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Review Paper

Emerging Role of Herbal Plants in The Management Of PCOS: A Literature Review

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ABSTRACT

Polycystic Ovary Syndrome (PCOS) is an endocrine and metabolic disorder in which multiple cysts can be seen in the ovaries of affected one. It is the complex syndrome of hormonal imbalance, metabolic dysfunction, and reproductive irregularities shows significant challenges in its management. PCOS is associated with various clinical symptoms such as irregular menstruation, infertility, androgen growth, hirsutism, insulin resistance, acne, obesity. Herbal medicines are currently most preferred way of treatment due to their perceived efficacy and less adverse effects compared to allopathic treatment. The abstract explores about the emerging role of herbal plants in the management of PCOS. Moreover, this abstract highlight the evidence-based efficacy of select herbal plants, such as Vitex agnus-castus, Foeniculum vulgare, Zingiber officinale, Cinnamomum zeylanicum, Withania somnifera, Aloe barbedensis, Mentha spicata Linn and Glycyrrhiza glabra. With the comprehensive survey of current literature, the active chemical constituents present in various herbal remedies are explained, along with their mechanisms of action in the management of polycystic ovary syndrome such as Aloe barbedensis improve fertility by increasing the number of ovarian follicles, vitex agnus-castus reduce hirsutism by reducing testosterone and androgen levels. It has also shown that Cinnamomum zeylanicum and Glycyrrhiza glabra improve the adverse effects on diabetes caused due to PCOS by lowering lipid and blood glucose levels. Furthermore, the abstract discusses about the challenges and opportunities related to introduction of herbal medicine into PCOS management. So it is concluded that the herbal plants are mostly preferred for the management of PCOS. However, more research and study including randomized controlled trials and long-term safety assessments, is required to validate their efficacy, safety and potency.

INTRODUCTION

Poly: many, Cysts: A cyst is a sac filled with water that contains an egg that should have been

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normally discharged for possible fertilization. The conversion of the egg into a cyst, termed as “functional cyst”, prevent ovulation. As ovulation is blocked, it results in disruption of the menstrual cycle, causing amenorrhea. Syndrome means “A set of symptoms that occur together—a symptom complex”. High levels of androgens, or male hormones, in females who are of reproductive age are linked to PCOS, an endocrine disorder^{1,2}. PCOS is a multifaceted reproductive and metabolic condition that manifests in several ways, including irregular menstruation (Oligomenorrhea/Amenorrhea), hyperandrogenism, polycystic ovaries, metabolic disorders and psychosocial issues³. In 1935 Irving Stein and Michael Leventhal reported seven cause of patients with amenorrhea, infertility, and enlarged multi cystic ovaries, which is when polycystic ovaries syndrome (PCOS) was originally identified. In the same year the discovery of testosterone by Laquer and Butenandt, together with the creation of the first

androgen assay and a deeper comprehension cardiovascular (depression, anxiety, poor self-esteem, disordered eating, psychosexual dysfunction) features of the physiological and pathological roots of the hormones, rocked the field of biochemistry^{4,5,6}. Later research revealed that the adrenal gland and the ovaries both produce androgens and that a surplus of androgens in women was the cause of hyperandrogenism. With this insight, PCOS and its symptoms are now well understood⁷. In 2012, the World Health Organization (WHO) reported that over 116 million women globally suffered with PCOS. In India PCOS affects one in five women. Globally, 1.55 million incident instances of PCOS in women between the ages of 15 and 49 were recorded; this indicates a 4.47% (2.86–6.37%) increase in the rate between 2007 and 2017. In 2020, a nationwide survey carried out in India revealed that approximately 16% of female participants aged 20 to 29 had PCOS^{8,9,10}.

