



## Polycystic ovarian syndrome (PCOS): Approach to traditional systems, natural and bio-chemical compounds for its management

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Polycystic ovary syndrome (PCOS) is a multifactorial endocrine disorder which is characterized by chronic anovulation. Irregular periods, *hirsutism*, weight gain are the other signs of PCOS. The prevalence of PCOS worldwide is between 6% and 26% while in India it was 3.7% to 22.5%. PCOS is the most prevailing female endocrine disorder and the preeminent cause of infertility. Risk factors that contribute to the development of PCOS include genetics, neuroendocrine system, sedentary lifestyle, diet, and obesity. Modern medicine has found many ways to heal. Synthetic drugs such as metformin and oral contraceptive pills were available in the market, but because of their side effects, people depend on traditional and herbal medicines. This review provides a detailed approach to different types of traditional and natural systems for the treatment and management of PCOS. Different approaches to managing PCOS include the traditional system of drugs, herbal remedies, herbs, and Phyto-ingredients that have proven their potential in treating PCOS. Traditional medicine includes Unani, Ayurveda, Siddha, naturopathy, yoga, and homeopathy. In addition to treatment, yoga also has potential in treating PCOS.

**Keywords:** Ayurveda traditional systems of medicine, Homeopathy, Indian traditional systems, Siddha, Unani, Yoga

### Introduction

Polycystic ovary syndrome (PCOS) is an intricate conglomerate endocrine disorder with an increasing prevalence. PCOS is also referred to as Steve-Leventhal syndrome, as first reported by Stein and Leventhal in 1935<sup>1</sup>. It is also called hyperandrogenic anovulation and is characterized by the indication of several ovarian cysts. The prevalence of PCOS is 6 to 26 worldwide. It is the most familiar hormonal disorder in women of reproductive age and a leading cause of infertility. Aside from endocrine disorders, PCOS is often characterized by an androgen excess or oligomenorrhea, a condition with an irregular or longer than normal menstrual cycle, anovulation with a lack of ovulation, or the existence of polycystic ovaries on ultrasound.

The hypothalamic-pituitary-gonadal (HPG) axis synchronizes human reproductive activity. Neurons in the hypothalamus produce gonadotropin-releasing hormone (GnRH) which invigorates the release of gonadotropins Luteinizing hormone (LH), Follicle Stimulating Hormone (FSH) from the anterior

pituitary. Gonadotropins act through their gonadal receptors and regulate the production of sex hormones. Internal and external factorial disorders in the HPG axis affect GnRH production and disrupt gonadotropin levels and affect hormonal imbalance. The use of GnRH antagonists is limited to re-energize normal ovulation<sup>2</sup>.

PCOS can also be genetic. FSH and AMH play a vital role in proffering human germ cells. Overexpression of AMH impedes the development of the ovarian follicle and this contributes to ovarian dysfunction<sup>3</sup>. Anti-Mullerian hormone (AMH) is considered a predominant hormonal indicator in the development and maturation of ovarian follicles in women. The fall in AMH levels has an impact on ovarian function<sup>4</sup>. Gene transcription also contributes to PCOS. Docking studies prove that the DENND1A genome is associated with PCOS<sup>5</sup>.

The exact reason for PCOS is not known, it may have to do with a hormonal abnormality and linked to poor diet, sedentary lifestyle, and stress.

PCOS can be symptomatic or asymptomatic. The main reasons were:

- Insulin resistance

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- Hormonal imbalance
- Obesity
- Stress and anxiety
- Sleep problems

Chronic stress increases the activation of the hypothalamic-pituitary-adrenal axis is directly related to PCOS. Stress aids in the elimination of visceral fats and increases blood glucocorticoid levels, which greatly enhance the absorption of carbohydrates and fats, the major cause of insulin resistance and one of the main reasons for PCOS.

Different approaches to managing PCOS are:

- 1) Traditional Medicine
- 2) Herbs and medicinal plants
- 3) Phytoconstituents

### Traditional formulations for the management of PCOS

Traditional medicine plays an important role in developing countries in furnishing health protection. India is known for its traditional medicinal systems Unani, siddha, Ayurveda, and homeopathy are known worldwide. These traditional Indian formulations take considerable part in the treatment of menstrual disorders in women. Even their mechanism of action is unknown and unclear, traditional systems are creating their own position in the treatment of various diseases. However, the dosage is also unclear and non-standard and varies from person to person depending on the severity of the disease (Table 1).

