulin resistance, and hyperandrogenism.

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Introduction

Polycystic ovarian syndrome (PCOS) is a compounded disorder marked by elevated androgen levels, menstrual deformities, and cysts on either one or both ovaries ⁽¹⁾. According to the WHO (World Health Organization), 116 million women worldwide, or nearly 3.4 percent, have PCOS. Polycystic ovarian syndrome (6.5–6.7%) is the most frequent endocrinopathy condition detected in premenopausal women. Polycystic ovarian syndrome, first recognized by Stein and Leventhal in 1935, is linked to long-standing oligo anovulation, polycystic ovarian morphology, as well as psychological and metabolic deformity ⁽²⁾. The major underlying factors found in women with PCOS are improper metabolism of estrogen, androgen, and androgen production in a controlled way ⁽³⁾. Indeed, theca cells produce androgens in response to luteinizing hormone (LH) therefore the blood levels of androgens rise in people with PCOS. Normally in each monthly cycle, one of the follicles in the ovaries grows and ripens to deliver an egg called an ovum. This

ovulation process is stimulated by bodily hormones. Due to hormonal imbalance in PCOS, sometimes these follicles do not unspool an egg. When the eggs do not mature properly, ovulation does not occur, so one does not menstruate regularly. There are many immature follicles in the ovaries that release male hormones these immature follicles are called cysts. The excess androgen and overproduction of male hormones are linked to 4 conditions.

- One-Genes studies show that PCOS runs in families, and many genes will contribute to this condition.
- Second-Insulin resistance up to 70% of women with PCOS have insulin resistance which means that their cells cannot use insulin properly and obesity is the major cause of insulin resistance.
- Third inflammation increased levels of inflammation in the body
- Four-lifestyle and psychological conditions, and is also linked with stress, modern faulty lifestyle, anxiety, and depression.

For the time being, the standard care therapy for women with PCOS ranges from lifestyle modification to pharmacological interventions. Lifestyle modifications are associated with diet, weight loss, and exercise. Pharmacological interventions include thiazolidinediones, and estrogen-progestin combination (oral contraceptives). There has been special attention to

medicinal plants since ancient times and today with numerous studies performed, worthwhile and beneficial medicinal plants are discovered ⁽⁴⁾. As the side effects of these medicines and their recognition have significant importance, so many studies including randomized controlled trials, case studies, and animal experiments are investigated for herbal drugs. Women with PCOS can approach an alternative therapy to manage such infertility problems. Hence the current scientific research focused on identifying the proven evidence from preclinical evaluation and summarizing the importance of herbal medicines in polycystic ovarian syndrome. The merits of herbal therapy over conventional therapy are that it is safer with fewer side effects, and the presence of multiple active compounds in medicinal herbs provides a potentiating effect ⁽⁵⁾. This hormone imbalance causes them to skip menstrual periods and makes it harder for them to get pregnant. Besides unpredictable hormonal behavior, this condition can trigger diabetes, infertility, Acne, and excessive hair growth. PCOS mainly affects the body's hormone balance in females. The following steps will help females to decrease their androgen levels in the body:

Maintaining healthy body weight: BMI (body mass index) ranges from 18.5-24.9 considered ideal and healthy for females, and above 30 considered obese and not healthy. Maintaining a healthy body weight or weight loss helps in enhancing overall body cholesterol levels, and reduces the risk of high blood pressure, heart diseases, diabetes maintaining ideal insulin levels

and androgen levels that also restore the ovulation phase in the menstrual cycle. Consult a dietitian for a weight loss program to reach a healthy BMI.

Limiting carbohydrate consumption: If you have PCOS follow a low-carb diet or complex carbohydrates diet that helps in maintaining insulin levels. Eat fish, meat, eggs, vegetables that grow above ground, and natural fats (like sunflower seeds, pumpkin seeds, sesame seeds, and butter), and avoid sugar and starchy foods (like potatoes, bread, rice, pasta, and beans).

Do regular exercise and be active: If you have PCOS doing regular exercise and becoming active will help in regulating blood sugar levels and keep your weight under control.

