International Journal of Herbal Medicine
Available online at www.florajournal.com

E-ISSN: 2321-2187
P-ISSN: 2394-0514
www.florajournal.com
IJHM 2025; 13(2): 17-29
Received: 02-01-2025
Accepted: 05-02-2025

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Review on herbal drugs used in PCOS (Polycystic ovarian syndrome)

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DOI: https://www.doi.org/10.22271/flora.2025.v13.i2a.974

Abstract
Polycystic ovary syndrome (PCOS) is a complex endocrine reproductive disorder that impacts women who are of reproductive age. Polycystic ovary syndrome (PCOS) was initially defined by Leventhal and Stein in 1935. This disorder can be managed through the use of herbal medication. Numerous herbal medications that aid in the treatment of PCOS are acknowledged in this review study. We looked at the effects of a few herbal medications on PCOS, including fennel, flaxseed, black cumin, cinnamon, liquorice, and Aloe Vera. Additionally, it is thought to increase insulin sensitivity, metabolic profiles, ovulation, fertility, reproductive outcomes, and hormone balance. It also shows antioxidant and anti-inflammatory properties. Variability in dosage regimen, however, emphasizes the necessity of more thorough clinical trials. This article offers a thorough analysis of herbal medications in the treatment of PCOS, educating patients and medical professionals about available phytotherapeutic choices.

Keywords: Polycystic ovary syndrome, herbal drugs, hormonal imbalance, insulin resistance, anovulation

Introduction
The disease was first described in 1935 by American gynaecologists Irving F. Stein and Michael L. Leventhal, who gave it the original name of Stein-Leventhal syndrome. The first recorded case of a young married woman with infertility and moderate obesity was documented by an Italian physician in 1721. The patient had larger-than-normal ovaries and was classified as having what is now known as PCOS, but at the time, the condition was not recognized. Despite Choureau's 1844 description of the sclerocystic alterations in ovaries, it wasn't until Stein and Leventhal conducted extensive research on the subject that it was acknowledged. Concerning ultrasonography [1, 2]. A polycystic ovary is characterized by an unusually high number of developing eggs visible at the ovarian periphery, resembling a string of pearls [3].

Metabolic abnormalities in women during reproductive stages are associated with PCOS, a complicated endocrine reproductive illness [4]. Many cysts on the ovaries, irregular or nonexistent menstrual cycles, and elevated levels of androgens (male hormones) in the body are the hallmarks of this condition after many cysts grow in the ovarian follicles due to the hormonal imbalance [5, 6]. PCOS (polycystic ovarian syndrome) is one of the most common conditions affecting the reproductive and metabolic systems [7]. Females aged 15 to 30 are the most common age group for this syndrome [8]. Hyperandrogenism, irregular menstrual cycles, and persistent ovulation are the main signs of PCOS. Even though this condition most certainly has epigenetic roots, its etiology is yet unknown, hence there is no one effective treatment [7]. In addition to increased ovarian steroid secretion, which may be connected to insulin resistance, PCOS is characterized by abnormal gonadotropin secretion, including luteinizing hormone (LH) and follicle-stimulating hormone (FSH) [9]. PCOS is identified by combining amenorrhea or oligomenorrhea, polycystic ovarian ultrasonography appearance, and clinical or laboratory indications of hyperandrogenism. Adverse insulin dynamics are widespread, similar to metabolic syndrome, and about half of PCOS patients are fat. Menarche-related symptoms typically start soon after and gradually worsen [10]. Research indicates that PCOS is a hereditary disorder [11]. Pharmacological therapies and lifestyle modifications are currently part of the standard care treatment for PCOS. Weight loss, exercise, and dietary changes are all related to changing one's lifestyle.

Drugs that reduce insulin (metformin and thiazolidinediones), inhibit testosterone (spironolactone, flutamide), and combine estrogen and progesterone (oral contraceptives) are examples of pharmacological therapies. Although these treatments come at a high cost and can have several negative consequences, including weight gain, gastrointestinal problems, irregular menstruation, and increased insulin resistance [12]. In contemporary medicine, metformin, eflornithine, letrozole, spironolactone, and clomiphene citrate are used to treat PCOS. Oral contraceptives are typically used to treat menstrual problems. Antiandrogens, oral contraceptive pills, and metformin are examples of pharmaceuticals that are often utilized. However, certain undesirable side effects are brought on by using these drugs [3].

Several metabolic problems can also be effectively managed by consuming phytochemicals in adequate doses. As such, using phytochemicals as a treatment option for PCOS may be an alternative [13]. This study investigated the possibility of using a variety of therapeutic plants as a substitute for PCOS therapy [12]. Herbs can be used as a kind of treatment for women with PCOS. Compared to manufactured medications, herbal plants are thought to be safer. Compound interactions between herbs can be both antagonistic and synergistic, making herbal medicine a complex intervention. These medications have fewer negative effects than allopathic medications and are crucial for the treatment of PCOS. Herbs are a safer and more effective way to treat PCOS and decrease the processes that lead to the formation of cysts in PCOS when used regularly. Herbal therapy is now widely used to treat a range of chronic conditions, including PCOS. PCOS can be treated more successfully with the use of herbal remedies and dietary changes [14]. Because of their multi-targeted efficacy, natural plants can help prevent serious sickness problems [15].