Ayurveda is an ancient Indian system known as the "Science of Life" because it focuses on the vision of man.

Siddha is a system of heritage Indian medicine practiced in South India. It is derived from the Tamil

word which reflects "perfection" or "a goal to be achieved". The Siddha medicine is considered rejuvenate the dysfunctional organs that cause disease. This system connects physically and spiritually and heals the person in a physical, physiological, social, and spiritual way.

Homeopathy is a 200-year-old form of traditional medicine that aims to stimulate the healing response and strengthen the body's ability to heal itself. Homeopathy focus on personality, lifestyle, medical history, and hereditary factors to treat the person. These drugs are prepared from natural sources such as plants, animals, and minerals and are therefore considered safe and free from side effects.

Unani medicine is also known as Arabic or Islamic medicine is a traditional system of healing and preserving health. According to unani, factors such as air, food, water, physical exertion, mental work, rest, and sleep have a direct influence on the mental and physical system of man. The Unani treatment system aims to normalize and balance the factors that affect the human system.

### Medicinal plants

Medicinal plants have had their own identity in the treatment of various diseases since prehistoric times. This is a rich source of ingredients that play a vital role in the development of pharmacopoeia, non-pharmacopoeia, and synthetic drugs. Due to their better compatibility and adaptability with the human body, most countries count on herbal medicines for health care. Herbal medicines have fewer side effects than synthetic drugs and it is for this reason that the use of herbal medicines is increasing all over the world (Table 2).

Table 1 —Formulations of Indian traditional systems

Name of the formulation	Dose	Uses	Ref
<i>Hab E Mudir</i>	1-2 pills (Twice/Thrice daily)	Regulates Periods in Women.	6
<i>Hab E Murr</i>	1-2 tablets (Twice daily)	Amenorrhoea and other functional disorders of Uterus.	6
<i>Uppu Chendooranam,</i>	-	Menstrual Disorders	7
<i>Kummati Mezhugu</i>	-	Menstrual Disorders	7
<i>Mahaveera Mezhugu</i>	-	Menstrual Disorders	7
<i>Malai Vembaadhi Thailam</i>	-	Female Sterility and Menstrual Disorders especially in Metrorrhagia.	7
<i>Calcarea Carbonica</i>	-	Rickets-constipation-Menstrual Disorders.	8
<i>Lilium Tigrinum</i>	-	Menstrual Disorders.	9
<i>Magnesia Carbonica</i>	-	Menstrual Disorders.	10
<i>Zincum Metallicum</i>	-	Menstrual Disorders.	11
<i>Asokarista</i>	-	Regulates the flow of menstrual discharge. useful in menstrual Disorders.	12
<i>Tapyadi Leha</i>	-	Menstrual Disorders	13

