IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Review On Herbal Approaches In The Management Of Polycystic Ovarian Syndrome (PCOS)

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Abstract:
Polycystic Ovarian Syndrome (PCOS) is a prevalent endocrine disorder in women of reproductive age, characterized by hyperandrogenism, insulin resistance, and menstrual irregularities. Conventional treatments such as oral contraceptives and metformin provide symptomatic relief but often cause adverse effects. This review synthesizes recent clinical and experimental studies on herbal and integrative therapies as safer, holistic alternatives. Medicinal plants like Ashwagandha, Shatavari, Spearmint, Turmeric, and Fenugreek demonstrate antiandrogenic, antioxidant, and insulin-sensitizing properties. Integrating lifestyle modification with herbal therapy offers a sustainable and effective approach for managing PCOS, minimizing pharmacological side effects, and improving overall reproductive and metabolic health.

Keywords: Polycystic Ovarian Syndrome (PCOS), Herbal Medicine, Ayurveda, Phytotherapy, Hormonal Imbalance, and Insulin Resistance.

1. Introduction

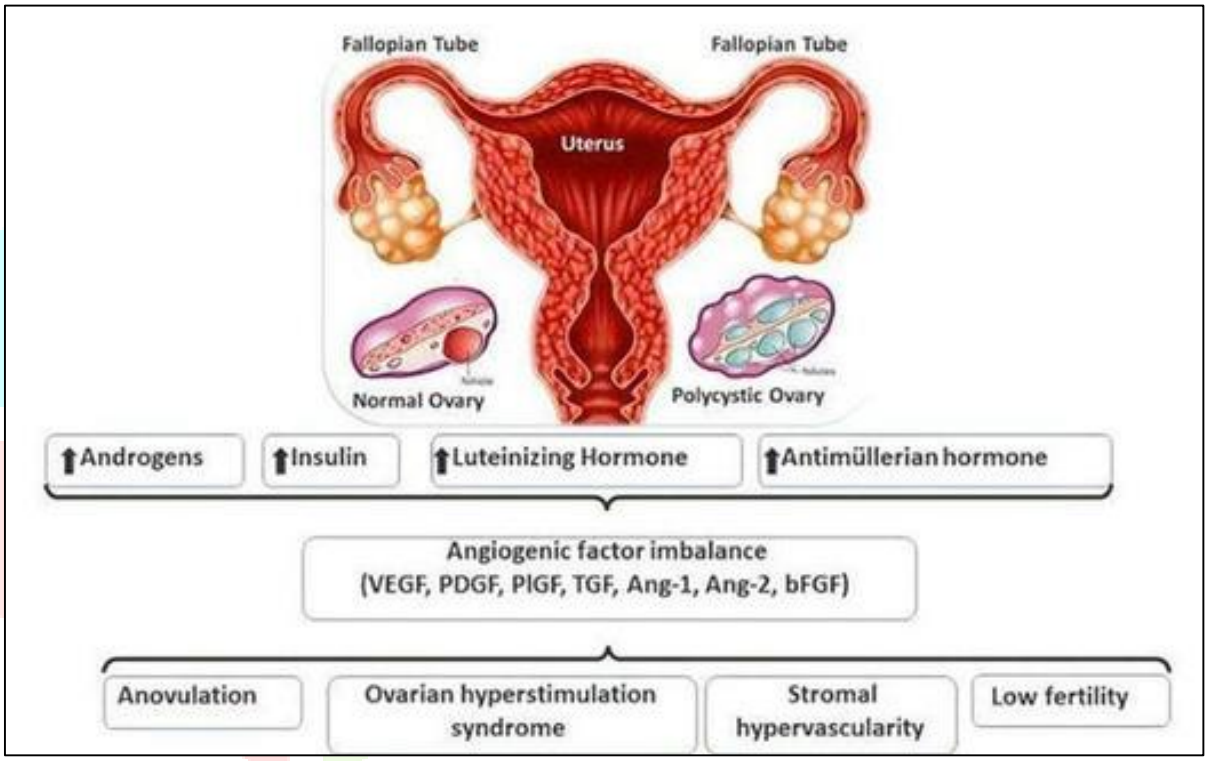
Polycystic ovarian syndrome (PCOS), which was first identified by Stein and Leventhal in 1935, affects around 6–8% of women worldwide. Psychological problems, polycystic ovarian morphology, and metabolic abnormalities—specifically compensatory hyperinsulinemia and insulin resistance—are linked to it. In 2012, the World Health Organization (WHO) estimated that 116 million women (3.4%) globally have PCOS. The prevalence of PCOS is estimated to be between 2.2% and 26% worldwide. Despite the lack of trustworthy published information on PCOS prevalence in India, doctors believe that 10% of Indian women are affected by the condition. One in five Indian women, or about 22.5% of them, currently have PCOS.

Ovarian follicles normally contain egg cells, which are released during ovulation, whereas polycystic ovarian syndrome is characterized by aberrant hormone levels that hinder follicles from developing and maturing in order to produce egg cells, as depicted. However, reproductive abnormalities are more likely in women with PCOS. This condition, also known as the Stein– Leventhal syndrome, is a significant contributor to infertility in women. Polycystic ovaries, hyperandrogenism, and several metabolic abnormalities (including insulin resistance and hyperinsulinemia) are its defining traits. The current standard of treatment for PCOS in women encompasses anything from pharmacological therapies to lifestyle adjustments. Diet, weight loss, and exercise are all linked to lifestyle adjustments. Current medications include antiandrogens like spironolactone and flutamide (oral contraceptives), metformin, thiazolidinediones, and estrogenprogestin combos.PCOS is typically treated with antiandrogens like spironolactone and flutamide (oral contraceptives) and modern medications like metformin, thiazolidinediones, and estrogenprogestin combos. Even though it works, this type of treatment is costly and can cause a lot of side effects, such as weight gain, irregular menstruation, gastrointestinal problems, and increased insulin resistance. Medicinal plants have garnered particular interest from ancient times. Numerous investigations have been carried out in the present day, which has resulted in the identification of beneficial and important medicinal plants. PCOS patients often have testosterone levels

almost twice as high as those of normal women, and they are often insulin resistant.A number of herbs have been highly regarded for their ability to lower PCOS as well as their anti-obesity and hypoglycemic effects. These include jeera powder (cumin seed powder), green tea, chia seeds, anise, fenugreek seeds, black seed oil, fennel seeds, flax seed, evening primrose oil, cinnamon powder, and turmeric. As they have since ancient times, integrated medicine, which includes yoga and traditional herbal therapies, can be more effective in treating polycystic ovarian syndrome.[1]