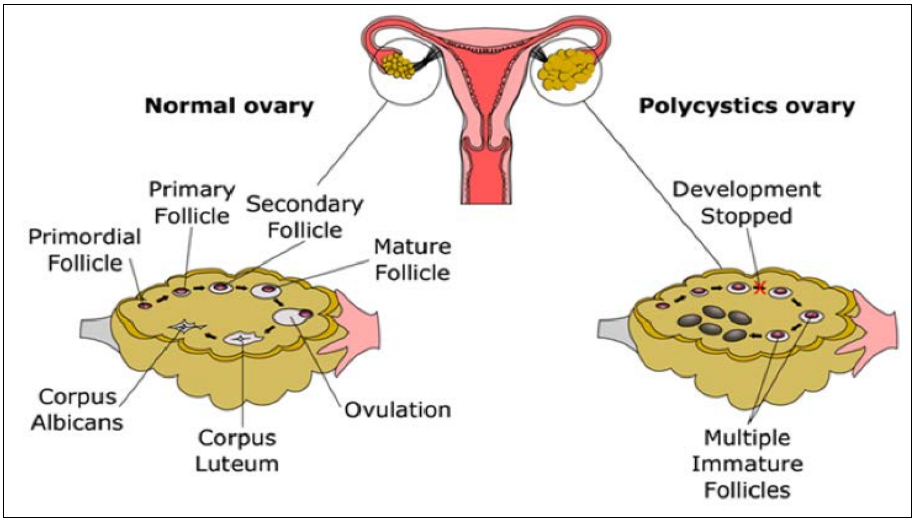

Fig 1: Basics of altered physiology of PCOS [16]

2. Causes

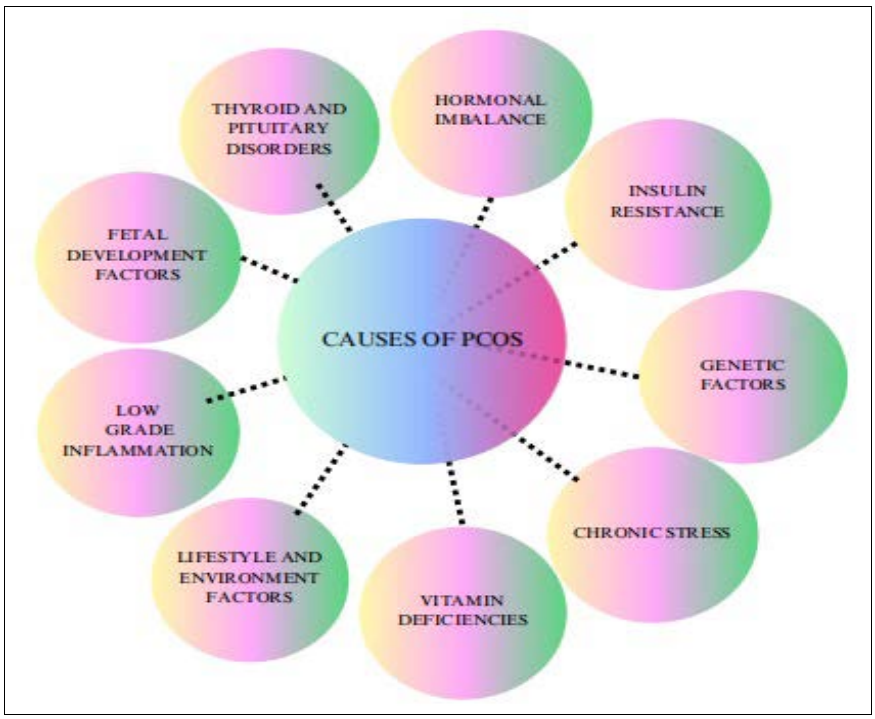

Fig 2: Causes of PCOS [9, 17-18].

While the exact etiology of PCOS remains unclear, two of its main features are altered androgen and estrogen metabolism and alteration of hormone secretion rates [13]. It's yet unknown what causes PCOS, although it's probably a complex process. The variety of anomalies in polycystic ovary syndrome cannot be adequately explained by a single etiologic cause [17]. Each and all woman's ovaries produce trace levels of the hormone testosterone. A lot of the symptoms of PCOS are linked to women who have slightly higher than usual levels of testosterone [18].

- Strong stimulation in adrenals in childhood
- Raised insulin levels
- Genetic predisposition
- Contraceptive pills
- Hormonal imbalance
- Stress
- Accumulation of Toxin
- Inflammation to uterus and ovaries [9, 19].
- Inheritable predilection [20].

Risk Elements [9, 21].

- PCOS in a family background
- Diabetic family history
- A history of infertility in the family
- Fatness
- Dietary practices centered around fast food
- A deficiency in physical activity
- lifestyle stress;
- High serum insulin level
- Imbalance of hormones
- Adrenal gland hyperstimulation