Table 2 — Medicinal plants and Herbs effective in PCOS

Medicinal plant	Scientific name	Family	Mechanism of Action	Ref
Rusty mimosa, Biswal	<i>Acacia pennata</i>	Fabaceae	Regulates Menstrual disorders	14
Maruvam	<i>Origanum majorana</i>	Labiataeae	Regulates Menstrual disorders	15
Ulatkambal, Devils cotton	<i>Abroma augusta</i>	Sterculiaceae	Uterine tonic and regulates menstrual flow	16
Red clover	<i>Trifolium pratense</i>	Fabaceae	Antioxidant, estrogenic, progesterogenic	17
Cinnamon	<i>Cinnamomum zeylanicum</i>	Lauraceae	Improves Insulin sensitivity	18
Coconut	<i>Cocos nucifera</i>	Arecaceae	Lowers blood sugar level and improves lipid profile.	19
Saffron petals	<i>Crocus sativus</i>	Iridaceae	Regulates steroidal hormones.	20
Fig	<i>Ficus religiosa</i>	Mulberry	Alleviates steroidal imbalances	21
Chickpea	<i>Cicer arietinum</i>	Fabaceae	Lowers blood glucose level, oxidative stress and improves sex hormones.	22
Anise, aniseed	<i>Pimpinella anisum</i>	Apiaceae	Anti-blastocystic. Inhibits the blastocyte attachment to uterus	23
Durian fruit	<i>Durio zibenth Linn</i>	Malvaceae	Antioxidant, anti-hyperglycaemic, anti-inflammatory, anti-cholesterol	24
Lodha tree	<i>Symplocos racemose</i>	Symplocaceae	Anti-androgenic effect, antioxidant	26
Gymnea	<i>Gymneaselvestra</i>	Apocynaceae	Normalizes menstrual irregularities	26
Pergularia	<i>Pergulariadaemia</i>	Apocynaceae	Normalizes menstrual irregularities	26
Flax seeds	<i>Linum usitatissimum</i>	Linaceae	Improves Estradiol, progesterone and testosterone level	27
Spearmint	<i>Mentha Spicata</i>	Lamiaceae	Anti-androgenic	27
Aloevera	<i>Aloe barbadense</i>	Liliaceae	Anti-androgenic, anti-hyperglycaemic	28
Liquorice	<i>Glycyrrhiza radix</i>	Fabaceae	Lowers androgen levels	29
Green tea	<i>Camelia sinesis</i>	Theaceae	Lowers free testosterone levels and IR resistance	30
Chamomile	<i>Chamemilumobile</i>	Asteraceae	Anti-inflammatory, Stimulates menstruation	31
Fennel seeds	<i>Foeniculum vulgare</i>	Apiaceae	Anti-inflammatory, antioxidant, Reduce LH, and testosterone levels, Enhance FSH levels	32

India is a medicinal plants reservoir and is the largest producer of medicinal plants. The use of herbal remedies is an ancient practice and important in the health system.

### Phytoconstituents

Table 3 shows Phytoconstituents are biochemicals that occur naturally in medicinal plants and herbs. These are also known as Phyto drugs or bio chemicals or Phytochemicals. Plants can contain one or more compounds that attach themselves to the treatment of various diseases according to their own mechanism. The Phytoconstituents play their own role in treating many diseases with fewer side effects compared to synthetic drugs.

### Resveratrol

Resveratrol is a polyphenol of plant origin with beneficial effects in the treatment of diseases such as cancer, diabetes. It lowers the levels of testosterone and AMH<sup>1</sup>. The use of this Phyto-ingredient increases menstrual flow in women with PCOS<sup>1</sup>. It occurs naturally in fruits, nuts, and vegetables.

### Puerarin

Puerarin is an isoflavonoid obtained from the roots of *Pueraria lobata*, which is commonly known as Gegen in China. Due to its ability to lower androgen levels, it can be considered a potential bio-compound for the treatment of PCOS<sup>1</sup>. This Phyto-ingredient also has a noticeable effect on lowering insulin levels and systolic blood pressure.

### Biochanin A

Biochanin is a Phyto estrogenic isoflavone found in *Trifolium pratense*, commonly known as red clover. It has estrogen-like activity<sup>1</sup>. This isoflavone is a potent beta-estrogen agonist and acts as selective estrogen receptor modulators and therefore has potential in the treatment of PCOS<sup>17</sup>. In addition, this Phyto-ingredient can be used in the treatment of cardiovascular disease, cancer, osteoporosis, and menopausal symptoms<sup>17</sup>.

### Daidzein

Daidzein is an isoflavone obtained from the aerial parts of red clover. It is also found in food sources