Some evidence suggests that stress may play a role in developing PCOS. Stress can affect the body's hormonal balance and may contribute to developing PCOS. For example, stress can lead to the production of the hormone cortisol, which can interfere with the production of other hormones such as estrogen and progesterone this hormonal imbalance can disrupt the menstrual cycle and lead to the development of PCOS. It is important to find ways to manage stress and take care of your mental health if you have PCOS. There was renewed interest in the surgical treatment of PCOS when laparoscopic treatment became popular. Newer technologies such as ultrasound to image ovaries were a breakthrough in the history of PCOS ⁽⁶⁾.

PCOS is now considered one of the most common disorders occurring in women. The exact statistical prevalence is unclear. The global prevalence of PCOS varies between 2.2 and 26%. The Asian country's percentage of women suffering from PCOS is around 2 to 7.5%, and in Sri Lanka, the percentage is around 6.3%. As per the Indian data, the % of PCOS in Indian women is around 9% to 22% ⁽⁷⁾. It is estimated that women with PCOS have the highest risk of obesity and hyperandrogenism. Newer technologies such as ultrasound to image ovaries were a breakthrough in the history of PCOS. In around 75% of instances, the cause of infertility is a lack of ovulation ⁽⁸⁾. PCOS is the primary cause of infertility in persons who have it. It is associated with an increased risk for metabolic conditions such as insulin-independent diabetes, dyslipidemia, obesity, endothelial dysfunction, and chronic low-grade inflammation. If a diagnosis is early and managed properly with lifestyle modifications, the onset of type 2 diabetes mellitus may be prevented. Regular measurement of androgen levels, ultrasonography, the morphology of polycystic ovaries, and the wide heterogeneity of polycystic ovarian syndrome are the currently used parameters to predict PCOS ⁽⁹⁾. For instance, in laparoscopy, cysts are removed from the ovaries through a surgical procedure. Drugs including Nafar Elin, troglitazone, clomiphene, metformin, and spironolactone are currently employed for the treatment of PCOS. However, these drugs can cause major complications with long-term usage, including menstrual abnormalities, nausea, vomiting, gastrointestinal disturbances, weight gain increased insulin resistance, less compliance, poor efficacy, and more contraindications ⁽⁹⁾. Hence, there is a pressing need to identify and develop drugs of plant origin, which are much more effective than existing allopathic drugs. Recently, the use of herbal medicines by healthcare professionals to treat PCOS has become a major turning point. Herbal medicines are extracts of entire plants or any part of a plant that shows a major therapeutic effect, with fewer side effects when compared to conventional therapy. They have a significant role in prevention, cure, and rehabilitation. Herbal drugs are complex interventions with the potential for synergistic and antagonistic interactions between compounds. They are essential for the management of PCOS and have fewer side effects than allopathic medicines. The regular usage of herbs is safe and more efficacious in treating PCOS and suppressing the events that contribute to the development of cysts in PCOS ⁽¹⁰⁾. Currently, herbal remedies are playing a prominent role in treating various chronic disorders, including PCOS. The use of herbal medicines and modifications to the diet may help in treating PCOS more effectively ⁽¹⁰⁾. Different herbs will exert their activity against PCOS through a variety of mechanisms, including the suppression of prolactin levels, anti-androgenic activity

promoting follicle-stimulating hormone (FSH), decreasing

luteinizing hormone (LH), the induction of ovulation, and restoration of glucose sensitivity, estrus cyclicity, and enzyme activity.

History of polycystic ovarian syndrome

Polycystic ovarian syndrome has a complex history. It was first described in 1935 by Drs. Stein and Leventhal noted enlarged ovaries with multiple cysts in some women with irregular periods and infertility. Initially called Stein-Leventhal syndrome, it was later renamed PCOS. Over the years, research has revealed its multifactorial nature, involving hormonal imbalances, genetic predisposition, and lifestyle factors. Diagnostic criteria and treatment approaches have evolved. Ongoing research continues to deepen our understanding of PCOS and improve therapeutic options ^[11].