Symptoms

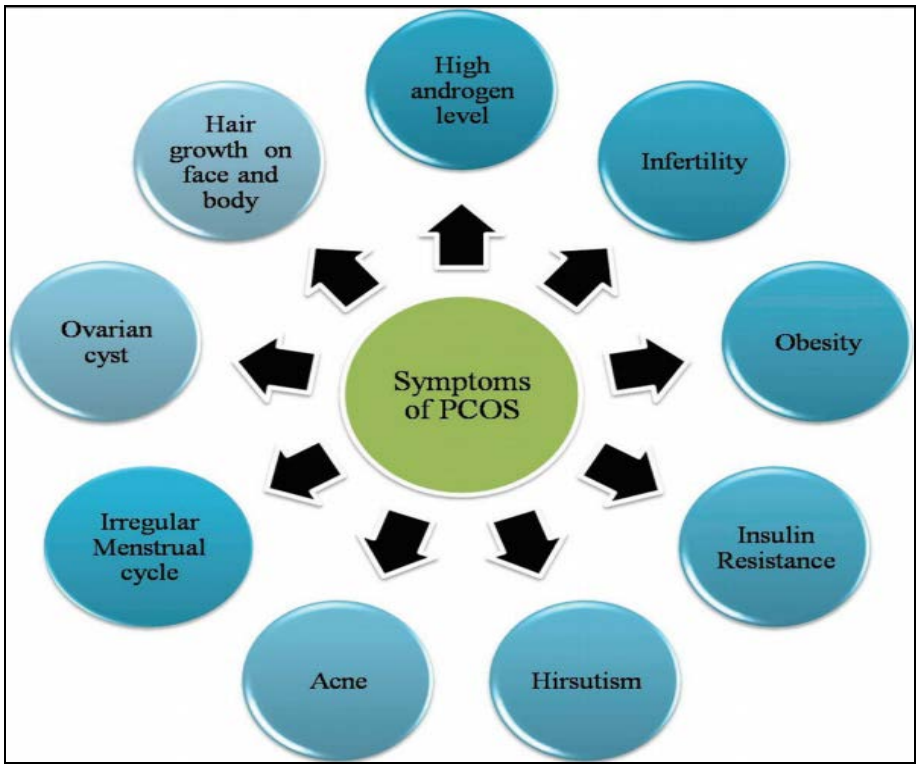

Fig 3: Symptoms of PCOS [15].

Irregular or absent periods: The menstrual cycle may be delayed; fewer menses are produced, and they are accompanied by pelvic pain. Increased free estrogen cannot function on the endometrium because of increased androgens, and when it is not eliminated in a timely manner, it causes oligomenorrhea [22].

Acne: An excess of masculine hormones is the cause of acne. In certain women, PCOD results in severe cystic acne. A skin inflammatory disorder that damages hair follicles and the sebaceous and apocrine glands that supply them. Elevated sebum production, despite often normal serum androgen levels, is the primary cause of acne in females.

Obsessive body hair and hirsutism: Hirsutism is the term for excessive facial hair growth. Due to the high levels of the masculine hormone androgens secreted by their ovaries, women with PCOD experience excessive hair growth. A common clinical sign of hyperandrogenism, hirsutism affects up to 70% of women with PCOS. Overgrowth of hair can affect the face, arms, back, chest, thumbs, toes, and abdomen. This is because PCOS is associated with hormonal swings that promote excessive hair growth.

Mood swing: This hormone imbalance is the source of sudden mood changes. Anxiety and depression are prevalent symptoms.

Darkening of the skin: The skin of the body, especially the neck, groin, and area under the breasts, may develop dark spots.

Difficulty in the Pelvic Area: When a woman is menstruating, she may experience pelvic pain in addition to headaches and heavy bleeding.

Weight gain or difficulty reducing weight: Women with PCOD have their bodies producing high levels of male

hormones and insulin, which causes them to gain weight suddenly [23].

Long or intense durations [20]: Since the periods are irregular, there has been an increase in buildup in the uterine wall. Every time a period happens, this results in increased bleeding [23].

Obesity: Sedentary lifestyles and unhealthy eating patterns can contribute to obesity, which can eventually accelerate the development of PCOS [24]. Adipose tissue, or fat, is regarded as an endocrine and immunomodulatory organ. It secretes proteins and hormones, such as cytokines, that disrupt the liver and muscles' insulin transduction pathways, leading to hyperinsulinemia and insulin resistance. [25].

- Decreased follicle-stimulating hormone (FSH) and increased luteinizing hormone (LH)
- Infertility (inability to conceive) [19].
- Ovarian enlargement of the cyst
- Weakness
- The retention of fluid.
- Disorders of metabolism [21].

Organs afflicted with PCOS: [26].

- Ovary: the female gonad organ, which is located beside the uterus on either side.
- Gland Adrenal: The glands are situated directly above each kidney.
- Pancreas: The gland in our bodies that makes insulin.
- Pituitary Gland: The gland directly beneath the brain that regulates all hormones

Normal process of ovulation: [27].

Normal ovulation procedure Hormones that control ovulation are produced by the pituitary gland, which is situated at the base of the brain. The pituitary gland releases luteinizing hormone (LH) and folic acid stimulating hormone (FSH) into the bloodstream once a month. Several hundred immature eggs begin to mature once these hormones enter the ovaries, increasing the size of follicles and secreting estrogen the primary hormone involved in female sex at the same time. The pituitary gland detects the surge of luteinizing hormone to the ovaries after the level of estrogen reaches a particular point, which causes the most developed follicle to release the egg, known as ovulation. After the free egg passes through the fallopian tube and is fertilized, the other follicles and eggs gradually disintegrate. The uterine lining loses during menstruation if the egg is not fertilized.