2. Pathophysiology of PCOS

The gonadotropic releasing hormones that are released or generated are follicular stimulating hormone (FSH) and luteinizing hormone (LH). Less intraovarian androgen is needed for normal follicular growth. FSH and the activating aromatase enzyme promote the conversion of testosterone to estrogen in granulose cells, which in turn aids in the development of follicles. The maturation of oocytes begins when LH promotes the growth of theca cells. PCOS increases LH levels, whilst lowering FSH levels causes immature follicle growth, increased androgen production, and decreased aromatase enzyme levels. Excessive testosterone in PCOS is associated with abdominal obesity and results in hyperinsulinemia and dyslipidemia. Because hyperinsulinemia reduces sex hormone binding globulin (SHBG), blood testosterone levels rise and theca cells produce more androgen.[2]



3. Causes and Risk Factors

The intricate and interconnected pathophysiology of this multifactorial illness makes it challenging to pinpoint its underlying causes. Environmental contaminants, dietary and lifestyle decisions, genetic factors, obesity, and gut dysbiosis can all have an impact on the genesis, prevalence, and regulation of the PCOS phenotype. The emergence of insulin resistance, partial folliculogenesis halt, excessive androgen secretion from the ovaries, and the persistent low-grade release of inflammatory mediators from white blood cells could all result from these circumstances, which would raise the metabolic syndrome.[13]

4. Symptoms

Each person may experience polycystic ovarian syndrome symptoms differently. Symptoms might fluctuate over time and frequently have no apparent cause. Possible symptoms include:

-Heavy, long, intermittent, unpredictable or absent periods

- Infertility
- Acne or oily skin
- Excessive hair on the face or body
- Male-pattern baldness or hair thinning
- Weight gain, especially around the belly.
- People with PCOS are more likely to have other health conditions including:
- Type 2 diabetes
- Hypertension (high blood pressure)
- High cholesterol
- Heart disease
- Endometrial cancer (cancer of the inner lining of the uterus).

Anxiety, despair, and a poor body image can also be brought on by PCOS. Social stigma may result from certain conditions, including obesity, infertility, and excessive hair growth. Other facets of life, including relationships, family, employment, and community activity, may be impacted.[14]

5. Associated health risks

There are several health risks associated with PCOS.

These include:

- Type 2 diabetes
- Infertility
- High cholesterol
- Elevated lipids
- Sleep apnea
- Liver disease
- Abnormal uterine bleeding
- High blood pressure
- Obesity possibly leading to issues with low self-esteem and depression
- Metabolic syndrome
- Nonalcoholic fatty liver (steatohepatitis)
- Depression and anxiety

Additionally, there is a higher chance of miscarriage, high blood pressure brought on by pregnancy, heart attacks, endometrial cancer, and gestational diabetes.[15]

6. Complications

- Infertility

According to Endocrine Society Guidelines, all patients should have their ovulatory status checked. Mid-luteal serum progesterone can be used to measure anovulation, which can occur in patients with eumenorrheic menstrual cycles as well. It's also advised to rule out other causes of infertility.

- Obstetric Complications

The detrimental effects of obesity on clinical pregnancy, miscarriage, and live birth rates after infertility therapy should be discussed with women with PCOS.

- Endometrial Cancer

Patients with PCOS are more likely to develop endometrial cancer, according to several studies. Both illnesses have a large number of risk factors. The Endocrine Society advises against routinely screening asymptomatic patients for endometrial thickness using ultrasound (US). Women should, however, be encouraged to report any unusual or unexpected uterine bleeding.

- Metabolic and Cardiovascular Diseases

Women and adolescents with PCOS must have their waist circumference and BMI measured in order to screen for obesity. At diagnosis, blood pressure, diabetes, and lipid screening should be done. Based on the results, follow-up levels should thereafter be evaluated on a regular basis. PCOS has been closely linked to insulin resistance. An elevated level of insulin resistance is present in between 33 and 66 percent of PCOS patients.

In order to screen for IGT and type-2 diabetes mellitus, the Endocrine Society recommends conducting an oral glucose tolerance test (OGTT) with fasting and 2-hour glucose following a 75 g OGTT. In PCOS patients, OGTT is preferred over HbA1c because of its lower sensitivity. Because risk factors are more common than in the general population, rescreening should be done every three to four years. Additionally, when this test comes out positive, patients who are overweight or obese should be evaluated for OSA symptoms and referred for sleep investigations.

- Metabolic Dysfunction-Associated Steatotic Liver Disease

MASLD, formerly known as nonalcoholic fatty liver disease (NAFLD), is three times more likely to occur in women with PCOS and has been linked to inadequate sex hormonebinding globulin and high androgen. Due to the low sensitivity and specificity of the MASLD diagnosis, routine LFT assessment is not advised unless the patient is overweight or obese. The risk of developing NAFLD in these patients can be reduced by switching to newer antidiabetic drugs, such as GLP-1 agonists.