Types of pcos:

PCOS is a hormone-related disorder and affects irregular periods. PCOS is categorized into four main types:

- Insulin resistant pcos furthermore, it will cause an increase in blood pressure
- Inflammatory PCOS
- Post pill pcos
- Hidden cause of PCOS Insulin resistant pcos:

This type of PCOS is one of the common types caused by various reasons like pollution, smoking, trans fats, and sugar. In this, ovulation is prevented due to the high level of insulin. It also triggers the ovaries to produce testosterone.

If you are on the borderline or are diabetic, your glucose levels are not normal, have a high insulin level, and are overweight, then there is a probability of you having insulin resistance

PCOD. It affects up to 70% of all Pcos. Your cells do not recognize that insulin exists in the body, causing insulin to rise over time and cause the following: Irregular periods, Excess weight, hormonal acne, and Hirsutism ^[12].

Inflammatory pcos:

Elements like inflammatory dietary, imbalanced hormones, toxins in surroundings, and stress lead to inflammatory pcos. This type prevents her body from ovulating and an increase in androgen is observed.

Skin allergies, deficiency of vitamin D, headache, Blood count is not as per the requirement, and an increase in the thyroid are some symptoms pointing towards inflammatory pcos.

Magnesium-containing supplements will help as they contain anti-inflammatory properties. Avoid taking the stress. It will take around 10 months to improve as it is a slow process. It happens when the immune system tries to protect against the foreign body but when it becomes overreacted creates such conditions. It is due to inflammation; ovulation is prevented hormones get imbalanced and androgen is produced. It can be caused by stress. People with PCOS have a type of long-term, low-grade inflammation that leads polycystic ovaries to produce androgens. Symptoms include brain fog, joint

pain, headache, Fatigue, gut disturbance, skin rash, thyroid disorders, and decreased ovulation.

Post pill pcos:

This type of PCOS is a common type of PCOS. You can observe the development of this type because of birth control pills that suppress ovulation.

Many women face these effects and they are temporary, they end when the effect of the pill is. However, some women fail to resume ovulating even after the effects of the pills are over. If the ovulating process takes longer than months to resume, it is consulting a doctor.

This occurs due to the surge of androgens produced when one stops taking the pill. The oral contraceptive pills will suppress ovulation.

Discontinuing the pill, and allowing the body to reestablish its natural hormonal balance. We can work to assist in proper detoxification while reducing androgens naturally.

Hidden cause of pcos:

Hidden Pcos are easy to understand. It can cause thyroid disease as a deficiency of iodine affects the ovaries, and a deficiency of zinc also leads to this type of PCOS.

It can be observed in a woman who follows a vegetarian diet. The artificial sweetener is another reason for this type of PCOS. Organs involved in pcod

- ovary: The female gonad organ is present on either side of the uterus.
- adrenal gland: The gland that is placed just above both kidneys.
- pancreas: Gland that produces insulin in our body.
- pituitary gland: The gland just below the brain, which is responsible for all the hormonal control.

In PCOS, the ovaries produce more androgen, which inhibits the maturation of ovarian follicles. If a woman has PCOS, she will have trouble getting pregnant as her ovum is unavailable ^[13]. The ovary which is normally oval in shape will have many cysts within it. Histological features of pcos

- Histological features of PCOS include:
- Whole ovarian hypertrophy
- Thickened capsule (>100)
- Increased number of subcapsular follicle cysts
- Scarcity of corpora lutea or albicantia
- Hyperplasia and fibrosis of the ovarian stroma
- Premature luteinization of the theca cells ^[3].
- Scarcity of corpora lutea or albicantia, hyperplasia, and fibrosis of the ovarian.