Anovulation in PCOS

PCOS Anovulation the pituitary gland disrupts the regular menstrual cycle in PCOS patients by releasing an excessively high level of luteinizing hormone into the bloodstream. Consequently, the follicle fails to mature and ovulation is prevented, which may result in anovulation. If the immature follicle does not dissolve, it persists as cysts or sacs filled with fluid. Because of the elevated testosterone caused by these cysts, there is an imbalance in hormones. Acne, a growth in body and face hair, and irregular periods may follow from this. In addition, the pancreas produces a large amount of the hormone insulin. Insulin and luteinizing hormone work together to cause the ovaries to produce too much testosterone, the male hormone. An abnormally high level of testosterone in the ovaries inhibits ovulation, which can lead to infertility. [27] PCOS is the most prevalent cause of anovulatory infertility (40%) [28].

Pathophysiology

Fig 4: Pathophysiology of PCOS [23, 24]

Insulin Resistance

Insulin resistance (IR) is a metabolic condition that is defined by a reduction in the cellular reactivity to insulin signaling. It is thought to be a key pathophysiologic mechanism in the development of any metabolic consequence of PCOS. Women with PCOS frequently have insulin resistance and hyperinsulinemia. Impaired glucose tolerance and type 2 diabetes are two issues that affect women with PCOS. Anovulation and infertility are caused by the thickness of theca cells in the ovaries as a result of hyperinsulinemia associated with insulin resistance. Insulin stimulates the related trophic hormones, which in turn promote steroidogenesis in steroidogenic organs such as the ovary and adrenal cortex. The primary cause of excessive ovarian or adrenal estrogen release is hyperinsulinemia, which stimulates LH. Furthermore, hyperinsulinemia reduces the synthesis of sex hormone-binding globulin (SHBG), a crucial circulatory protein that regulates testosterone levels, resulting in an increase in free circulating testosterone [23].

Hormonal Imbalance: In PCOS, the blood concentration of FSH (follicle stimulating hormone) diminishes, resulting in elevated serum levels of androgen, which contribute to the retention of immature follicles within the ovaries, ultimately leading to cyst formation [21].

Oxidative Stress: Infertility, recurrent abortions, preeclampsia, and other reproductive abnormalities are among the numerous reproductive issues and anomalies that some women experience as a result of oxidative stress. It was discovered that PCOS women had considerably lower blood amino acid levels than healthy controls [29].

Gonadotrophins: Women with PCOS have greater LH/FSH ratios because of elevated levels of gonadotrophin-releasing hormone (GnRH) in PCOS patients [1]. A possible cause of PCOS's increased estrogen production is impaired gonadotropin dynamics. Theca androgen production may be directly enhanced by high LH pulse frequency and amplitude that results in consistently elevated LH levels. Conversely, it has been proposed that an overabundance of androgen activity on the hypothalamic-pituitary axis causes defective negative feedback on LH secretion, which leads to high LH levels [30].

Theca Cell Hypertrophy: Hypertrophy of the Theca Cell (Increase Androgen) Elevated LH leads to the hypertrophy of theca cells, which enhances androgen synthesis. As a result of this hypertrophy, the concentration of androgen rises [16].

Diagnosis

PCOS cannot be diagnosed with a single test; instead, the diagnosis is based on the presence or lack of three distinct components: oligo anovulation, androgen excess (either biochemical or clinical), and ultrasound evaluation of ovarian morphology. Two of the three diagnostic criteria must be met for the diagnosis of adult women, according to the Rotterdam criteria, which were approved by the International Evidence-Based Guideline. It is advised to rule out hyperprolactinemia (prolactin), non-classic congenital adrenal hyperplasia (screening with 17-hydroxy progesterone), and thyroid illness (thyroid-stimulating hormone, TSH). Those who exhibit amenorrhea and other abnormalities should be evaluated further. Hypogonadotropic hypogonadism or Cushing syndrome should be evaluated, and if the androgenic picture is more severe, androgen-producing tumours ought to be examined. If the serum androgen levels are more than twice the higher limits of normal for the local clinical assay standard, then there are severe androgenic profiles. There are four phenotypes (A-D) based on whether the three diagnostic criteria are met or not, and the recommendations also support the use of phenotype descriptions in PCOS diagnosis. Furthermore, a review of metabolic features and phenotypes found that although androgenic phenotypes were more frequently linked to more severe metabolic dysfunction, the presence of adiposity complicated this finding in the majority of studies, with higher adiposity resulting in more severe complications and not all studies controlling for BMI [31]. An irregular menstrual cycle, or more specifically, a skip of more than three cycles, is referred to as oligomenorrhea. In order to investigate monthly irregularities, a number of blood tests are performed. These include measuring levels of prolactin, TSH, FSH, and luteinizing hormone (LH). These tests are together referred to as the PCOD panel since they are performed under the same conditions. Hyperandrogenism occurs when there is excess production of androgens, which is exposed by acne, greasy skin, and abundant hair on the face, chest, and stomach [2]. Based on the 2003 Rotterdam criteria, a diagnosis should be made and verified by two of the three criteria: polycystic ovarian morphology, irregular cycles, and hyperandrogenism (clinical or biochemical) [32].

Diagnostic Assessment Standard

Taking the patient's medical history: Information about prior medical conditions in the patient's family should also be gathered [33].

Physical examination: This involves looking for signs of acanthosis nigricans, acne, male pattern baldness, blood pressure, obesity, body mass index, and general body habitus [34].

