

ROLE OF HERBAL MEDICINES IN THE MANAGEMENT OF POLYCYSTIC OVARY SYNDROME (PCOS): A REVIEW

*Ms. Gayatri Y. Borse, Ashwini S. Pundkar

Rajesh Bhaiyya Tope College of B. Pharmacy, Nipani Chh Sambhajinagar.



*Corresponding Author: Ms. Gayatri Y. Borse

Rajesh Bhaiyya Tope College of B. Pharmacy, Nipani Chh Sambhajinagar.

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ABSTRACT

Polycystic Ovarian Syndrome (PCOS) is a complex endocrine disorder commonly affecting women of reproductive age. In India, nearly two out of every ten women are affected by PCOS. The condition is characterized by polycystic ovarian morphology, ovulatory dysfunction, and hyperandrogenism. PCOS is considered one of the major causes of female infertility and is associated with several complications such as metabolic disorders, irregular menstruation, hypertension, insulin resistance, and elevated androgen levels including testosterone. Women with PCOS may also experience multiple sub-follicular cysts in the ovaries. Additionally, vitamin deficiencies in PCOS patients may increase the risk of severe COVID-19 infection, especially due to reduced sun exposure during quarantine periods. Hence, increasing public awareness regarding PCOS is essential. Although PCOS is a manageable disorder, natural remedies including herbs and seeds have gained importance because of their safety and effectiveness. Development of polyherbal formulations may help reduce the cost, duration, and side effects associated with conventional therapies. Furthermore, lifestyle modifications such as a balanced diet, regular exercise, yoga, and healthy habits play a significant role in controlling PCOS. Therefore, this review highlights the potential use of natural remedies in the management of PCOS.

KEYWORDS: PCOS; hyperandrogenism; herbs; seeds; yoga asanas.

1. INTRODUCTION

According to the World Health Organization, approximately 116 million women worldwide, or nearly 3.4% of the female population, are affected by PCOS.^[1] Polycystic ovarian syndrome is one of the most common endocrine disorders among premenopausal women, with a prevalence of about 6.5–6.7%. First described by Irving Stein and Michael Leventhal in 1935, PCOS is associated with chronic oligo-anovulation, polycystic ovarian morphology, and several metabolic and psychological abnormalities.^[2] Women with PCOS commonly experience symptoms such as acne, alopecia, hirsutism, obesity, and related disorders due to elevated androgen levels.^[3] Previous studies have also shown that PCOS causes various physiological changes in the ovaries. Research from the United States reported that nearly 15% of women with PCOS develop type 2 diabetes mellitus and cardiovascular diseases during their reproductive years, which further contribute to the

progression of PCOS symptoms.^[4] Genetic and twin studies indicate that PCOS, particularly hyperandrogenism, has a strong hereditary basis. Among the identified gene candidates, fibrillin-3, a member of the TGF- β superfamily involved in extracellular matrix protein coding, is considered one of the most reliable genes associated with PCOS.^[5] Traditional herbal medicines have gained increasing attention worldwide because of their preventive, curative, promotive, and rehabilitative roles in healthcare.^[6–8] Herbal therapies are generally considered safer than conventional treatments due to their minimal side effects, while the presence of multiple active constituents may produce enhanced therapeutic effects.^[9,10] Recently developed rat models of PCOS have provided important insights into chronic anovulation and polycystic ovarian conditions, although these models may not completely replicate the reproductive features observed in humans.^[11] Therefore, the present study aimed to evaluate the mechanisms of

action of medicinal plants with pharmacological activities beneficial in managing PCOS-related complications and to explore various herbal and polyherbal formulations for improving their therapeutic acceptability in PCOS treatment.

1.1. Types

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

- 1) Insulin-resistant PCOS;
- 2) Inflammatory PCOS;
- 3) Post-pill PCOS;
- 4) Hidden cause of PCOS.

1.2. Organs Involved in PCOS

- 1) Ovary—the female gonad organ presents at either side of the uterus;
- 2) Adrenal gland—the gland which is placed just above both of the kidneys;
- 3) Pancreas—the gland which produces insulin in our body;
- 4) Pituitary gland—the gland just below the brain, which is responsible for hormone control.

In PCOS, the ovaries produce excessive amounts of androgens, which interfere with the normal development and maturation of ovarian follicles. As a result, ovulation does not occur properly, leading to anovulation. Due to the absence of a mature and released ovum, women with PCOS often face difficulties in achieving pregnancy.^[12]

1.3. Symptoms of PCOS^[13,14,15]

The symptoms of PCOS may become more severe in women who are overweight or obese. Common symptoms include absent or irregular menstrual periods, insulin resistance, ovarian cysts, weight gain, and acne, as illustrated in Figure 1.