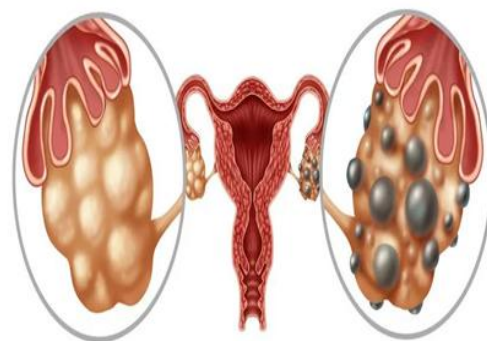
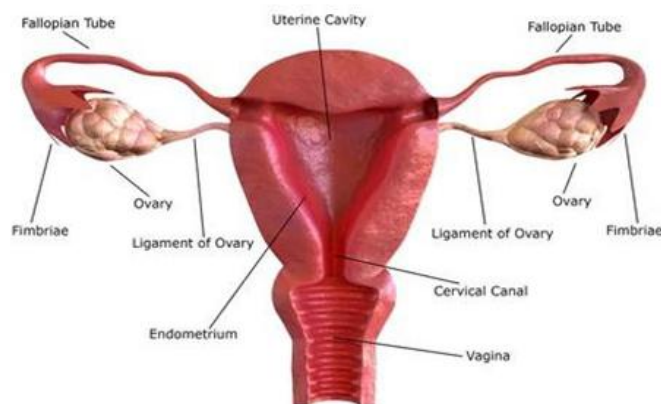


Figure no 1: comparison between normal ovary and polycystic ovary

SYMPTOMS

The PCOS patient often display, sugar cravings, frequent urination, delayed healing, fatigue, blurred vision, tingling, sensation, mood swings etc.^{11,12}. Many clinical signs, including regular menstruation, infertility, androgen increase, hirsutism, insulin resistance, acne, weight gain, and ovarian cysts, are linked to PCOS. In addition

to aberrant gonadotropin secretion of follicle stimulating hormone (FSH) and luteinizing hormone (LH), PCOS is characterized by an increase in the secretion of ovarian steroids, which may be associated to insulin resistance^{13,14}. Along with metabolic and reproductive issues, PCOS is linked to cardiovascular disease, psychological issues like eating disorders, anxiety, sadness, low

self-esteem, and psychosexual dysfunction¹⁵. Acanthosis nigricans, a disorder where light-coloured or black patches appear on skin, is caused by an imbalance in hormones in PCOS patients. Skin pigmentation is more common on the skin of the neck, thighs, armpits, and breast^{16,17}.