Ultrasonography: To find any cysts and swollen ovaries, an ultrasound of the uterus, ovaries, and pelvis is recommended [33]. The Rotterdam criteria state that an ultrasound examination of an ovary should reveal the presence of 12 or more tiny follicles. The follicle count is a contributing factor to the ovaries 1.5-3 times bigger than average size.

Lab examinations: On day three of the menstrual cycle, the ratio of luteinizing hormone (LH) to follicle-stimulating hormone (FSH) is greater than 1:1 (and occasionally more than 3:1). Lipid profile and biochemical screen while fasting. Patients with PCOS may have impaired glucose tolerance (insulin resistance) based on the results of a two-hour oral glucose tolerance test (GTT) if they have any of the risk factors (obesity, family history, history of gestational diabetes). Fasting insulin level, or glucose tolerance test (GTT) with insulin levels (IGTT): High insulin levels have been shown to be useful in predicting pharmacological response and may identify patients who require greater metformin dosages or the use of a second medicine to lower insulin levels. Insulin resistance is consistent with a hypoglycemic response, where blood sugar is lower, and the two-hour insulin level is higher than during fasting [34].

Medical Care [2].

There are differing opinions on how to treat PCOS. While some believe there is no cure for the condition because it is a lifetime condition, others have found that treating PCOS with hormone therapy and changing one's lifestyle can be effective.

A change in lifestyle is the first stage in the therapy process. Certain lifestyle management techniques are effective while treating PCOS. These include:

A low-carb diet; regular physical activity or exercise; behavior modification; stress-free lifestyle; reduction in the consumption of processed and fast food; reduction in the consumption of alcoholic beverages; and regular monitoring of vitamin D levels.

Prevent obesity or being overweight (weight management)

Herbal remedies for PCOD

Herbal medications have been shown to reduce testosterone, restore the estrous cycle, balance female hormones, reduce insulin resistance, and enhance lipid metabolism in PCOS patients [35]. Phytochemicals, or plant-centered medicinal medicines, have the following pharmacological characteristics [36].

Table 1: List of Drugs

Species	Common name	Uses	Family
Foeniculum vulgare	Fennel	Antimicrobial, Antiaging, soothes pain, Works in menstruation related problems (PCOD/PCOS), Improves digestion.	Umbelliferae
Asparagus racemosus	Shatavari	Helps in weight loss, improves reproductive health, Maintains blood sugar level, Mood enhancer	Asparagaceae
Vitex agnus-castus	Chaste Berry	Supports fertility, Helps relieve acne, Works in PMS, Used in PCOD, Menopause.	Lamiaceae
Glycyrrhiza glabra Linn.	Liquorice	Lung, liver, circulatory and kidney diseases, Menopausal symptoms, viral infection.	Leguminosae
Linum usitatissimum (Linn.)	Flax seed	Cardiovascular health, Digestive health, Hormonal balance, Cancer prevention, Inflammation reduction.	Linaceae
(Cinnamomum zeylanicum and Cinnamon cassia)	Cinnamon	Eases menstrual pain, Cures morning sickness, Treats arthritis pain, Antidiabetic, Anticancer, Anti-inflammatory	Lauraceae
Elettaria cardamomum	Cardamom	Antispasmodic, Antioxidant, in Blood pressure, Eliminates Bad breath, Improves digestion	Zingiberaceae
Ocimum sanctum	Tulsi	Reduce stress, Lower blood glucose and cholesterol, Immunity Booster, Antibacterial.	Lamiaceae
Nigella sativa	Kalonji	Anti-inflammatory, Balance hormones and Mood swings, regulates menstruation, Relieves joint pain, Antioxidant.	Ranunculaceae
Commiphora molmol	Myrrh	Antiseptic, Anti-inflammatory, Anticancer, reduce stress, Regulate Hormonal imbalance, Improved Fertility.	Burseraceae
Commiphora wightii	Guggul	Dysmenorrhea, Antibacterial, Antidepressant, improve metabolism, used in Asthma and Bronchitis.	Burseraceae
Mentha spicata	Spearmint	Relieves Headache, Migraine, Mood swings, used in PCOS, Hirsutism and Menstrual irregularities.	Lamiaceae
Curcuma longa	Turmeric	Alzheimer's and Parkinson's, Antifungal, Antibacterial, Bloating, Mood swings, Anticancer, Arthritis, Antioxidant	Zingiberaceae
Aloe Barbadenis	Aloe vera	Hormonal imbalance, Regulates Menstrual cycle and improve Fertility, Antibacterial, Anti-inflammatory.	Asphodelaceae
Cucurbita pepo	Pumpkin seeds	Control Insulin and Cholesterol levels, reduce hair loss, rich in magnesium, treat PCOD, Improve PMS symptoms.	Cucurbitaceae
Bauhinia variegata	Kachanaar	Laxative, Tonic and Anthelmintics, Dyspepsia.	Ceasalpiniaceae
Sesamum indicum	Sesame seeds	Improves hormonal balance, reduce risk of Osteoporosis, used in prevention of Colon cancer.	Pedaliaceae
Withania somnifera	Ashwagandha	Reduce anxiety and stress, Boosts immunity, Increases muscle strength, Lower cortisol.	Solanaceae
Emblica officinalis	Amla	Hormonal balance, used in PCOD, Anti-inflammatory, Diuretic, Improves Digestion, Good for Liver, Antioxidant.	Phyllanthaceae
Panax ginseng	Asian ginseng	Alzheimer disease, Depression, Erectile dysfunction, Menopause, Hair health, Diabetes	Araliaceae
Punica granatum L.	Pomegranate	Improves Fertility, skin health, hair, used in Menopause during Hot flashes, reduce Oxidative stress, has Anticancer properties for Lungs, Breasts and Skin.	Lythraceae
Cocos nucifera	Coconut	Used in Hormonal balance, PMS, Improve Digestion, Skin health, Antioxidant, Regulate blood sugar and Insulin levels.	Arecaceae