Etiology

The major etiology behind PCOS is primarily disordered gonadotropin secretions, ovarian and adrenal hyperandrogenism, and disorder of insulin resistance, The regulation of gonadotropin-releasing hormone

(GnRH) is uncontrolled, which may lead to increased luteinizing hormone (LH) and decreased FSH; this may lead to the suppression of the response of ovarian follicles to FSH, elevated anti-Müllerian hormone (AMH), follicular arrest and the increased secretion of testosterone, estradiol, and dehydroepiandrosterone. Disrupted ovarian synthesis of steroid hormones in these diseases may result in an increase in circulating androgens, which may be more pronounced in women with polycystic ovarian syndrome [14]. Hyperinsulinism and hypogonadism are considered as the capability of insulin to stimulate gonadal and adrenal androgen production, and this hyperinsulinism is also one of the major risk factors of PCOS [14]. In PCOS, immature follicle development was observed due to increased LH levels and decreasing levels of FSH. Similarly, the increased production of androgens and reduced blood levels of aromatase were observed. Excessive androgens in PCOS are due to elevated abdominal fat, and this may lead to hyperinsulinemia and dyslipidemia. An increase in cell androgen production and hyperinsulinemia reduces sex hormone binding globulin (SHBG) to increase circulating testosterone.

Symptoms

These symptoms differ from woman to woman but to needs to have at least two of the following issues:

- Acne
- Darkening of the skin
- Excessive hair growth on body and face
- Fatigue
- Fluid retention
- Infertility
- Irregular periods
- Menstrual pain
- Mood swings
- Ovarian cysts
- Weight gain
- High blood pressure
- Diabetics
- The skin of the neck and underarms is covered with dark-colored patches
- Pelvic pain is generally chronic.

Pathophysiology of pcos

The interplay between neuroendocrine levels, metabolic levels, and ovarian anomalies may contribute to the development of polycystic ovarian syndrome. However, insulin resistance and obesity are the leading causes of PCOS in the majority of people. Elevated insulin levels cause abnormalities in the hypothalamic-pituitary-ovarian axis. This deviation may lead to the suppression of insulin effect on post receptors, the elevation of blood vessels of fatty acids, androgens, and cytokinins such as TNF-alpha and IL-6, and the maximum deposition of leptin and resistin in adipocytes in the abdomen. Elevated

androgen levels in the blood may cause adipocytes to inhibit adiponectin, resulting in an insulin sensitivity reduction as well as an insulin increase in the blood. However, insulin may also stimulate the synthesis of Aldo-keto reductase Ic3 (AKR1C3), which in turn promotes the release of adipose androgens present in females. Oxidative stress also has a role in the etiology of many reproductive problems and anomalies in certain women, including infertility, repeated abortions, and preeclampsia. Reduction in blood amino acid levels was found to be significantly induced in Pcos women as compared to healthy controls [4]. In addition to amino acids a deficiency in vitamins may also induce metabolic abnormalities that might lead to the development of cysts in the ovary. In a few cases, genome variation in susceptible genes such as cytochrome P1A1, CYP17A1, (CYP1A1), CYP11A, CYP19, 17beta-hydroxysteroid dehydrogenase (HSD17B6), androgen receptor (AR), insulin receptor substrate 1 (INSR), sex hormone-binding globulin (SHBG), insulin receptor substrate 1 (IRS1) and peroxisome proliferator-activated receptor gamma (PPAR-gamma) is responsible for PCOS [2].

Risk factors of pcos

Polycystic ovarian syndrome has several risk factors, including:

1. Family history: Having a family member with PCOS increases the risk.
2. Insulin resistance: PCOS is associated with insulin resistance, which can lead to higher insulin levels in the body.
3. Obesity: Excess weight can exacerbate insulin resistance and hormonal imbalances, increasing the risk of PCOS.
4. Hormonal imbalance: High levels of androgens (male hormones) and irregular menstrual cycles are common in PCOS.
5. Age: PCOS can occur at any age, but it's often diagnosed during the reproductive years.
6. Stress: Chronic stress may exacerbate hormonal imbalances and contribute to the development of PCOS.
7. Environmental factors: Exposure to certain environmental pollutants or endocrine-disrupting chemicals may increase the risk of PCOS, although more research is needed in this area.

Diagnosis

Medical history:

- The doctor asks questions about your menstrual periods, weight changes, and other symptoms.

Physical examination:

- It includes weight, height, and blood pressure measurements.
- Examination of unwanted hair growth

Pelvic examination:

- The doctor checks for any swellings or

growths in the pelvic region.

Blood tests:

- Tests for female as well as male hormones
- Thyroid tests
- Cholesterol and triglyceride
- Blood sugar levels.