Table 3 — Potential Phyto-ingredients in the management of PCOS

Phytoconstituent	Biological source	food source	Pharmacological action	Ref
Resveratrol	<i>Vitis vinifera</i>	red grapes, cranberries, peanuts	Anti-androgenic, Lowers LH and AMH levels	1
Puerarin	<i>Pueraria lobata</i>	-	Lowers cholesterol and testosterone levels	1
Biochanin A	<i>Trifolium pratense</i>	soybeans, kidney, beans	Reduce androgen synthesis	1, 17
Daidzein	<i>Trifolium pratense</i>	raisins, horse gram	Decrease testosterone levels	1, 17
Formononetin	<i>Trifolium pratense</i> , <i>Astragalus embranaceus</i>	green beans, sprouts	Antioxidant, improves ovarian function	1, 17
Anthocyanin	<i>Crocus sativus</i>	Saffron petals	Improves ovarian dysfunction	20
Curcumin	<i>curcuma longa</i>	Turmeric	Antioxidant, Antihyperlipidemic, Hypoglycaemic, Estrogenic.	33, 34
Berberine	<i>Berberis vulgaris</i>	Barberry, Turmeric	Improves ovulation	35
Quercetin	<i>Camellia sinesis</i>	citrus fruits, green tea, bracholi	Anti-androgenic, Reverse Insulin resistance	36
Naringenin	-	citrus fruits, cherries, tomatoes, beans	Reduce Insulin resistance, Anti-androgenic	37
Rutin	<i>Ruta graveolens</i> , <i>Eucalyptus macrorhyncha</i>	black tea, figs, apples	Enhances BAT activity, improves metabolism	38
Apigenin	-	parsley, spinach	Decreases count of ovarian cysts	39
Hesperidin	-	Grapes, citrus fruits, spearmint, onions	Enhances follicle development	40
Genistein	<i>Gunneratinctora</i>	Horse gram, soy protein	Anti-androgenic, improves ovarian function	41

such as beans, horse grass, raisins. Daidzein has many health benefits against diseases such as cancer, inflammation and has been proven by studies. Research has shown that Daidzein has a potential effect on the development of healthy follicles in PCOS ovaries and increases progesterone levels<sup>1</sup>.

### Formononetin

Formononetin is another Phyto estrogenic isoflavone obtained from aerial parts of *Trifolium pratense*. Due to its positive effects on reducing oxidative stress, lipid levels, glucose levels and improving insulin resistance, it can be put forward as a potential compound for the treatment of PCOS<sup>1</sup>.

### Anthocyanin

Anthocyanin is a Phyto chemical obtained from saffron petals (*Crocus sativus*). It improves ovarian dysfunction<sup>20</sup>. Consumption of saffron petals as dietary supplement regulates the mRNA levels of LH, FSH, estrogen and progesterone. It also regulates inflammatory genes<sup>20</sup>. This indicates that anthocyanin possess anti-inflammatory property. Anthocyanin naturally obtained from saffron petals acts as a potent Phyto-ingredient in the treatment of PCOS.

### Curcumin

Curcumin is polyphenol obtained from turmeric (*Curcuma longa*). It has several pharmacological

effects and is said to have multiple health benefits. It put up to the increased oxidation of fatty acids and glucose in peripheral tissues<sup>33</sup>. Curcumin is favorable in preventing hyperglycemic, hyperlipidemic and oxidative stress. This Phyto-ingredient also has advantageous effect on the metabolism of glucose and lipids. Curcumin lowers testosterone levels and better's progesterone and estradiol levels<sup>34</sup>.

### Berberine

Berberine is a bioactive alkaloid compound that can be extracted from medicinal plants like *Berberis vulgaris*, *Berberis aristocrat* and can be obtained naturally through foods like barberry, grapes, and turmeric *etc.* It perfects ovulation by increasing the cystic follicles in the ovary. Berberine also has great potential to reduce insulin resistance and modulate the LH to FSH ratio by modulating metabolic syndromes<sup>1</sup>. Berberine ameliorates cystic follicles and LH levels and shows a reduction in corpus luteum<sup>35</sup>.

### Quercetin

Quercetin is a flavonoid that can be acquired naturally from fruits and vegetables<sup>1</sup>. In androgens on expressive PCOS, it regulates androgens. Quercetin improves inflammation of the ovaries and inverts insulin resistance. It also inhibits granulocyte apoptosis and regulates androgen negative

overexpression<sup>36</sup>. Quercetin is naturally obtained from foods such as onions, citrus fruits, bracholi, *etc.*

### Naringenin

Naringenin is a natural flavonoid obtained from various fruits such as citrus fruits, cherries, *etc.*, and vegetables such as tomatoes, beans, *etc.*<sup>1</sup>. It has antioxidant and anti-inflammatory properties. Naringenin is this Phyto-ingredient lowers testosterone levels and regulates the LH/FSH ratio<sup>1</sup>. The pharmacological effects of naringenin were like those of metformin and acted by reducing insulin resistance in PCOS<sup>37</sup>.