Foeniculum vulgare

Usually referred to as fennel but also known as saunf, this plant is in the Apiaceae family [12, 29]. A phenolic component found in F. vulgare has been linked to the prevention of disorders like cancer, inflammation, and cardiovascular disease that are brought on by oxidative stress [36]. Fennel is thought to have the ability to control the treatment of polycystic ovarian syndrome (PCO) because of its phytoestrogen components. In PCOS patients, fennel extract

enhanced serum progesterone levels and endometrial thickness while lowering serum estrogen levels and uterine epithelial cell thickness [37]. Fennel oil's analgesic, estrogenic, and anti-spasmodic properties make it useful for treating a variety of gynecological conditions, including amenorrhea, dysmenorrhea, menopause, lactation, PCOS, and pre-menstrual diseases [38]. In PCOS rats, renal failure can also be effectively treated with fennel seed aqueous extract [39].

Fig 5: *Foeniculum vulgare* [20]

Ocimum sanctum*, or *Tulsi

The two primary medical uses of this holy herbal plant are the treatment of hypoglycemia and obesity [7]. The appropriate control and use of androgen levels is Tulsi's function. Moreover, it has antioxidant properties [40]. The lack of ovulation prevents the androgens from being used. [26] Moreover, the liver makes very little SHBG protein [41].

Fig 6: *Ocimum sanctum* [20]

Asparagus racemosus

Ayurvedic Indian medicine has long employed *Asparagus racemosus* (Asparagaceae) [15]. Women utilize the medicinal plant for infertility, menstrual cycle management, ovarian follicle development, and optimal functioning [40]. It is believed that the plant contains phytoestrogen, a naturally occurring form of plant-based estrogen that supports the healing of women's reproductive systems. Shatavari impact was observed in young PCOS-afflicted women. A study suggests that the plant increases folliculogenesis by enhancing the hormone that promotes the development of new follicles [7]. Shatavari is utilized as a hormone balancer, immunomodulator, antioxidant, and anti-inflammatory [6]. Shatavari can generate reproductive system hormones and a healthy libido. It aids in raising estrogen hormone levels necessary for ovarian function [38].

Fig 7: *Asparagus racemosus* [40].

Nigella sativa

Nigella sativa, a member of the Ranunculaceae family and common names like Kalonji or black cumin, is a plant with considerable medicinal significance that grows across the country [7]. Common names for it include nutmeg blossom, black cumin, and black onion seed. Originating in Southern Europe, Asia, and North Africa, the plant is currently grown all over the world [42]. Thymoquinones, one type of phytochemical found in these seeds, are well-known for their anti-inflammatory and antioxidant characteristics [43]. Black cumin is thought to be actively utilized in the management and treatment of women's polycystic ovarian syndrome [40]. In addition to relieving menopausal symptoms, N. sativa enhances oocyte quality and preimplantation embryo development, leading to better reproductive performance [44].

Fig 8: *Nigella sativa* [26].

Commiphora Molmol

Also known as Commiphoramyrrha, this genus of flowering plants is thought to have the greatest diversity of species and is a member of the Burseraceae family. In Arabic, the word for "myrrha" is "Murr," which means "bitter" [40]. The absence of menstruation, or amenorrhea, is mostly Myrrha's fault. Iron-rich meals are combined with myrrh to support the menstrual cycle. Another role of myrrh in PCOS is in menorrhagia, a medical condition marked by heavy and prolonged bleeding throughout the menstrual cycle. Myrrh prevents excessive blood loss during prolonged, irregular bleeding. When there is an abnormality in the uterus, the resin can also function as an emmenagogue, increasing blood flow. Oleo-gum resin is used to treat a number of uterine infections [7].

Fig 9: *Commiphora molmol* [40]

Cinnamomum cassia

This plant is a member of the Lauraceae family. By taking it orally during the luteal phase, when progesterone levels are most likely to be regulated, cinnamon is utilized as an adjuvant in the treatment of PCOS. Likewise, eating cinnamon everyday will help to successfully decrease polycystic ovarian syndrome and aid to restore the menstrual cycle [29]. For many years, cinnamon, also known as Dalchini (*Cinnamomum zeylanicum*), has been a widely used spice. Cinnamon has been shown to have potential as an insulin-sensitizing agent for PCOS treatment. For PCOS-afflicted non-diabetic women, oral cinnamon therapy improves insulin sensitivity and tolerance [15].

Fig 10: *Cinnamon cassia* [20]

Commiphora wightii

This medicinal flowering plant, which is a member of the Burseraceae family, is also known by the popular names Guggulu, Guggul, and Gugal. Although it can be found in Central Asia, guggul is most frequently found in Northern India [40]. The study showed that guggul minimizes morphological abnormalities by reducing the DHEA-induced PCOS in the ovarian follicles. The hormonal swings therefore return to normal. The study also demonstrated a significant increase in hormone levels in the DHEA-induced PCOS profile, which comprises progesterone, estrogen, testosterone, FSH, and LH [7].