- Depression

Compared to non-BMI-matched controls, PCOS women showed evidence of a higher prevalence of depression symptoms. Women with PCOS also had greater rates of major depression, recurrent depression, and suicide attempts. It is necessary to screen for and diagnose anxiety and depressive problems. Treatment ought to be appropriate.[16]

7. Diagnostic Test

1. Ovulatory dysfunction and irregular menstrual cycles (in adolescence):

In order to diagnose PCOS in adult females, oligomenorrhea and ovulation are necessary. The initial PCOS diagnostic criteria, called the NIH criteria, required oligomenorrhea/amenorrhea in order to diagnose PCOS in adult women. According to a systematic study evaluating diagnostic criteria for PCOS during adolescence, menstrual abnormalities are almost always necessary for the identification of the disorder in teenagers. In some investigations involving adult women, an ovulation has been used as a diagnostic criterion for PCOS. A physiological event that occurs during specific menstrual cycles in the early postmenarchal years may be the cause of this illness.

Increased blood pressure, a higher body mass index (BMI), and lower insulin sensitivity are all associated with irregular menstruation. A prospective study found that adolescents who experienced three or more menstrual cycles longer than 42 days at the age of 14 had higher BMI, insulin, glucose levels, and insulin resistance at the age of 25, suggesting that menstrual irregularities at an early age may indicate a higher metabolic risk as a young adult.

2.Polycystic Ovary Morphology (PCOM):

Larger ovaries with more stroma and little peripheral cysts are referred to as having "polycystic ovary morphology" (PCOM). According to the Androgen Excess–PCOS Society Task Force, PCOM should be categorized as 20 follicles per ovary using a transvaginal probe and highresolution technology. Adolescent girls' ovaries appear multifollicular, which makes it difficult to assess their ovarian morphology because of the elevated gonadotropin stimulation that causes increased ovarian volume and follicular proliferation.

Additionally, teenage girls find it difficult to use transvaginal probes. Teenage girls' PCOM is an unpredictable outcome that has nothing to do with anovulation or metabolic disorders. Therefore, ovarian ultrasounds are not required in teenage girls.

3.Pelvic Ultrasound to Evaluate PCOM:

Despite being part of the Rotterdam diagnostic criteria for PCOS in adult women, PCOM and pelvic ultrasonography are not recommended for use in diagnosing PCOS in teenagers due to the possibility of overdiagnosing the disorder at this age. Be advised that, in accordance with global evidence-based guidelines, pelvic ultrasonography should not be used to diagnose PCOS in people whose gynecological age is less than 8 years. Adolescents shouldn't have pelvic ultrasonography for two main reasons. First, the accuracy of the data is compromised because most ultrasounds are done trans-abdominally rather than trans-vaginally.

8. Organs involved in PCOS

- OVARY - The female gonad organ present at either side of uterus.
- ADRENAL GLAND- The gland which are placed just above the both the kidneys
- PANCREAS- Gland that produces insulin in our body.
- PITUTARY GLAND- The gland just below the brain, which is responsible for all the hormonal control.
- UTERUS- Irregular menstrual cycles, noendometrial hyperplasia.
- FALLOPIAN TUBE- Increased risk of tubal damage and infertility.[3]

9. Classification Based on Phenotype When PCOS is present, four distinct phenotypes can be identified: A, B, C, and D

Overall, it appears that while ovarian morphology is not a predictor of metabolic dysfunction, body mass index, hyperandrogenism (HA), and the degree of monthly irregularity are [4,5]. – PCOS is divided into four phenotypes, which include: (A) oligoanovulation, hyperandrogenism, multiple polycystic ovaries, and ultrasonography. (B) By ultrasonography, hyperandrogenism, oligoanovulation, and normal ovarian appearance. (C) Polycystic ovaries with hyperandrogenism and regular, regular menses as seen by ultrasonography. (D) Without hyperandrogenism, oligoanovulation, polycystic ovaries, and ultrasonography.

1.PCOS Phenotypes A and B

The PCOS phenotypes A and B are referred to as classic PCOS. Women with the standard PCOS phenotypes A and B have increased levels of insulin secretion, insulin resistance, menstrual disruption, and metabolic syndrome risk. Obesity and atherogenic dyslipidemia (AD) are more common in typical PCOS than in other PCOS subtypes [6]. Hepatic steatosis is also more common in PCOS phenotypes A and B than in other PCOS phenotypes with normal androgen and normal healthy controls [7]. Another feature of classic PCOS is a significantly elevated level of antimullerian hormone [8].

2.Phenotype C – Ovulatory PCOS

Phenotypic C (ovulatory PCOS) patients often exhibit slightly elevated serum insulin, atherogenic lipids, and androgen levels, along with high hirsutism ratings, in comparison to those with classic and non-hyperandrogenic PCOS. Ovulatory PCOS also has a higher prevalence of metabolic problems than other types of PCOS [9]. In a group of Italian PCOS patients, the ovulatory phenotype was linked to a higher socioeconomic level [10]. The distribution of tissue fat and insulin levels caused by food choices may account for some of the diversity in ovulation patterns among high socioeconomic groups.

3.Phenotype D – Nonhyperandrogenic PCOS

Phenotype D is distinguished from healthy controls by having normal androgen, minimally elevated levels of other endocrine variables [17,18], and the least amount of metabolic dysfunction [11,12]. The endocrine findings include a lower LH/FSH ratio, a lower level of T3 and T4, and a higher quantity of sex hormone-

binding globulin compared to those with classic PCOS [19]. People with PCOS phenotype D often have regular menstrual cycles with occasional irregularities [20].

10. Stages of PCOS

1. Mild PCOS: Minimal symptoms, regular menstrual cycles
2. Moderate PCOS: Irregular menstrual cycles, mild hyperandrogenism
3. Severe PCOS: Significant hyperandrogenism, irregular menstrual cycle, polycystic ovaries.

11. Gene involved in steroid hormone effects

• Androgen receptor gene-

The "q" arm of chromosome X contains the 11 exon AR gene, which codes for a 90 kb tridomain protein [21]. It is believed that structural disruption and gene alterations are the causes of PCOS. The disruption of the cellular mechanism brought on by "X" chromosomal inactivation, which increases androgen hormone levels, is the cause of PCOS. Since the AR gene is located on the X chromosome, changes to a single copy of the gene can cause illness. Furthermore, GWAS showed that a novel gene variation causes PCOS [22].