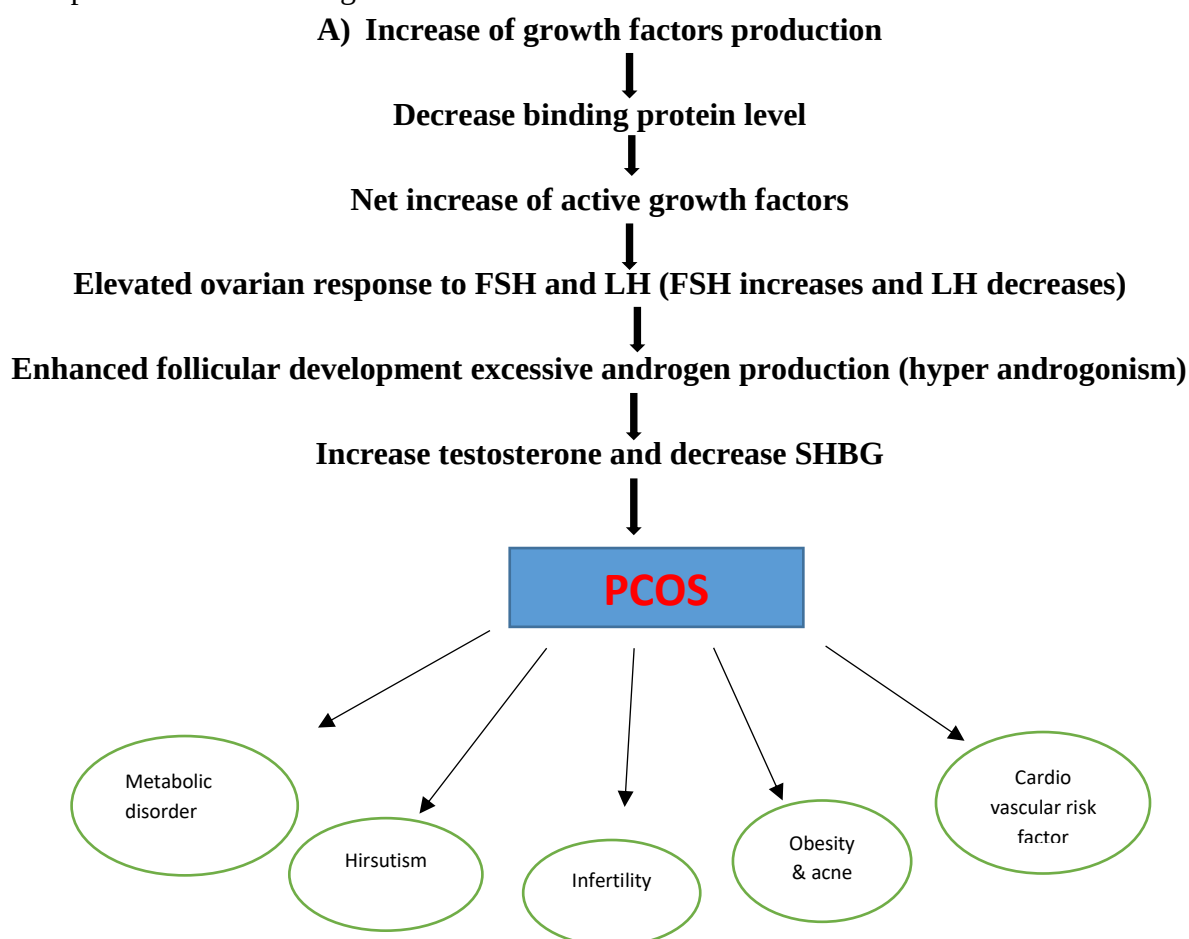
ETIOLOGY

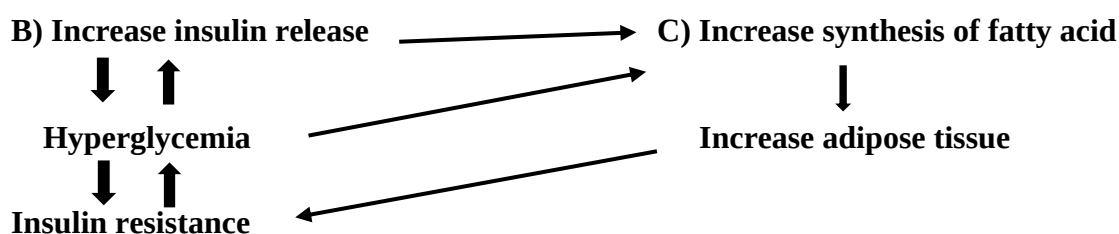
The major etiology behind PCOS is primary disordered, gonadotropins secretions, ovarian, and adrenal hyperandrogenism and disorder of insulin resistance¹⁸. Uncontrolled gonadotropin hormone (GnRH) regulation can result in follicular arrest, high anti-mullerian hormone (AMH), decreased FSH, increased luteinizing hormone (LH), and increased release of testosterone, estradiol, and dehydro epiandrosterone¹⁹. An increase in LH and a decrease in FSH have been linked to immature follicle growth in PCOS, as this inhibits follicle maturation at the final stage. Similarly, the increased production of androgens and reduced

blood level of aromatase were lead to hyper insulinemia and dyslipidaemia^{20,21}. Disrupt ovarian synthesis of steroid hormone in these disease may result in an increase in circulating androgen, which may be more pronounced in women with polycystic ovarian syndrome. Hormonal imbalance can result from a lack of aromatase activity because the enzyme is responsible for catalyzing the manufacture of estrogen from androgens²².

PATHOGENESIS

The exact pathogenesis of PCOS is not known yet, but evidence suggest that higher ovarian androgen production, either genetically or due to extra ovarian factors such as hyperinsulinemia or disturbance of the hypothalamic pituitary ovarian axis are the main cause in the pathogenesis of PCOS^{23,24}. Following are the flow charts which can justify the pathogenesis of PCOS





CAUSES OF PCOS

The main causes of PCOS includes environmental factors, genetics factors, eating habits, improper lifestyle, using personal care, products containing cancerous, preservatives, family history, inflammatory factors, altered steroidogenesis, obesity and hormonal imbalance, which is further indicated by an irregular menstrual cycle, Many cysts in ovaries, amenorrhea and hirsutism in females of reproductive age²⁵⁻²⁸. The other main important factor is chemical exposure which includes pesticides, vehicle exhausts, industrial pollutants, cosmetic, cleaning agents, chemotherapeutics etc²⁹.