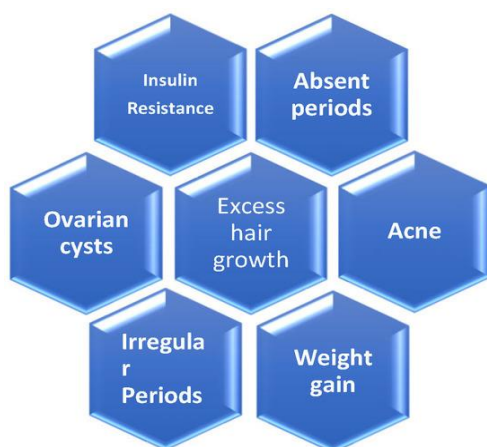


Figure 1: Symptoms of PCOS.

1.4. Causes of PCOS^[14]

- Gene defect perturbs the biochemical pathway & leads to dysfunction of an ovary
- Contraceptive pills;
- Strong stimulation in adrenals in childhood;

- Raised insulin levels;
- Hormonal imbalance and stress.

1.5. Risk factor

Women are more likely to develop PCOS if she is having the following risk factors. These factors affect and are also associated with secondary complications like type 2 diabetes, high blood pressure, and uterine cancer.

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

1.6. Histological Features of PCOS

- ovarian hypertrophy, indicated with a thickened capsule ($>100\ \mu$);
- Increased number of sub follicular cysts;
- Scarcity of corporeal lutea or albicantia, hyperplasia, and fibrosis of the ovarian stroma.^[16]

1.7. PCOS Pathophysiology

Pituitary gonadotropins are crucial for maintaining normal reproductive function. Their secretion from the pituitary gland is regulated by gonadotropin-releasing hormone (GnRH) released from the hypothalamus along with integrated feedback mechanisms.^[17] Follicle-stimulating hormone (FSH) initiates follicular development and activates aromatase enzymes in granulosa cells, which help convert androgens into estrogens. Luteinizing hormone (LH) mainly promotes progesterone secretion during the luteal phase, but it also contributes to testosterone synthesis during the follicular phase. In women with PCOS, increased LH secretion can enhance androgen production by the theca cells. Continuous pulsatile GnRH stimulation is required for normal gonadotropin secretion, whereas prolonged exposure may lead to pituitary desensitization and reduced hormone release. Changes in GnRH pulsatility during the menstrual cycle influence the secretion ratio of FSH and LH, as illustrated in Figure 2.^[17]

In PCOS, elevated androgen levels are associated with increased abdominal fat accumulation, which contributes to hyperinsulinemia and dyslipidemia. Hyperinsulinemia lowers hepatic production of sex hormone-binding globulin (SHBG), thereby increasing the concentration of biologically active testosterone in circulation.^[18] Key features of PCOS include hormonal imbalance and elevated androgen levels, which may lead to symptoms such as acne, hirsutism, and androgenic alopecia.^[19] Women affected by PCOS commonly experience irregular or absent menstrual cycles due to impaired ovulation, making conception more difficult. Ultrasound examination often reveals enlarged ovaries containing numerous small immature follicles, commonly referred to as cysts, which have failed to mature completely.^[19]

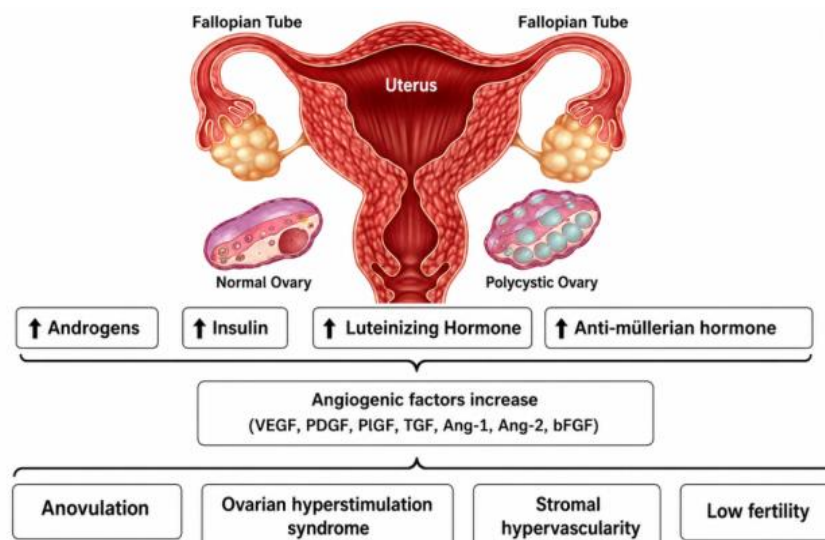


Figure 2. Pathophysiology of PCOS.

1.8. Necessity to Study PCOS

Early diagnosis and appropriate treatment of PCOS can help reduce the risk of long-term complications such as infertility, metabolic syndrome, obesity, diabetes, and cardiovascular diseases, as illustrated in Figure 2 and Figure 3.