Sex hormone-binding globulin gene -

The SHBG gene is found on chromosomes 17p13–p12. SHBG produces a protein with 373 amino acids. The protein product of SHBG controls the body's sex hormone levels by binding to androgens, namely estrogens and testosterones [23, 24]. The majority of SHBG is produced by hepatocytes in the liver. Two metabolic factors that control the hepatocytes' synthesis of SHBG include insulin and androgens [25–27]. The primary cause of the lower SHBG concentrations in females with PCOS is the inhibitory effect of hyperinsulinemia on SHBG production [26]. A significant association between PCOS and a single nucleotide polymorphism in the SHBG gene 1 has been documented by numerous studies.

12. Gene involved in insulin action and secretion

•The Insulin Gene -

Insulin also has a significant role in the androgen production that takes place via theca cell receptors. This insulin action is triggered by phosphoinositide 3-kinase/protein kinase B, which becomes active in PCOS theca cells [28]. Similar to LH, a high insulin level stimulates the production of androgens [29,30]. The INS gene is located at 11p15.5, wedged between tyrosine hydroxylase and IGF-II [31]. The 5 untranslated region is occupied by a tandem repeat of VNTR [32]. The transcriptional rate of INS and IGFII is regulated by VNTR polymorphism [33]. It is possible to perform VNTR anywhere from 26 to 200 times. PCOS and this VNTR polymorphism are related. INSR -

This gene encodes the turmeric protein, which consists of two alpha and two beta chains [34]. Infertility and PCOS were the subject of numerous studies, but none of them were effective in establishing a connection [35]. Conway et al. also looked at the INSR region that encodes the tyrosine kinase domain in women with PCOS [36]. Talbot et al. [37] scanned the whole gene of women with PCOS. Neither of these studies found any connection between PCOS and ISR. D19S884 was found to have the strongest association with PCOS following a more comprehensive study of chromosome 19p12.2 [38]. This chromosomal region also contains the INSR gene.

•Insulin Receptor Substrate Proteins –

The insulin binds to its receptor. The receptor becomes autophosphorylated when insulin binds. IRS-1 and IRS2.34 are subsequently phosphorylated by the tyrosine kinase activity of the INS receptor. These activated substrates are then used further in the downstream process. The connection between PCOS and the IRS-1 and IRS-2 genes has been the subject of numerous studies. El Mkadem et al. found no appreciable difference between PCOS patients and controls [40], although Petermann et al. reported that women with PCOS had a greater frequency of Arg972 IRS-1 [39]. Dilek et al. [41] found that Gly972Arg was substantially more common in IRS-1 in Turkish women with PCOS. Both associations and none at all have been reported. These differences highlight the role of ethnicity and the environment.

•Calpain10 Gene CAPN10 –

It is located on the long arm of chromosome 2's "q" and contains 12 exons. The gene encodes the calcium-dependent cysteine protease, a heterodimeric protein. The gene is associated with type 1 diabetes [42]. A protein called calpain 10 interferes with insulin release and metabolism. Because low insulin causes PCOS, a mutation in calpain 10 also causes PCOS. Therefore, CAPN10 may be a gene linked to PCOS.

13. Other Genes

• Fat Mass Obesity (FTO) - The FTO gene encodes an enzyme called alpha-ketoglutarate. The gene is located on the "q" arm of chromosome 16. The gene has been associated with type 2 diabetes and obesity [43]. According to one study, among Pakistani women with PCOS, the single nucleotide polymorphism (SNP) rs9939609 was significantly associated with diseases. The SNP rs9939609 of the affected women was significantly higher than that of the study's healthy participants. • PCOS1 -

Chromosome 19p13.2 contains PCOS1. Numerous studies have connected the gene to PCOS. PCO is another name for the gene, which is actually a susceptibility region on chromosome 19. It was initially identified in two sisters in 1971. Urbanek and associates. subsequently replicated the results in 2005.

SRD5A2 and SRD5A1 -

You may find SRD5A2 on chromosome 2p23.1. those with PCOS had increased SRD5A activity than those without PCOS, according to a 1999 study by Jakimiuk et al. [44]. Research on SRD5A2 and SRD5A1 susceptibility to PCOS in hirsutism patients later in 2006 found that a variant in SRD5A2 was associated with protection against PCOS, whereas variants in SRD5A1 were associated with a higher risk of hirsutism and therefore PCOS.[45]

14. Epigenetics of PCOS

Heritable differences in gene expression that are not caused by a change in DNA sequence but are heritable between generations and during mitosis are known as epigenetic changes. Epigenetic involvement has been connected to a number of diseases, such as type 2 diabetes, prostate cancer, and PCOS. Increased androgen secretion throughout fetal life has been associated with diseases in models using sheep, rats, and monkeys. PCOS is associated with symptoms of a number of disorders. Despite the ethical limitations on utilizing humans for testing, some studies have shown that an increased level of androgen during prenatal life predisposes the offspring to later PCOS like symptoms.

Qu and colleagues discovered that granulosa cells' PPARG1 and NCOR1 exhibit differential CPG island methylation, resulting in hyperandrogenism-induced epigenetic alterations and the onset of ovarian failure. According to Ning Xu et al., PCOS patients exhibit a distinct DNA methylation pattern from control individuals.[46]

15. Allopathy medication

Drug	Mechanism	Indication	Dosage
Birth control pills (e.g. Yasmin, Diane)	Hormone regulation	Menstrual irregularities	Varies
Letrozole	Aromatase inducer	Ovulation indication	2.5-5 mg/day
Spironolactone	Anti- androgen	Hirsutism, acne	50-100 mg/day
Metformin	Insulin sensitizer	Insulin resistance	500-2000 mg/day

Polycystic ovarian syndrome and polycystic ovarian disorder are complex diseases that have an impact on multiple organ systems. The patient's looks and desire for pregnancy should determine the course of treatment. Birth control pills are one sort of medication that can help regulate periods. Drugs and technologies used to treat PCOS symptoms, including adverse medication reactions.