Co-morbidities associated with PCOS

PCOS is associated with an increased risk of obesity, diabetes mellitus, insulin resistance, cardiovascular diseases, endometrial cancer, endometrial hyperplasia, depression, anxiety and metabolic, sleeping and sexual disorders³⁰.

DIAGNOSIS OF PCOS

It includes some tests like:

- **Medical history:** it includes symptoms like irregular periods, hirsutism, acne, weight gain, and any other relevant medical history.
- **Physical test:** A physical exam may include checking your blood pressure, BMI, waist circumference, and signs of excess hair growth or acne.
- **Blood test:** Blood tests may be conducted to measure hormone levels, including testosterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), prolactin, and thyroid hormones. Elevated levels of androgens (male hormones) such as testosterone are common in PCOS³².

- **Sonography test:** A sonographic test of pelvic may be performed to examine ovaries for the presence of cysts (follicles). The diagnosis of PCOS is generally made when at least two out of three following criteria are matched:

1. oligo menorrhea or amenorrhea²³⁻²⁵.
2. Clinical signs of hyperandrogenism (excess male hormones), such as hirsutism, acne, or elevated levels of androgens in blood test.
3. Polycystic ovaries are observed on ultrasound scan (multiple cysts on the ovaries)

Material and Method (Data Extraction Process)

Articles published up to January 2024 were searched and overall, 142 related articles were downloaded for this review. The articles were collected from searches in PubMed, WHO, Research gate, Science Direct, and Google Scholar search engine for different types of plants, which have effect on fertility process and PCOS, using their vernacular and scientific names. Then, we chose the plants that have positive effect on female fertility and searched articles with different keywords such as "the effect of (name of plant) on the female reproductive system or reproductive function or oogenesis or PCOS." Original papers without time restrictions were chosen. 105 articles were selected after eliminating duplicate studies. Information from selected articles was classified according to the target effect of a plant extract on in vitro and in vivo (rodent and human female reproductive) function. In view of the significance of herbal remedies in the treatment of PCOS, herein, we discuss the chemical constituents, mechanisms of action and therapeutic application of selected herbal drugs against PCOS by referring

to the Scopus, Science direct, PubMed, Google Scholar and Research gate. The following is a detailed discussion of the selected herbal drugs that are effective against PCOS via various mechanisms.

RESULT AND DISCUSSION

Management of PCOS based on herbal therapy

The demand of herbal medicines has been increased nowadays due to the low economic cost and fewer side effects of the herbal drugs. Herbal medicine often takes a more holistic approach to health, focusing on treating the root cause of the problem rather than only treating its symptoms²⁻⁷.

1. Fennel

Biological name: *Foeniculum vulgare* Miller

Family: Umbelliferae **Part used:** Fruit

Mechanism of action: fennel inhibit the formation of dihydrotestosterone receptor complex which reduces testosterone level. fennel contains anethole which promotes menstruation, facilitates birth and induces estrogen level. Fennel may increase the aromatase enzyme, which is responsible for the conversion of androgen into estrogen^{24,25}. It also contains vitamins that have very high antioxidant property which protect the cell from oxidative damage. It also helps in hirsutism. A long-term use of fennel has negative feedback effect on LH and testosterone level.

Other uses: A series of studies have shown that fennel has beneficial effects against numerous infectious disorders of fungal, bacterial, viral, mycobacterial and protozoal origin as well as antitumor, antioxidant, cytoprotective, chemopreventive, hypoglycemic, hepatoprotective and androgenic properties.

Side effects: A study on rats showed that low doses (50 µg/100 g body weight) of fennel extract after 10 days caused vaginal cornification and induced the estrus cycle while at moderate doses (250 µg/100 g body weight), and it increased the weight and volume of genital organs (mammary glands, oviduct, endometrium, myometrium,

cervix, and vagina) in female rats. Fennel extract reduced the frequency of uterine contractions by affecting the synthesis of oxytocin and PGF₂ and alleviated dysmenorrhea pain at different doses^{22,25}.