Ultrasonography:

- The USG may show enlarged ovaries and cysts.
- Ayurvedic Herbal Remedy for Polycystic Ovarian Syndrome:

There are several herbs are used for the treatment of polycystic ovarian syndrome. The herbs are also used for correcting hormonal imbalance, treating obesity, and also treat insulin resistance. The herbs like:

- Aloe vera
- Amla
- Tulsi
- Pumpkin seeds
- Flax seeds
- Fennel seeds
- Aloe vera:
- Synonym: Kumari mussbar
- Biological source: Dried latex leaves of various species of aloes, mainly aloebardensis.
- Family: Liliaceae
- Parts used: Leaves and juice.

Aloe vera has been discovered to have antimicrobial, and anti-carcinogenic. Anti-viral, immunomodulatory, antioxidant, anti-inflammatory, skin protecting, and wound healing qualities, in addition to managing PCOS and being antidiabetogenic. Co-treatment of the inductive agent (letrozole) with the aloe vera gel prevented the development of the PCOS phenotype' Aloe vera gel formulation exerts a protective effect against the PCOS phenotype by restoring the ovarian steroid status. And altering key steroidogenic activity. This can be attributed to the Phyto components present in the extract [15].

Flax seed:

- Synonym: linseed, Flax, linseed oil, grain
- Botanical name: Linum usitatissimum
- Family: Linaceae
- Biological source: It is obtained from dried seeds of Linum usitatissimum

The lignans flax seeds may help both menopausal and postmenopausal women alike who have PCOS. Flax seeds contain both soluble and insoluble fiber, which can help regulate blood sugar, promote weight loss, and prevent constipation. Soluble fiber can also help reduce cholesterol levels.

Amla:

- Synonym: Emblica, Indian gooseberry, Emblica,

myrobalan

- Biological source: Dried as well fresh fruits of the plant Emblica officinalis
- Family: Euphorbiaceae

Amla is a wonderful detoxifying and cholesterol-reducing agent. Its free radical scavenging and anti-inflammatory effects can help to restore the hormonal balance in the body. If you struggle with hormonal issues due to PCOS, then it is best to keep amla juice handy. Amla juice is enriched with vitamin C, calcium, and iron.

Tulsi:

- Synonym: Ocimum sanctum, Ocimum tomentous
- Biological source: Tulsi consists of fresh and dried leaves of Ocimum species like Ocimum sanctum L. and Ocimum basilicum L. etc
- Family: Labiatea
- Parts used: Entire herb (leaves, stem, root, seeds,)

The androgens are not utilized because the ovulation process does not take place. Also, the SHBG protein produced by the liver is pretty low. This is why women have excessive facial hair growth and acne, and trouble conceiving. Tulsi can control androgens and moderate insulin levels. It's also an excellent antioxidant. Chew at least 10 leaves early in the morning on an empty stomach. Consume boiled tulsi water regularly. The chemical constituents present in this Eugenol, are ursolic acid, rosmarinic acid, chlorophyll, caryophyllene, oleanolic acid, and linolenic acid. Nutritional compounds found in this tulsi include vitamin A, vitamin C, calcium, iron, and zinc.

Pumpkin seeds:

- Synonym: Ivory nut, oil-rich seed
- Biological source: The seeds are a moderate source (10-19%) of riboflavin, folate, pantothenic acid, sodium, and potassium.
- Family: Cucurbitaceae

Pumpkin seeds also contain healthy omega-3 fatty acids that can help manage the high cholesterol and high insulin levels seen in PCOS. They also contain beta-sitosterol that can remove excess androgens and treat the hirsutism, acne, and weight gain symptoms of PCOS.

Herbs that increase ovulatory cycles:

Changes in prolactin levels and hormonal imbalances will have a significant impact on ovulatory cycles. Decreasing prolactin levels or improving the hormonal balance has a positive impact on ovulatory cycles and the treatment of PCOS. These two activities have the potential to reduce cyst formation, dissolve cysts, and improve ovulatory cycles. vitex and turmeric are two herbs that show a beneficial effect on PCOS by increasing the ovulatory cycles.