16. Side effects of Allopathy drugs -Allopathy drugs used to treat PCOS have various side effects. Here are some common ones [47,48]

1. Hormonal Contraceptives:

• Birth control pills (e.g., Yasmin, Dianette)

- Weight gain
- Mood swings
- Breast tenderness
- Increased risk of blood clots,
- stroke
- Headaches
- Nausea

• Progestin-only pills (e.g., Micronor)

- Irregular bleeding
- Weight gain
- Mood changes - Breast tenderness

2. Fertility Medications:

• Letrozole (Femara)

- Hot flashes
- Fatigue
- Headaches
- Dizziness
- Nausea

3. Anti-Androgen Medications:

• Spironolactone (Aldactone)

- Breast tenderness
- Menstrual irregularities
- Fatigue
- Dizziness
- Headaches
- Increased risk of birth defects

4. Insulin-Sensitizing Medications:

• Metformin (Glucophage)

- Nausea
- Diarrhea
- Abdominal pain

17. Herbal medication

Polycystic Ovary Syndrome (PCOS) is a hormonal condition that affects women of reproductive age, resulting in irregular periods, weight gain, acne, and infertility. Herbal medication treatment has grown in popularity due to its possible advantages and low risk of negative effects. Here are a few natural therapies that have been shown to benefit PCOS.

Herbal drugs

1. Improve insulin sensitivity without medications
2. Regulate menstrual cycle naturally
3. Reduce androgen levels without hormonal side effects
4. Enhance fertility without invasive procedures
5. Other a holistic approach to overall well-being

Herbal Arena for Treatment of Polycystic Ovarian Syndrome (PCOS)

1. Ashwagandha:

Botanical Name: Withania somnifera

Family: Solanaceae

Chemical constituents – alkaloids, steroids, flavonoids, to phenols

Uses-Ashwagandha powder is one ayurvedic herb that has long been recognized as a powerful adaptogen. Adaptogens are herbs that help the body adjust hormone levels, perhaps reducing stress and PCOS symptoms. Ashwagandha's adaptogenic (anti-stress) characteristics help to balance thyroid and hormones, improve adrenal function, normalize cortisol levels, and regulate insulin levels in the body. Ashwagandha may help with PCOS-related anxiety and depression symptoms. By binding to GABA receptors, ashwagandha has a calming, anti-stress, and extremely stabilizing effect.

Furthermore, ashwagandha root includes tryptophan, a component of serotonin, the hormone that improves mood. Furthermore, it addresses irregular menstrual periods and relieves menstrual discomfort. The primary purpose of Withania somnifera extract is to promote hormonal balance and the release of gonadotropin-releasing hormone. It is commonly used as a natural estrogen replacement therapy due to its capacity to change the estrus cycle and powerful estrogenic effects, such as reversing vaginal and uterine atrophy and increasing ERα and ERβ expression in reproductive tissue. [49]

2. Spearmint:

Botanical Name: Mentha spicata

Family: Labiatae

Chemical constituents – menthol, menthone, and menthyl, carvone, 1,8-cineole, limonene, and various terpenoids and flavonoids.

Uses – Spearmint's antiandrogen properties have been demonstrated and proven. Mentha spicata is indicated for women with PCOS. Because M. Spicata helps with PCOS's metabolic and reproductive issues. Alkaloids inhibit alpha-glycosidase, which lowers intestinal glucose transport, whereas carbs enhance glucose tolerance and release. As a result, M. Spicata acts as an anti-diabetic medication by increasing insulin synthesis, release, and utilization while decreasing glucose absorption from the gut. In PCOS ovarian cysts, spearmint inhibits atretic follicles while increasing graafian follicles. It possesses anticancer, antidiabetic, and anti-inflammatory effects. Mentha modulates the blood LH/FSH ratio.

Based on this change in LH/FSH levels in the blood, it may be effective in treating PCOS. Flaxseed and spearmint have been recommended and used to treat PCOS. Spearmint's antiandrogenic effects have been found to drastically lower testosterone levels in PCOS patients. In one case study, women with PCOS had reduced levels of androgen after taking spearmint hydroalcoholic extract. A different study found that spearmint can benefit persons with hirsutism by reducing their levels of DHEA, LH, and FSH. Spearmint tea

may help reduce testosterone levels in the body, thereby alleviating symptoms such as male pattern baldness and acne. [49]

3. Aloe vera:

Botanical Name: Aloe barbadensis

Family: Liliaceae

Chemical constituents – vitamins, enzymes, minerals, sugars,

amino acids, anthraquinones, and fatty acids

Uses- The current investigation on the efficiency of aloe vera gel formulation in PCOS found that the formulation restores ovarian steroid status and changes key steroidogenic activity, hence protecting against the PCOS phenotype. This is due to the extract's phytochemicals. It can also improve plasma lipoprotein levels, glycemic sensitivity, and the estrus cycle, as well as reduce cholesterol formation in the liver. Aloe vera is effective in treating PCOS caused by metabolic issues since it regulates blood cholesterol and glucose levels.[49]

4.Cinnamon:

Botanical Name -Cinnamomum cassia

Family – Lauraceae family

Chemical constituents- Phosphatidylinvestyl 4-kinase

Use: Cinnamon extract has been shown in both in vitro and in vivo trials to reduce insulin resistance by increasing insulin action through phosphatidylinositol 3-kinase activity in the insulin signaling pathway. For eight weeks, fifteen women with PCOS were randomly randomized to receive either daily oral cinnamon or a placebo. When post-treatment insulin sensitivity indices were compared to baseline insulin sensitivity indices utilizing fasting and 2-hour oral glucose tolerance tests, the cinnamon group showed significant improvements in insulin resistance while the placebo group did not.[50]

5.Fennel seeds:

Biological name: Foeniculum vulgare

Family: Umbelliferae

Chemical constituents: Trans anethole-photoanethole, estragole, fenchine, and P- anisaldehyde Dianethole, cinnamic acid, fumaric acid, benzoic acid, vanillic acid.