2. Liquorice

Biological name: *Glycyrrhiza glabra* **Family:**

Fabaceae **Part used:** roots and stolones

Mechanism of action: Liquorice may have estrogen-like activity and mild inhibitory effects on the metabolism of endogenous hormones. Licorice inhibits the activity of 17-hydroxyl esterase dehydrogenase and 17,20-lyase activity, stimulates aromatase activity, affects α₅ and β₅ reductase, and is used for the treatment of menopause due to estrogen like effects^{1,30}. Licorice reduces excess hair growth due to enzymatic effects on the melatonin production cycle and possibly inhibits tyrosinase activity. Licorice also reduces serum hormones level by damaging the activity of 11β- hydroxysteroids dehydrogenase and increasing the aromatase activity or by progesterone-like activity. Yang et al. found that licorice extract inhibits the symptoms of PCOS by regulating controlling levels of serum FSH, LH/FSH ratio, and irregular ovarian follicles^{31,32}.

Other uses: It is used in various medical conditions, such as an expectorant and demulcent, to treat various infections and in osteoarthritis. The plant issues potent antidiabetic, spasmolytic, antidepressive, laxative, antiulcer, and anti-inflammatory effects.

Side effects: A dose higher than 2 mg kg⁻¹ day⁻¹ of pure glycyrrhizic acid (i.e., the main constituent of liquorice) may result in side effects such as hypokalemia, hypertension, apparent mineralocorticoid excess (AME) syndrome (via inducing sodium retention and suppressing the renin-angiotensin-aldosterone system), muscle weakness, and even death^{1,7,25}.

3. Spearmint



Biological name: *Mentha spicata* **Family:** Linaceae **Part used:** Leaves and flowering tops **Mechanism of action:** It reduced the free and total testosterone levels, as well as the degree of hirsutism. Spearmint improves ovarian cysts in PCOS by reducing atretic follicles and enhancing graafian follicles. *Mentha* regulates the blood ratio of LH and FSH. Based on this regulation of LH/FSH in the blood, it could be useful for the treatment of PCOS. Several preclinical studies have shown that spearmint has anti-androgen properties^{13,19}.

Other uses: The plant *Mentha spicata* is commonly used in the treatment of loss of appetite, common cold, bronchitis, sinusitis, fever, nausea and vomiting, and indigestion as an herbal agent. It has anti-inflammatory, antidiabetic and anti-cancer properties. *M. spicata* is highly active as fungitoxicants and could safely be used as natural preservatives to replace synthetic fungicides in the prevention and cure of some plant, human and animal fungal disease.

Side effects: Spearmint is well tolerated in recommended single doses of up to 500 Mg or taken as a tea twice daily for 30 days. At higher doses i.e. more than 500 Mg it can cause chest pain. When spearmint tea is given in regular basis for up to 30 days shows lipid peroxidation, hepatic damage and uterine damage^{7,22}.

4. Ginger

Biological name: *Zingiber officinalis* **Family:** Zingiberaceae **Part used:** Roots and rhizomes **Mechanism of action:** Ginger helps in estrogen-progesterone balance and it regulate the sex hormones in the blood. Ginger's phytoestrogen can balance the estrogen to progesterone ratio. it shows anti-prostaglandin effect by inhibiting prostaglandin production and suppressing arachidonic acid production. Ginger also contain anti-oxidant properties and may prevent free radical generation^{23,36}.

Other uses: Ginger possesses variety of biological activities, including antioxidant, anti-inflammatory, antimicrobial, infectious diseases, helminthiasis anticancer, neuroprotective, cardiovascular protective, respiratory protective, antiobesity, antidiabetic, antinausea, and antiemetic activities. *Zingiber officinalis* used in rheumatism, muscular aches, pains, sore throats, cramps, hypertension and as well as dementia. it improves insulin sensitivity, reduce inflammation and oxidative stress, and relieve digestive discomfort i.e. bloating, gas and indigestion. **Side effects:** No toxicity can observe at 1000mg/kg body weight but some minor side effects can be seen like heartburn, gastric irritation at dose higher than 6 gm^{35,23,25}.