Fig 11: *Commiphora wightii* [45]

Spearmint

One of them is included in the Lamiaceae family and is called Mentha spicata. Additionally, spearmint can lower oxidative stress, cholesterol, and symptoms related to diabetes mellitus type 2 [15]. Reducing androgen levels, particularly free testosterone levels, is one way that a plant with anti-inflammatory and antioxidant qualities may help with hirsutism, a typical symptom of polycystic ovarian syndrome (PCOS) [43]. Spearmint is beneficial for PCOS patients with ovarian abnormalities due to its capacity to reduce atretic follicles and increase granule follicles. It has anti-inflammatory properties, inhibits diabetes, and combats cancer [29].

Fig 12: Spearmint [46]

Cardamom: Elaichi, or *Elettaria cardamomum* (L.) Maton, is the botanical name of cardamom, which is a member of the Zingiberaceae family. The volatile oil, cineol, terpineol, terpene, and other active chemical elements of cardamom have anti-inflammatory, carminative, antipyretic, and fragrant qualities [15]. It is well known that cardamom supports metabolic processes by lowering the risk of type 2 diabetes, improving insulin sensitivity, and controlling blood sugar levels. Cardamom aromatherapy is also used by some people as a relaxation technique, which unintentionally helps PCOS sufferers regulate their stress levels [43].

Fig 13: Cardamom [47]

Turmeric

Curcuma longa, a member of the Zingeberaceae family, is widely used as a spice throughout Asia [29]. The lipophilic yellow pigment known as curcumin (diferuloylmethane) is derived from the rhizome of turmeric (*Curcuma longa L.*). Supplementing with curcumin lowers oxygen radical species, enhances lipid metabolism, and improves glycemic control in PCOS patients. Its purported anti-inflammatory and antioxidant properties make it crucial for PCOS treatment. [14].

Fig 14: Turmeric [20]

Liquorice

(Leguminosae Family; Botanical Name: *Glycyrrhiza glabra*) [19]. Combining spironolactone and licorice to treat pregnant women has also been shown to aid with PCOS by decreasing spiranolactone's volume depletion and potentially enhancing its antiandrogenic effect [5]. Licorice may be used as an adjuvant treatment for polycystic ovarian syndrome and hirsutism [26]. Liquorice has the ability to lower testosterone [38]. One treatment for polycystic ovarian syndrome (PCOS) that has been found to improve insulin sensitivity is licorice root. PCOS raises blood sugar levels and increases the risk of type 2 diabetes [43].

Fig 15: Liquorice [20]

Flaxseed

Flaxseed is derived from *Linum usitatissimum* (Linaceae), a food high in omega-3 fatty acids and one of the greatest dietary lignin sources [5]. (*Linum usitatissimum*, Family: Linaceae; botanical name) [19]. Due of flaxseed's high lignan content, it lowers the concentration of testosterone. By reducing ovarian volume, it also lowers the levels of luteinizing hormone, insulin, and estrogen. Flaxseed enhances the menstrual cycle, reducing the number of ovarian follicles and treating PCOS [38].Typically, they have 28% dietary fiber, 20% protein, and 41% oil. [42]. By lowering the body's androgen levels, flax seeds aid in the maintenance of the hormonal profile in PCOS [48].

Fig 16: Flaxseed [20]

Aloe vera

(Family: Liliaceae; Botanical Name: *Aloe barbadensis*), [19]. Aloe vera (L.) Burm.f. increased levels of high-density lipoprotein cholesterol (HDL-C); normalized follicular development; and decreased plasma levels of triglycerides (TG), total cholesterol (TC), and low-density lipoprotein cholesterol (LDL-C) [35]. This plant is a member of the genus Aloe, which is named after two classical Arabic words: "vera" means genuine and "alloeh" means glossy. In addition to managing PCOS and having antidiabetic qualities, aloe vera has been shown to have "antimicrobial," "anti-carcinogenic," "anti-viral," "immunomodulatory," "anti-oxidant," "anti-inflammatory," "skin protective," and "wound healing" qualities [21]. Because aloe vera gel formulation restores ovarian steroid status and modifies important steroidogenic action, it protects against the PCOS phenotype [26]. Aloe vera's antioxidants fight free radicals and lessen oxidative stress related to polycystic ovary syndrome [43].

Fig 17: *Aloe vera* [20]

Chaste Berry

(Lamiaceae Family; Botanical Name: *Vitex agnus-castus*) [19]. *Vitex agnus-castus* has been used for millennia in traditional medicine as an effective menstrual cycle regulator [49]. One of the most often utilized herbs to treat PCOS is chaste berry since it helps to stimulate and regulate the pituitary gland's function. Luteinizing hormone, which can lower estrogen and androgen levels while increasing progesterone levels, is released by the pituitary gland [26]. This balance may help monitor ovulation, increase fertility, control cycles, maybe lessen acne and improve skin health [43].