Vitex agnus castus:

- Synonym: chaste berry, monk pepper
- Biological source: It is a plant native to the Mediterranean region
- Family: Lamiaceae

Vitex agnus castus has been used in herbal medicine for the past 2000 years. It is a large shrub native to Europe and is also broadly disseminated in southern regions of the United States. The *Vitex* fruits contain flavonoids such as luteolin, apigenin, 3-methyl kaempferol, castig, chrysoplenetin, and chrysophanol D, and iridoids such as cynaroside were also reported.

These flavonoids play a major role in suppressing prolactin levels by inhibiting dopamine-2 (D-2) receptors and increasing the ovulatory cycles. All the above mechanisms can further facilitate the suppression of cyst formation in the ovary and may be useful for the treatment of PCOS.

Curcuma longa:

- Synonym: curcuma domestica Loir, curcuma domestica vale, curcuma, yellow ginger, Indian saffron
- Biological source: Turmeric is the dried rhizome of *curcuma longa* Linn.
- Family: zingiberaceae

Its rhizome is routinely used as a spice in the Asian continent. Turmeric contains a range of primary and secondary metabolites, and more than 250 phytoconstituents have been reported, including carbohydrates, proteins, terpenes, and resins. Resins of turmeric, commonly called curcuminoids, constitute the major secondary metabolites and they are responsible for the color and most of the biological properties. Curcuminoids have significant effects in the treatment of PCOS. They reduce the follicular sheath and improve the formation of the corpus luteum and the ovulation process. Hence, turmeric improves the histological features of polycystic ovaries. Curcuminoids also suppress the serum levels of progesterone and elevate the levels of estradiol in women with PCOS. Furthermore, their estrogenic, antihyperlipidemic, antioxidant, and hypoglycemic effects are useful in managing PCOS and preventing ovarian cell dysfunction thereby improving ovulation and fertility.

Herbs with Anti-Androgen Properties

Elevated blood levels of androgens are also one of the major etiologies behind PCOS. Hence, drugs with anti-androgen activity are used in the treatment of PCOS. Herbs including *Glycyrrhiza glabra*, *Linum usitatissimum*, *Mentha spicata*, *Cocus nucifera*, and *Punica granatum* have anti-androgenic action and these herbs could be useful for the management of PCOS.

Glycyrrhiza glabra:

- Synonym: Licorice
- Biological source: licorice is the dried, peeled, or unpeeled, roots, rhizome, or stolon of *glycyrrhiza*.
- Family: Leguminosae.

It contains mainly 2–9% glycyrrhizin, glycyrrhizin acid, flavonoids, isoflavonoids, carbohydrates, amino acids, and triterpenoid saponins. liquiritin, isoliquiritine mainly found in licorice [49]. It acts as a potent anti-androgen and helps the body to maintain biosynthesis and the release of estrogen. The flavonoids of *Glycyrrhiza* possess estrogenic activity and they interact with estrogenic receptors, and this results in their anti-androgenic effect. Additionally, flavonoids can help in the secretion of insulin, which reduces blood sugar levels and contributes positively to the treatment of PCOS [5]. In addition to its benefits in PCOS, licorice has other therapeutic roles, such as cough suppression, antibacterial and antiviral activity, and treatment for digestive issues, hepatitis, and mouth ulcers.

Cocus nucifera:

- Synonym: coconut palm
- Biological source: The biological source of *cocos nucifera* is the coconut palm tree
- Family: Aceraceae

The oil contains primarily alpha-tocopherol and lauric acid, and, in the case of roots, it has rich phenolic compounds, such as flavonoids and saponins [15]. *C. nucifera* contains twenty-five volatile and semi-volatile phytoconstituents. The lipid methyl (9Z,12Z)-9,12-octadecadienoate present in this plant possesses anti-androgenic properties. Preclinical research has shown that *Cocos nucifera* has a beneficial effect in modifying the histology of the ovaries in PCOS patients, in terms of cyst size and number. Similarly, it also suppresses the weight of the ovary and increases the uterus's weight. Based on the regulation of hormones, it could be useful for preventing cyst formation in the ovaries. In India, infusions of coconut inflorescence taken orally are used to treat menstrual cycle disorders [16]. Similarly, upon oral administration, coconut milk has a contraceptive property. Triterpenoids of *Cocos nucifera* that possess anti- androgenic activity.