5. Turmeric

Biological name: *Curcuma longa* **Family:** Zingiberaceae **Part used:** Rhizomes **Mechanism of action:** Turmeric decrease androgen and Progesterone level which help in restoring the ovulation. It reduces follicular sheath and improve formation of the corpus luteum. It also suppresses the serum levels of progesterone and elevate the levels of estradiol in women with PCOS. It activates insulin receptors which helps in insulin resistance (IR)^{25,37}.

Other uses: Turmeric is used in rheumatoid arthritis, cancer, cardiovascular disease, type 2 diabetes mellitus and improve comorbidities associated with it. It possesses a wide variety of biological effects like anti-inflammatory, antioxidant, hypoglycemic, anti-hyperlipidemic activities and estrogenic effects. It also used as anti-viral, anti-fungi and antiseptic agent^{38,39}. **Side effects:** The dose of curcumin 8000mg/day causes no toxicity. But some minor side effects can be seen with large doses like hepatotoxicity and gastric irritation³³.

6. Aloe



Biological name: Aloe barbedensis **Family:** Liliaceae **Part used:** Leaves **Mechanism of action:** Aloe vera not only suppressed 3β -HSD activity and 17β -HSD activity but also reduced the ovary weight, resulting in the suppression of overall androgen secretion. Additionally, it also increased estrogen synthesis by stimulating the flux of the steroidogenesis pathway. It may help to reduce inflammation and oxidative stress associated with PCOS, regulate hormones, improve insulin sensitivity. The histological analysis found that aloe vera decreases the ovarian atretic cysts^{27,30}.

Other uses: Aloe vera shows hypoglycaemic effects and it is rich in fiber which accelerates gastrointestinal transit, absorption, and modulation of hemostasis. Some studies reported that Aloe vera can reduce Triglyceride (TG) and low-density lipoprotein (LDL-C) levels, decrease atretic follicles, and improve glucose intolerance and lipid metabolizing enzyme activities. Aloe vera boost the immune system. It is also used in skin burns, Seborrheic Dermatitis and mucositis²⁷.

Side effects: A risk of arrhythmia and potassium depletion may increase with prolonged use of oral aloe latex. Occasional abdominal cramping and diarrhoea with oral use have been reported anecdotally by practitioners. Using laxatives such as aloe latex for more than 7 consecutive days may aggravate constipation or cause dependency. Chronic use or abuse of it for more than 1 year has been associated with increased risk of colorectal cancer³⁸.

7. Cinnamon

Biological name: Cinnamomum zeylanicum **Family:** Lauraceae **Part used:** Bark **Mechanism of action:** Cinnamon act as an adjunctive therapy in the treatment of PCOS. Cinnamon supplementation improved the menstrual cyclicity and it is effective for polycystic ovary syndrome. Cinnamon extract enhance insulin signalling at the post-receptor level, increase the activity of

Phosphoinositide 3 (PI3) kinase, increase the glucose uptake via enhancing the GLUT4 glucose transporter, inhibit the glycogen synthesis, and enhance glycogen synthesis and hypoglycaemic effects. cinnamon acts as an insulin sensitizer^{28,29}.

Other uses: It is used for the treatment of dyspeptic conditions, flatulence, loss of appetite, abdominal pain, diarrhoea, leucorrhoea, vaginitis, rheumatism, wounds, and toothache. It has free radical scavenging and antioxidant activities. **Side effects:** Two textbooks on herbal medicines reported that cinnamon is safe when used in medicinal amounts, but may be of concern when used in excessive amounts or in the long term (Newall et al. 1996; McGuffin et al. 1997). One of these texts reported that cinnamaldehyde consumption should not exceed 700 g/kg (Newall et al. 1996). A case was reported in which a child ingested 60 mL of cinnamon oil had serious side effects, including vomiting, diarrhoea, dizziness, and loss of consciousness (Pilapil 1989)²⁹.

8. Ashwagandha

Biological name: Withania somnifera **Family:** Solanaceae **Part used:** Roots **Mechanism of action:** Ashwagandha increases the secretion of gonadotropin hormones and finally improved oogenesis, due to boosting the HPG axis and improving serum estrogen balance.