Uses- Fennel essential oils can enhance vaginal function, infertility, and uterine contraction. Fennel causes a moderate increase in the number of follicular and multilayered follicles, as well as an improvement in the ovaries' folliculogenesis. According to research, eating fennel fruit every day may help women become more fertile and alleviate the symptoms of irregular menstruation. Fennel is a herbal plant that may have had pharmacological effects due to its estrogenic characteristics. Fennel seeds are suggested to aid in the treatment of PCOS because of their antihirsutism properties and capacity to lower levels of androgens (male hormones).[49]

6.Amla

Biological name: Phyllanthus emblica

Family: Phyllanthaceae

Chemical constituents: Ascorbic acid, Tannins, Phytochemicals

Use: Amla is an excellent cholesterol-lowering and detoxification vitamin. Its anti-inflammatory and free radical scavenging characteristics may help restore the body's hormonal balance.

7.Turmeric

Botanical Name: Curcuma longa

Family: Zingiberaceae

Chemical constituents – curcuminoids, essential oils, and other aromatic compounds.

Uses - Curcuminoids have a significant effect on PCOS treatment. They reduce the follicular sheath, which promotes ovulation and corpus luteum formation. Turmeric improves the histological characteristics of polycystic ovaries. Curcuminoids enhance estradiol levels and block progesterone in the circulation in women with PCOS. Curcuminoids enhance estradiol levels in women with PCOS while decreasing progesterone levels in the blood. Furthermore, its hypoglycemic, antioxidant, antihyperlipidemic, and estrogenic characteristics promote ovulation and conception by preventing ovarian cell dysfunction and treating PCOS.[49]

8.Tulsi

Biological name: Ocimum sanctum

Family: Lamiaceae

Chemical constituents: Linalol, eugenol, camphor, citral

Use: Androgens are not used since ovulation does not occur. Additionally, the liver creates a little quantity of SHBG protein. This explains why women have trouble conceiving, as well as acne and excessive facial hair development. Tulsi can help lower insulin levels and regulate androgens. It also serves as an excellent antioxidant. On an empty stomach, chew at least ten leaves first thing in the morning. Consume boiled tulsi water on a regular basis.

9.Ginger

Biological name: Zingiber officinalis

Family: Zingeberaceae

Chemical constituents: Phenolic acid, terpene compounds.

Use: Relieve nausea and vomiting while also aiding digestion. Ginger extract may ameliorate sex hormone alterations compared to the PCO-induced group that received no therapy. We discovered that ginger extract had a beneficial and dose-dependent effect on serum levels of LH, FSH, estrogen, and progesterone in PCOS. However, higher doses of ginger extract are more effective in improving hormonal alterations.[51]

10. Flaxseed:

Botanical Name: Linum usita tissimum

Family: Linaceae

Chemical constituents – alpha-linolenic acid (an omega-3 fatty acid), lignans (phytoestrogens with antioxidant properties), fiber (both soluble and insoluble), proteins, and phenolic compounds.

Uses- Consistent flaxseed consumption by dietary supplementation can significantly lower ovarian volume and follicle size in the ovaries while also controlling menstrual cycle frequency. It is also used to treat a number of diseases, including neoplasms, diabetes mellitus, arrhythmia, obesity, and blood vessel clotting disorders. Flaxseed has also been recommended as a treatment for endocrine abnormalities and the regulation of female sex hormone levels.

This study looked at how consuming 30g of flaxseed per day altered the hormone levels of a 31year-old woman with PCOS. The patient consumed 83% of the prescribed amount of flaxseed throughout a four-month period. Height, weight, and fasting blood samples were measured at baseline and 4 months later, and insulin, total serum testosterone, free serum testosterone, and body mass index (BMI) all decreased significantly. At the conclusion of the study, the patient also reported decreased hirsutism. This case study revealed a clinically significant decrease in testosterone levels accompanied by a commensurate decrease in hirsutism.[52]

11.Shatavari:

Botanical Name: Asparagus racemosus

Family: Asparagaceae

The Shatavari effect has been seen in young PCOS women. According to one study, the plant is supposed to promote folliculogenesis by increasing the hormone that drives folicle formation. According to some research, the ovaries' weight may also increase. As a result, they have two tonics: one for general health and one for female reproduction. Shatavari includes a number of chemical components found in the plant's leaves, stem, flower, roots, and shoots; however, the root is regarded to be critical for major or medical uses since it acts as a diuretic and has cytoprotective characteristics that help prevent ulcers. Shatavari is known as the "Queen of Herbs".In the same manner that it promotes male fertility, shatavari is a powerful herbal medicine that is truly beneficial to female fertility. Shatavari displayed the several activities listed below:

1. has highly beneficial properties as a tonic for women, rejuvenating energy and affecting desire in both genders.

2. It aids in lowering genital organ inflammation and fatigued

3. maintains the ideal pH and hydration levels, which helps the dry tissue of the female reproductive organs

4. affects postpartum processes by enhancing milk production, which supports the balance and maintenance of uterine and ovarian hormones for the mother.

Dried plant roots are utilized in medicine because they contain phytoestrogen. It revitalizes the female reproductive system, regulates the menstrual cycle, and stimulates the formation of ovarian follicles Shatavari has the following impacts on the reproductive system: Nervous system stimulation; support for hormone production and maintenance. Shatavari, on the other hand, is a herb that supports the HPO axis and plexus and acts to balance the hormones that are disrupted in PCOS, hence maintaining hormone levels. Shatavari also increases blood flow during menstruation, the duration of the menstrual cycle (3 to 7 days), and the time between menstrual cycles (28 to 35 days). [52]

12.Fenugreek:

Botanical Name: Trigonella foenum-graecum

Family: Fabaceae

Chemical constituents -saponins, trigonelline, 4hydroxyisoleucine, and galactomannan