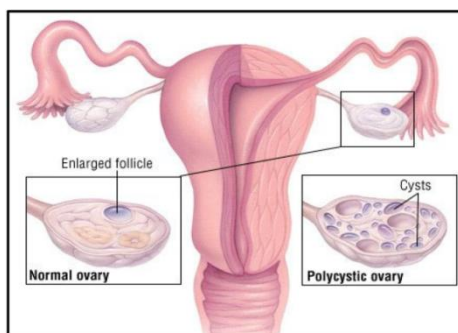


Figure 3. Polycystic ovary.

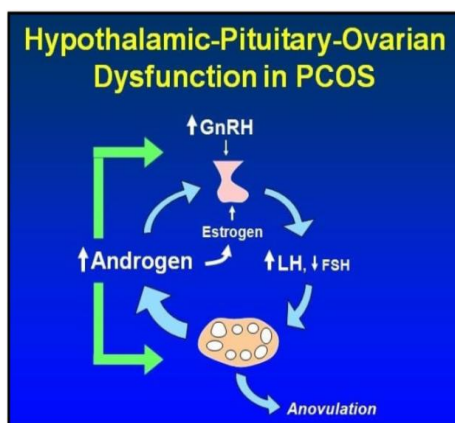


Figure 4. Hypothalamus involvement in PCOS.

According to the PCOS Society, nearly two out of every ten women in India are affected by PCOS, and a significant number of teenage girls are also diagnosed with the condition. Studies conducted by the Department

of Endocrinology and Metabolism at AIIMS indicate that PCOS affects approximately 20–25% of women of reproductive age. Among women with PCOS, around 60% are reported to be obese, while 35–50% suffer from fatty liver disease. Additionally, nearly 70% exhibit insulin resistance, 60–70% show elevated testosterone levels, and 40–60% experience glucose intolerance. Compared with allopathic treatment, Ayurveda and Homeopathy are often considered beneficial approaches for the management of PCOS.^[2]

2. Genetic Propensity

There have been discussions on genes including CAPN10, cytochrome family p450, the insulin gene, AR, FTO, and FSHR. Recent research involving over 30,000 women has suggested that genetics may contribute to the development of PCOS.^[20]

2.1. Insulin Level

The body may create more insulin if cells become less responsive to the actions of insulin, which could raise blood sugar levels.

2.2. Excess Androgen

High levels of androgen cause high levels of hirsutism and acne, and they are produced by the ovaries.^[21]

3. Ayurvedic Herbal Remedies Available for PCOS

Ayurvedic medicine uses a multifaceted strategy to.

- Correct the hormonal imbalance;
- Treat obesity and avoid high cholesterol levels;
- Treat insulin resistance.

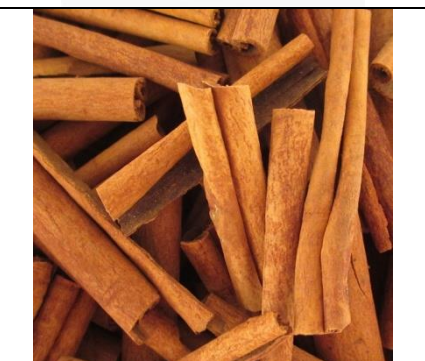
Table 1: Herbs used in the treatment of associated PCOS complications.

Symptom/Complication associated with PCOS	Herb used for Treatment
Hormonal imbalance	Bauhinia variegata
Regulation of hormones	Phyllanthus emblica, Terminalia liabellirica, Terminalia chebula, and Commiphora wightii
Anti-oxidant	Cinnamon cassia, Ocimum sanctum
Reproductive dysfunction	Tribulus terrestris
Depression & Mood swings	Hypericum perforatum
Menorrhagia	Commiphora myrrha
Cholesterol	Nigella sativa
Estrogenic action	Saraca asoca
Folliculogenesis	Asparagus racemosus
Regulation of menstrual flow	Tinospora cordifolia

The three main phenotypes of Endometriosis are ovarian endometriomas, superficial peritoneal lesions, and deep infiltrating endometriosis. Among these, superficial peritoneal lesions are considered the least severe form of the disease, whereas deep infiltrating endometriosis is regarded as the most severe phenotype.^[22] At present, limited evidence is available for the accurate diagnosis of Endometriosis, and no reliable biological marker or

measurable indicator has yet been identified.^[23] Therefore, lifestyle modifications and dietary changes remain important approaches in managing these gynecological disorders. In addition, the use of herbal therapies is increasingly preferred by many patients. This review highlights several natural herbs and explains their role in managing PCOS-related complications, as presented in Table 1.

Table 2: Herbal drugs information.