Other uses: Ashwagandha is used as anti-cancer, anti-inflammatory, anti-diabetic, anti-microbial, anti-arthritis, anti-stress/adaptogenic, neuro-protective, cardio-protective, hepato-protective, immunomodulatory properties. It is also used for the management of premature ejaculation, polyarthritis, painful swellings, lumbago, oligospermia, vitiligo, general debility, ulcers, impotency, uterine infections, leucorrhoea, and orchitis^{37,38}.

Side effects: The LD50 of W. somnifera root extract was found to be more than 1000 mg per kg in female albino rat. During acute and chronic



toxicity studies, some gross observational effects at the dose of 1000 mg per kg were recorded as the initial excitement, followed by mild depression, dullness, decreased respiration and reduced spontaneous motor activity but there was found no mortality in any group of rats^{25,39}.

9. Chaste tree berry

Biological name: Vitex agnus-castus **Family:** Verbenaceae **Part used:** Fruit and leaves

Mechanism of action: Chaste tree berry can reduce the release of the prolactin and FSH hormones by affecting the HPG axis. By acting on dopamine receptors, its extract reduces prolactin secretion, modulates the release of FSH and LH, increases serum levels of estrogen and progesterone, and ultimately improves sexual function¹³. The extract of this plant also stimulates the secretion of corpus luteum after ovulation to produce progesterone, which ultimately regulates female sexual cycle. It can correct hormonal imbalances and improve fertility. It increased progesterone levels and decreased testosterone levels, but did not affect estradiol and DHEA levels¹⁹. The plant extract may also increase the activity of aromatase enzyme and reduce testosterone levels by aromatizing it to estradiol¹⁷.

Other uses: The German health authorities have approved the use of V. agnus-castus for menstrual cycle irregularities, premenstrual syndrome, mastalgia, and menopausal disorders. It has several pharmaceutical effects including antioxidant, chemopreventive, immunomodulatory and cytotoxicity, tumoricidal, antimutagenic, antimicrobial, antifungal, insect repellent, larvicidal, fracture healing, osteopenic, antinociceptive, opioidergic, antiepileptic, preventing nonalcoholic fat liver disease and oxidative stress, and anti-inflammatory activities.

Side effects: The German Commission E has been suggested that 3–6 g daily of dried herb and 1 g/day of dried fruit could be taken daily for menstruation disorders²². After treatment with the

essential oil of V. agnus-castus leaves, no animal death was observed even at the highest dose (5000 mg/kg) after 2 days from administration. Therefore, the LD₅₀ of this essential oil in mice exceeded the highest dose of 5 g/kg. Adverse effects followed by application of this plant are mild and reversible. The most recurrent adverse events are nausea, intermenstrual bleeding or menstrual disorders, headache, gastrointestinal disturbances, weight gain, acne, dizziness, and allergic reactions^{22,17}.

10. Chamomile

Biological name: Matricaria chamomilla **Family:** Asteraceae **Part used:** Flower

Mechanism of action: Antispasmodic effect of chamomile makes the menstrual cramps easier and reduce premature births. Apigenin is one of the major flavonoid chamomile components which inhibit the binding of flunitrazepam (benzodiazepine derivatives). Benzodiazepine joined to gamma aminobutyric acid (GABA) is a natural neurotransmitter amino acid in brain and reduces the secretion of LH. Chamomile contains phytoestrogen which can decrease the menstrual disorder through changes in hormone positive estrogen feedback^{22,34}. It increases progesterone, 17 β -estradiol, and dehydroepiandrosterone levels, decreased ROS (reactive oxygen species), follicular diameter, and antrum formation, and prolonged the survival of oocytes. In addition, phytoestrogens inhibit progesterone metabolizing enzyme, 20-alpha-hydroxysteroid dehydrogenase and increase progesterone hormone. It also prevents weight gain and reduce cholesterol levels.

Other uses: Chamomile have anti-inflammatory, antispasmodic, and antioxidant effects.

Side effects: Side effects are uncommon and may include nausea, dizziness, and allergic reactions. Rare cases of anaphylaxis (a life-threatening allergic reaction) have occurred in people who consumed or came into contact with chamomile products. There have been reports of chamomile as



a potential carrier of *Clostridium botulinum* spores. A review reported the genotoxicity of Chamomile in mice using ultra-viable micronucleus assay of reticulocytes. However, Wang et al. reported that the aqueous and alcohol extracts of this plant are safe for mice²⁵. It has been reported that the maximum tolerated dose of aqueous and alcohol extracts are 535 and 425 times higher than the usual adult dose in a clinic. So far, only a few studies have been carried out to evaluate its toxicity, and more studies are required to confirm the safety of consuming chamomile³¹.