Herbs That Restore Glucose Sensitivity Estrus Cyclicity and Enzyme Activity:

Decreasing insulin sensitivity and elevated blood glucose levels are also two of the major symptoms observed in women suffering from PCOS treatment. Herbs such as *Cinnamomum cassia* and *aloe vera*, which have the same mechanism, can reduce blood glucose as well as regulate the estrus cycle and could be useful.

Cinnamomum cassia:

- Synonym: Cinnamon bark, Ceylon cinnamon
- Biological source: Cassia is the dried stem bark of *Cinnamomum cassia* blume.
- Family: Lauraceae

Cinnamomum contains carbohydrates, dietary fiber, moisture, protein, ash, and vitamins. Phenolic compounds regulate blood insulin levels. Cinnamon extract improves insulin selectivity in women with PCOS. Cinnamon is used as an adjunctive in the treatment of PCOS through oral

supplementation during the luteal phase, where it could regulate progesterone levels. Similarly, taking cinnamon daily will help to normalize the menstrual cycle and effectively suppress polycystic ovary syndrome. The overall effect size showed that there was a statistically significant difference in the LDL levels of PCOS patients who consumed cinnamon alone and those who used a mixture of herbs.

Herbs That Promote FSH and Decrease LH Secretions:

In PCOS, a common complication is elevated levels of LH and decreased levels of FSH. Hence drugs that can elevate the levels of FSH and reduce the concentrations of LH are beneficial in the treatment of PCOD.

Foeniculum vulgare:

- **Synonym:** common fennel
- **Biological source:** Fennel consists of the dried ripe fruits of *Foeniculum vulgare* miller.
- **Family:** Umbelliferae

Foeniculum vulgare is usually called fennel. Fennel is beneficial for PCOS due to its potential to regulate hormones. It's often consumed as tea or added to dishes. Some studies suggest that it may help in managing irregular periods and hormonal balances. The main component that is

believed to be beneficial for the treatment of PCOS is anethole. It balances the hormone levels which can be beneficial for managing PCOS symptoms.

Panax ginseng:

- **Synonym:** Ginseng Blanc
- **Biological source:** Obtained from dried roots of *Panax ginseng*
- **Family:** Araliaceae

Panax ginseng is known as "the king of herbs" and has been used for more than 2000 years. *P. ginseng* can stimulate the growth of estrogen receptor (ER)-positive (p) cells in vitro. Ginsenoside Rb1 and Rg1 can stimulate ERs with estrogen-like activity. Hence, this can significantly elevate serum estradiol while suppressing follicle-stimulating hormone (FSH) and luteinizing hormone (LH). A significant decrease in plasma LH levels may be beneficial and effective for improving the fertility rate in PCOS anovulation patients. Ginseng can also help with postmenopausal symptoms such as insomnia, anxiety, and depression. It is often used as a natural estrogen replacement therapy, as well as because it can modify the estrus cycle and shows significant estrogenic effects, as suggested by the reversal of atrophy of the vagina and uterus with the upregulated expression of ER α and ER β in the reproductive tissue. All the above-discussed features of ginseng are positive factors that could contribute to the treatment of PCOS⁽¹⁷⁾.



Conclusion:

Infertility, metabolic and cardiovascular problems, and long-term health problems that might last a lifetime are just a few of the consequences associated with PCOS, the most frequent hormonal disorder in women from youth to pre-menopause. As an alternative to synthetic drugs for PCOS treatment and control, patients are turning more and more to herbal therapy to improve acceptance and recovery rates. This article offers a comprehensive analysis of herbs that can help with PCOS and its associated symptoms. Additionally, treating PCOS with herbs works well. The therapy has no negative side effects and offers a long-term solution for PCOS. A review of several important medicinal herbs, their main chemical components, and their specific role in the treatment of PCOS has been conducted. We are positive that researchers studying herbal treatments for PCOS will find great benefit from our assessment.

Author contributions

All authors are contributed equally.

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