Sr.No	Botanical Name	Common Name	Major Chemical Constituents	Uses in PCOS/PCOD	Figure
1.	Bauhinia Variegata	Kanchanar	Flavonoids, tannins, saponins, terpenoids, phenolic compounds, glycosides	Helps manage PCOS, hormonal imbalance, uterine cysts, and supports detoxification and lymphatic function[24]	
2.	Triphala: (Combination of Amla, Bibhitaki, Haritaki)	Triphala	Polyphenols, tannins, gallic acid, ellagic acid, vitamin C	Improves digestion, metabolism, insulin resistance, and reduces oxidative stress in PCOS[25]	
3.	Cinnamon Cassia	Cinnamon	Cinnamaldehyde, eugenol, cinnamic acid, coumarins, polyphenols	Improves insulin sensitivity, glucose metabolism, and menstrual cyclicity[26]	

4.	Nigella Sativa	Black Seed (Kalonji)	Thymoquinone, nigellone, alkaloids, flavonoids, saponins	Reduces insulin resistance, inflammation, and oxidative stress in PCOS[27]	
5.	Commiphora Wightii	Guggul	Guggulsterones (E and Z), terpenoids, steroids, essential oils	Supports hormonal balance, lipid metabolism, weight management, and detoxification[28]	
6.	Ocimum sanctum	Tulsi (Holy Basil)	Eugenol, ursolic acid, rosmarinic acid, flavonoids, linalool	Reduces stress, improves glucose metabolism, and exhibits antioxidant activity[29]	
7.	Foeniculum vulgare	Fennel	Anethole, fenchone, estragole, flavonoids, phenolic compounds	May help regulate menstrual cycles and reduce hormonal imbalance[30]	
8.	Gymnema sylvestre	Gymnema	Gymnemic acids, gurmarin, saponins, flavonoids	Improves insulin sensitivity, blood glucose control, and metabolic function[31]	

9.	Panax ginseng	Ginseng	Ginsenosides, polysaccharides, flavonoids, peptides	Improves insulin resistance, hormonal regulation, and overall reproductive health[32]	
10.	Emblica officinalis	Amla	Vitamin C, gallic acid, ellagic acid, emblicanin A & B, tannins, flavonoids	Antioxidant activity, improves insulin sensitivity, reduces oxidative stress associated with PCOS[33]	

4. Management of PCOS^[34,35,36,37]

Regular physical activity plays an important role in the management of PCOS. Exercise helps reduce blood glucose levels and may aid in preventing or improving insulin resistance, which is commonly associated with PCOS. Increasing daily physical activity and maintaining a consistent exercise routine can also support weight management and lower the risk of developing diabetes, as illustrated in Fig. 14.

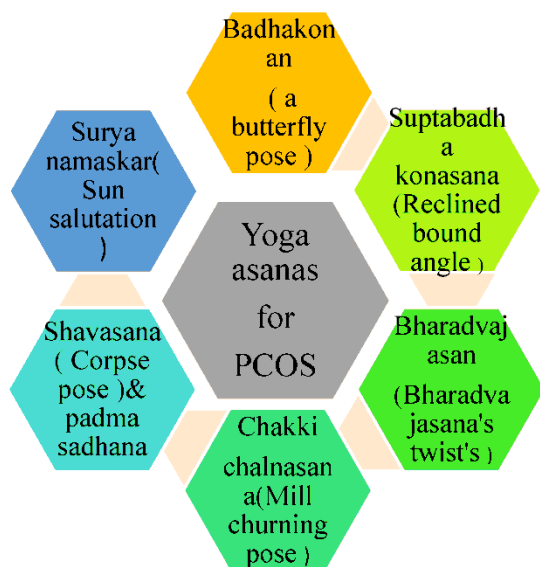


Figure 14. Yoga asanas for PCOS.

CONCLUSION

Polycystic Ovarian Syndrome (PCOS) is a highly prevalent endocrine disorder in women and a leading contributor to infertility across the world. It is characterized by symptoms such as irregular menstrual cycles, obesity, insulin resistance, acne, hirsutism, ovarian cysts, and hormonal disturbances, all of which can significantly impact a woman's overall health and

well-being. While synthetic medications are commonly prescribed for PCOS management, prolonged use may lead to unwanted side effects. In recent years, herbal medicines have gained attention as a safer and effective alternative because of their lower risk of adverse effects and holistic therapeutic benefits. Medicinal herbs, used individually or in combination, may help regulate menstruation, restore hormonal balance, strengthen immunity, and reduce complications associated with PCOS. Herbal combinations often demonstrate synergistic activity, producing greater pharmacological effects than single-herb treatments. Furthermore, lifestyle interventions including balanced nutrition, regular physical activity, and yoga are essential components in controlling PCOS symptoms. Thus, integrating herbal therapies with healthy lifestyle practices may offer a beneficial long-term strategy for PCOS management, though additional scientific and clinical research is needed to validate their efficacy and safety.

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