11. Fenugreek

Biological name: *Trigonella foenum* **Family:**

Leguminosae **Part used:** Seeds and Green leaves

Mechanism of action: It decreases insulin resistance in women with PCOS. Fenugreek has hypoglycaemic effects through stimulating insulin synthesis, insulin secretion from beta-pancreatic cells, and inhibiting alpha-amylase and sucrose. It helps in reduction of cyst size.

Other uses: Fenugreek has anti-diabetic and cholesterol lowering effects³³. It may also help to regulate the menstrual cycles. It has been shown to exert significant antiatherogenic, antianorexic, antioxidant, anticarcinogenic, antihyperlipidemic, galactagogue and anti-inflammatory effects.

Side effects: Studies in animal models suggest a low acute toxic potential of fenugreek by oral route at 2 and 5 g/kg bw in mice and rats respectively and by intraperitoneal route at 0.65 and 3.5 g/kg bw in mice and rats respectively²². Thus, to prevent an accidental overdose in man and woman by oral administration, 21g/ per adult human weighing 60 kg is suggested as a limit. At high doses the potential side effects of fenugreek include diarrhea, nausea, and other digestive tract symptoms and rarely, dizziness and headaches. Large doses may cause a harmful drop in blood sugar. Fenugreek can cause allergic reactions in some people²⁵.

Herbal Plants and Their Effects on PCOS

Sr. No.	Herbal Plant	Scientific Name	Family	MOA	Effects on PCOS
1	Fennel	<i>Foeniculum vulgare</i>	Apiaceae	Antiandrogen and phytoestrogen	Decreased LH and increased concentration of FSH
2	Liquorice	<i>Glycyrrhiza glabra</i>	Fabaceae	Antiandrogen and phytoestrogen	Improves the adverse effect of hyperandrogenism
3	Spearmint	<i>Mentha spicata</i>	Lamiaceae	Antiandrogen	Reducing testosterone and blood sugar level
4	Ginger	<i>Zingiber officinalis</i>	Zingiberaceae	Antioxidant and anti-inflammation	Lowering excess levels of LH and increasing LH production
5	Turmeric	<i>Curcuma longa</i>	Zingiberaceae	Antioxidant and anti-inflammation	Suppresses serum levels of progesterone and elevates estradiol levels
6	Aloe	<i>Aloe barbadensis</i>	Asphodelaceae	Antiandrogen	Decreasing testosterone and insulin levels by improving progesterone levels
7	Cinnamon	<i>Cinnamomum zeylanicum</i>	Lauraceae	Increasing glycogen production and insulin receptor phosphorylation	Improves insulin sensitivity and reduces lipid and blood glucose levels
8	Ashwagandha	<i>Withania somnifera</i>	Solanaceae	Increases secretion of gonadotropin hormones, boosting the HPG axis	Improves serum estrogen balance

9	Chaste berry	Vitex agnus-castus	Lamiaceae	Antiandrogen and phytoestrogen	Decreased serum level of testosterone and increased serum level of progesterone
10	Chamomile	Matricaria chamomilla	Asteraceae	Antispasmodic and phytoestrogen	Reduces the secretion of LH
11	Fenugreek	Trigonella foenum	Leguminosae	Hypoglycaemic	Decreased insulin resistance

CONCLUSION

This review is helpful to understand the symptoms, causes and pathogenesis of polycystic ovarian syndrome. The PCOS is one of the common reproductive disorder in females. It is severe, as it may cause infertility in females. This study concluded that the herbal plants may have potential to improve the insulin resistance, hormone level in blood, obesity, lipid profile and hair loss. This review is an attempt to summarise some important herbal plants for the management of PCOS. Herbal plants may take a little longer time to cure but regular use of these herbal plants or herbal drugs can help to treat the disease from its root. Further investigations should be made for better understanding of Effectiveness, doses and mechanism of action of the herbal drugs

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