Uses –It lowers cyst size and ovarian volume in women who take it as a dietary supplement on a daily basis for 90 days. It also lowers the LH/FSH ratio; oral supplementation was observed to greatly prolong the menstrual period. These findings imply that this herb could be significant and beneficial for PCOS. The remaining constituents include 15-28% protein, 6-12% fat, 4-8% ash, 816% fiber, and 0.2-0.3% essential oil. Fenugreek seed oil contains camphor, neryl acetate, βpinene, and β-caryophyllene, which effectively prevent cysts.[52]

18.FORMULATIONS THAT CAN BE MADE FROM HERBS WHICH ARE USED IN TREATMENT OF PCOS

1) Shatavari Root Powder

Ingredients:

- Dried shatavari root
- Blender or grinder

Instructions to make shatavari root powder:

A. Preparation of the Powder

1. **Cleaning:** Wash the dried shatavari root thoroughly under running water to remove all dirt and debris.
2. **Drying:** Pat the root dry with a clean cloth or paper towel, then spread the pieces on a tray or rack and allow them to air-dry completely. This drying process may take several days, depending on humidity.
3. **Grinding:** Once the root is entirely dry, break it into smaller parts if needed, and then finely grind it using a high-quality blender or grinder.
4. **Sifting:** Sift the resulting powder through a fine-mesh sieve to achieve a consistent, smooth texture and eliminate any coarse contaminants.

B. Storage and Shelf Life

- **Container:** Store the finished powder in an airtight container, such as a glass jar or a resealable plastic bag.
- **Location**: Keep the container in a cool, dark place, away from direct sunlight and moisture.
- **Duration**: When stored correctly, the shatavari root powder will remain fresh for up to six months.

C. Methods of Consumption

The powder is versatile and can be consumed in several ways:

Mixed into warm milk or water.

Blended into smoothies.

Incorporated into culinary recipes.[53]

2) Fenugreek root powder

A. Ingredients and Equipment

- **Ingredients:** Fenugreek seeds, Liquorice powder, Mannitol, Cocoa powder (optional/additional ingredients).
- **Equipment:** Blender or grinder, Frying pan, Sieve, Airtight container.

B. Composition and Therapeutic Benefits of Fenugreek Seeds

- **Composition:** Fenugreek seeds are rich in protein, minerals, vitamins, gum, fiber, alkaloids, flavonoids, saponin, and volatile components.
- **Therapeutic Properties:** This ancient and promising herb is known for its antioxidant, anticarcinogenic, antidiabetic, and hypoglycemia characteristics, and also aids in lactation.

C. Procedure for Preparing Fenugreek Powder

1. **Measurement:** Weigh and take the required quantity of fenugreek seeds.
2. **Roasting:** Gently roast the seeds in a frying pan until they turn golden brown. This step is performed to reduce their natural bitterness.
3. **Grinding:** Use a suitable method (blender or grinder) to finely powder the roasted fenugreek seeds.
4. **Sieving:** Sieve the resulting powder to ensure a uniform and desired particle size.

5. **Compounding (Optional):** Add suitable amounts of other ingredients, such as liquorice powder, mannitol, and cocoa powder.
6. **Storage:** Store the final powder mixture in an appropriate airtight container to protect it from moisture.

3) Spearmint tea (Mentha spicata)

Spearmint tea may help reduce testosterone levels in the body, thereby alleviating symptoms such asmale pattern baldness and acne.

If one has PCOS caused by insulin resistance or is prediabetic, spearmint tea can help manage blood sugar levels. Spearmint tea can help balance hormones by reducing androgens, luteinizing hormone, and follicle-stimulating hormone. Because of its hormone-lowering properties, continued consumption of spearmint tea may help regulate periods.

How much spearmint tea should a person consume?

Ideally, it can be made like any other loose-leaf tea. Boil water and soak the leaves for 3-5 minutes. There is no exact amount of spearmint tea recommended, however one gram of leaves in twelve ounces of water may be ideal. Any changes caused by spearmint tea will take several months to take effect because it is not a commercial drug but rather a herbal tea. Tea drinking for at least 5-6 months may result in alterations.[55]

Churna- Churna (Sanskrit: चूर्ण cūrṇam “powder”, Pali: चुण chunam “powder”)[1]

is a mixture of powdered herbs and or minerals used in Ayurvedic medicine

Which all churnas are used in PCOS

1. Shatavari Churna
2. Satapuspa Churna
3. Latakaranj Seed Churna
4. Kounch Seed Churna
5. Shivlingi Seed Churna
6. Aavipattikar Churna

4) Shatavari kalpa: –

Shatavari Kalpa is an age-old Ayurvedic combination of shatavari and elaichi that helps moms feel less uncomfortable, weary, and weak overall while also boosting their ability to make breast milk. It gives the new mother energy and sustenance while efficiently balancing the Pitta and Vata doshas. Women of all ages, including new mothers, can use this mixture to increase their immunity and stamina during menstrual cycles, the postpartum period, and even during pregnancy.

Ingredients:

Each 10 gm of the formulation contains:

-4 g Shatavari – Asparagus racemosus root

-0.05 g Elaichi/ Cardamom – Ela Elettaria cardamomum

-5.95 g Sharkara or Sugar

Method of Preparation:

1.Shatavari and elaichi should both be washed under running water.

2.Place it in the sun for four to five days, or until the moisture content is completely gone.

3.Pulverize both of them into a fine powder.

4.To obtain a fine combination, strain the powdered herbs through sieve number 100.

5.Melt sugar in a big container with a bottom.

6.Stir in the dried herbs.

7.Stir well.

8. After letting it cool, roll them into tiny grains.

9.Allow the grains to air dry.

10.For later use, store it in a jar in a cold, dry location.

Health Benefits of Shatavari Kalpa

•Regulates PMS Symptoms

Shatavari Kalpa is known for its ability to balance hormones in women. It helps to regulate menstrual cycles and relieves PMS symptoms like cramps, mood swings, and bloating. This makes it an excellent treatment for people with irregular periods or hormonal abnormalities.

•Enhances Lactation

This formulation is frequently administered to nursing moms because it promotes breastfeeding. Shatavari boosts the production of prolactin, a hormone that promotes breast milk production. It also improves the quality of milk, ensuring that the newborn gets enough nutrients.