### Rutin

Rutin is a glycoside found in the plant *Ruta graveolens* and has various pharmacological actions<sup>1</sup>. It lowers androgen levels and increases progesterone levels<sup>[1]</sup>. Helps reduce cystic follicles. Rutin has been shown to enhance brown adipose tissue activation and enhance PCOS phenotypes such as acyclicity and infertility<sup>38</sup>.

### Apigenin

Apigenin is a flavonoid found in leafy greens such as spinach, parsley and onions which are also found in herbs such as chamomile and basil. This Phyto-ingredient has various pharmacological actions, such as anti-cancer, anti-viral and anti-mutagenic. It changes lipid and glucose levels and enhance insulin resistance and. It brings down oxidative stress and reduces the number of cystic follicles<sup>1</sup>. Apigenin lowers estrogen levels and LH/FSH ratio<sup>39</sup>.

### Hesperidin

Hesperidin is a bioflavonoid profusely exist in citrus fruits. Lifestyle modification like exercise, diet plays a key role in the treatment of PCOS, and hesperidin may improve lifestyle modification<sup>1</sup>. Hesperidin forbids the sperm enzyme hyaluronidase and acts as an anti-infertility agent<sup>40</sup>. Research has shown that hesperidin increases the rate of follicular development and promotes follicular development in the ovaries<sup>40</sup>.

### Genistein

Genistein is a phytochemical that has an anti-estrogenic effect. It is found in *Guneratinctora*, *Gunera saggitalis*. It can also be obtained through foods such as horse gram, soy protein. An *in vivo* study conducted by Xiao-Xing CHI proved that genistein improves ovarian function by enhancing Bcl-2 and decreasing Bax proteins<sup>41</sup>.

### Natural remedies for curing PCOS

Apart from the form systems mentioned above, yoga also plays an important role in healing many human diseases like PCOS, diabetes, hypertension, *etc.* With PCOS, yoga shows significant healing as compared to other practices. Research has shown that yoga is more effective than other physical exercises in lowering cholesterol, LH and FSH<sup>42</sup>. Yoga aids to regulate menstrual cycles with insignificant changes in body weight, FSH. Yoga helps reduce stress and regular yoga practice increases blood circulation, puts pressure on the reproductive organs and improves hormone stimulation<sup>43</sup>.

### Discussion

This review provides a brief overview of the different systems of traditional medicine available for the management of PCOS. However, the mechanism of action of some formulations was unclear, but their potential has been demonstrated since ancient times. Have a good diet with more fruits and vegetables and avoid excessive consumption of salt, refined sugar, and saturated fats. Not only do probiotics help your digestion and gut health, but they also play an important role in treating PCOS by regulating sex hormones such as androgens and estrogens.

Eat less saturated fat, reduce your salt intake, eat more fruits and vegetables, and avoid refined sugars. Of course, PCOS can be cured by regulating the diet. A good diet of fruits and vegetables not only helps to cure and prevent PCOS, but also many other diseases. A fruit diet helps cure PCOS<sup>44</sup>. It is well known that hormonal imbalance and obesity are the main causes of PCOS, which can be controlled by naturopathy and yoga. Long-term benefits can be obtained through the regular practice of asanas and brisk walking. Avoiding stimulants such as tea, coffee, and alcohol can help control PCOS<sup>43</sup>.

Apart from the above proven methods few herbs like *Areca catechu*<sup>44</sup>, *Clerodendrum infortunatum*<sup>45</sup> which have proven anti-oxidant and anti-inflammatory properties can be effective in treating PCOS.

### Conclusion

Women with PCOS are challenged in their fertility wisdom. Several threatening factors, including insulin resistance, obesity, anovulation, and dyslipidemia, have been studied in PCOS. Synthetic drugs such as metformin and clomiphene have already been shown to be effective in treating PCOS. But their known and

unknown side effects lead them to prefer traditional systems and herbal remedies that have few or no side effects. Traditional medicines like Ayurveda, Homeopathy, Unani, and Siddha Addiction contain medicines based on herbs, animals, and minerals. Medicinal plants and herbs and phytoconstituents have proven to be successful in treating PCOS. Lifestyle improvisation, healthy diet, and exercise facilitate recovery from PCOS.

### Conflict of interest

All authors declare no conflict of interest.

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