•Supports Reproductive Health

Shatavari Kalpa promotes overall female reproductive health. It strengthens the uterine wall, promotes fertility, and is commonly used to treat polycystic ovarian syndrome (PCOS) and endometriosis. It also promotes the health of the female reproductive organs.

Shatavari Kalpa Dosage:

The optimal therapeutic dosage of Shatavari Kalpa may vary from person to person, depending on characteristics such as age, physical strength, effects on hunger, severity, and patient condition. Seeking counsel from an ayurveda physician or practitioner is strongly recommended, since they will evaluate the patient's symptoms and medical history and prescribe an appropriate dose for a set period of time.

The typical dosage of Shatavari Kalpa is:

Adults: 1-2 teaspoons mixed with milk or water, taken once or twice daily.

Children: ½ to 1 teaspoon, adjusted according to age and weight.

It is recommended to consult an Ayurvedic practitioner [56]

5) Shatavaryadi churna -

Shatavari is a traditional herb used in Ayurvedic therapy. Many people use Shatavari to treat PCOS, a prevalent hormonal disease in women. Shatavari and PCOS can be linked in terms of treating PCOS to balance hormones and promote reproductive health. It is used as a supplement to assist regulate menstrual periods and alleviate symptoms of PCOS.

-Materials and methods Collection of plant material:

Shatavaryadi Churna consists of five ingredients. Asparagus racemosus tuber powder, Withania somnifera root powder, Tribulus terrestris fruit powder, and Mucuna pruriens seed powder Chlorophytum borivilianum root powder.

-Method of preparation of shatavaryadi churna formulation

All the above plant ingredients are powdered separately and miked together in specified quantity stored in air tight container in dry place

Shatavari Benefits of PCOS

- Improved Fertility

-Regulation of Menstrual Cycles

-Reduction in Insulin Resistance

-Boosts Energy Levels

-Mood Stabilisation

Medication – Ayurveda

1. Chitrakadi Vati
2. Nastpushpantaka
3. Patrangasava
4. Ashokarishta [57]

6) Evecare Syrup:-

Ingredients of Evecare Syrup:- Each 5 ml contains extracts of

A. Primary (Highest Quantity) Ingredient

Ingredient	**Botanical Name**	**Quantity (mg)**
Asoka	Saraca indica	50

B. Mid-Range Ingredients (33 mg to 32 mg)

Ingredient	Botanical Name	Quantity (mg)	Notes / Properties
Dashamoola	Group of 10 roots	33	An effective group of anti-inflammatory herbs.
Guduchi	Tinospora cordifolia	33	-
Lodhra	Symplocos racemosa	33	-
Kakamachi	Solanum nigrum	33	-
Punarnava	Boerhaavia diffusa	32	-
Shatavari	Asparagus racemosus	32	-

Narikela	Cocos nucifera	32	Coconut; used in Ayurveda for thousands of years, with medicinal applications for the fruit and water.
Ghritakumari	Aloe barbadensis	32	-

C. Secondary Ingredients (25 mg)

Ingredient	Botanical Name	Quantity (mg)	Notes / Properties
Chandana	*Santalum album*	25	Sandalwood.
Babbula	Acacia arabica	25	Also known as Babool; used in Ayurveda for treating skin diseases, dhat syndrome, bleeding disorders, and intestinal worms.
Mustaka	Cyperus rotendus	25	-
Anantamoola	Hemidesmus indicus	25	-

D. Combination Formulas and Minor Ingredients (20 mg to 5 mg)

Ingredient	Botanical / Common Names	Quantity (mg)	Composition Details
Vasaka	Adhatoda vasica	20	-
Triphala	—	20	A combination of *Embelica officinalis*, *Terminalia chebula*, and *Terminalia bellerica*.
Trikatu	—	20	A combination of *Zingiber officinale* (Ginger), *Piper*

			longum (Long Pepper), and *Piper nigrum* (Black Pepper).
Manjista	Rubia cordifolia	20	-
Shalmali	Bombax malabaricum	12	-
Shuddha Shilajitu	Asphaltum	5	-

Uses

-Benefits of Eve Care Syrup: -Repairs endometrium.

-Regularizes menstrual cycle

-Anti-spasmodic and anti-inflammatory.

-Stimulates immune system.

-Increase the level of hemoglobin in blood.

-Improve fertility by normalizing the hormone levels.

Indication of Evecare Syrup:

•Premenstrual syndrome -PMS

•Dysmenorrhea – painful periods

•Menstrual irregularities

•Menorrhagia – heavy/prolonged menstruation

•Oligomenorrhoea – infrequent/scanty menstruation

•Metrorrhagia – heavy uterine bleeding

•Dysfunctional uterine bleeding -DUB

•Infertility -as an adjuvant therapy to assist conception.

Dose and Duration

Dosage of Evecare Syrup:

General dosage – 5 ml to 1tsp twice a day.

In severe cases 10 ml to 2 tsp twice a day.[58]

20.Conclusion

Polycystic Ovarian Syndrome (PCOS) is a multifaceted endocrine and metabolic disorder that continues to challenge conventional management approaches. Current pharmacological treatments provide symptomatic relief but are often associated with adverse effects and limited long-term efficacy. Emerging research underscores the therapeutic promise of herbal and integrative interventions, particularly those employing Ashwagandha, Shatavari, Spearmint, Fenugreek, Cinnamon, and Turmeric, which exhibit antiandrogenic, insulin-sensitizing, and antioxidant activities. When combined with lifestyle modifications—encompassing diet, exercise, and stress management—these phytotherapeutic agents offer a holistic and sustainable approach to restoring hormonal balance and improving reproductive and metabolic health. Nevertheless, comprehensive, well-designed clinical trials are essential to substantiate these findings, establish standardized formulations, and ensure safety and efficacy. Integrating evidence-based herbal medicine within individualized treatment frameworks may thus represent a viable, patient-centered strategy for the effective long-term management of PCOS.

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