Fig 18: Chasteberry [20]

Pumpkin seeds

Cucurbita spp., often known as pumpkins, are an annual plant that belongs to the Cucurbitaceae family. The seeds are rich in vitamins (particularly A, C, E, and the B group vitamins), minerals (K, P, Mg, Ca, Na, Mn, Zn, Cu, and Fe), and protein (24-40%). They also contain 22-64% oil. In traditional medicine, pumpkin is a widely used and well-known plant that is used as an antioxidant, to cure diabetes and high cholesterol, as a diuretic, to fight helminth infections, and to treat benign prostatic hyperplasia [42]. The beneficial omega-3 fatty acids found in pumpkin seeds can also aid in controlling the elevated insulin and cholesterol levels associated with PCOS. Additionally, they contain beta-sitosterol, which helps reduce excess androgens and treat PCOS symptoms like hirsutism, acne, and weight gain [26].

Fig 19: Pumpkin seeds [20].

Saraca Asoca

The Ashoka tree is a member of the Leguminosae family. The calcium-containing materials found in the tree's dry bark include catechol, tannins, and other compounds. Many essential ions, including phosphate, sodium, calcium, and magnesium, are present in the Asoka tree [7]. Ashoka bark is mostly used to treat dysmenorrhea, PCOS, uncontrollably heavy bleeding, irregular menstrual cycles, uterine spasms, and mild to moderate discomfort. Asoka is regarded as one of the best uterine tonics because it aids in overcoming miscarriage and irregular menstrual periods. The herb is used as an antimenorrhagic or to stop excessive bleeding. Women with PCOS and other uterine disorders use both the flower and the bark parts of the plant. Uterine haemorrhage is another condition that is treated with Asoka's stem. Additionally, the herb's oxytocin activity is said to have thickened the endometrium, the uterus' innermost lining, helping to prevent uterine diseases [40].

Fig 20: *Saraca asoca* [40]

Sesame seeds

Rich in omega-3, omega-6, and vitamin E, sesame seeds are a healthy food choice. Sesame seeds, like sunflower and flax seeds, are thought to enhance hormone production and follicle activity because they contain these minerals. Like flax and pumpkin seeds, sesame also contains lignans, which aid in blocking excess oestrogen during the luteal phase [50]. non-lignan components in bound phenolics contribute to antioxidant and antiproliferative properties [51].

Fig 21: Sesame seeds [52]

Sunflower seeds

Members of the Asteraceae family include sunflowers. It contains linoleic acids, which can help in PCOS treatment [53]. Minerals like calcium, iron, magnesium, phosphorus, potassium, sodium, zinc, copper, manganese, and selenium are abundant in sunflower seeds, as well as vitamin E. During the luteal phase, when progesterone increases and oestrogen decreases, the trace mineral selenium aids in the liver's detoxification of excess oestrogen by binding it [50]. Helianthus annuus sunflower seeds, which belong to the Asteraceae family and contain chlorogenic acids, have been shown to have anti-obesity properties. Sunflower extract consumption improves lipid profile, body weight, and fat mass [51].

Fig 22: Sunflower seeds [54]

Nucifera cocos

Coconut Name in biology: *Cocus nucifera* Arecaceae is the family. restored the estrous cycle, raised HDL-C levels, and decreased TC, TG, and very low-density cholesterol. Flowers in lowering the main numerous symptoms in female rats with PCOS produced by letrozole. The explanation for the recovery from polycystic ovaries could be because the extract of C. nucifera lowers the active levels of hormones, like FSH and LH, to normal levels [18, 55].

Fig 23: Coconut [18]

Pomegranates

Anar Punicaceae Family: In pomegranate seed oil (*Punica granatum*, scientific name), ischemia and I/R groups showed lower levels of GSH and SOD activity but significant increases in MDA, TNF-α, and NADPH oxidase activity. Pomegranate extract may help with polycystic ovarian syndrome hormonal abnormalities, according to a study [51, 18].

Fig 24: Pomegranate [18]

Conclusions

Polycystic Ovary Syndrome (PCOS) is a complicated hormonal disorder that affects women of childbearing age. It is marked by unpredictable menstrual cycles, high levels of androgens, and polycystic ovarian shape. Even though no one knows for sure what causes PCOS, it is thought to be a mix of genetic, environmental, and hormonal factors. Some of the main biochemical processes that cause PCOS are insulin resistance, hormonal imbalance, and oxidative stress. A complete medical history, a physical examination, ultrasonography, and lab work are all used to make a diagnosis. Changing lifestyle, hormonal treatments, and herbal remedies are all possible ways to treat it. Long-term problems like impotence, metabolic syndrome, and heart disease can be avoided by diagnosing and treating the condition early on. Additional study is required to better understand the underlying causes of PCOS and create effective treatment techniques.

References

1. Mishra V, Lakra A. Ayurvedic review of PCOD and its management. European Journal of Pharmaceutical and Medical Research. 2023;10(9):239-243.
2. Minocha N. Polycystic ovarian disease or polycystic-ovarian syndrome: how to identify and manage - a review. Archives of Pharmacy Practice. 2020;11(2):102-106.
3. Sathya R, Kanimozhi K, Manimekalai V, Matheshvaran S, Saravanadevi MD. An approach to the therapeutic management of polycystic ovarian syndrome (Soothagavayu) in Siddha system of medicine - a literature review. World Journal of Pharmaceutical Research. 2023;12(14):323-341.
4. Pachiappan S, Ramalingam K, Balasubramanian A. A review on phytomedicine and their mechanism of action on PCOS. International Journal of Current Research and Review. 2020;12(23):81-90.
5. Andhalkar S, Chaware V, Redasani V. A review on medicinal plants of natural origin for treatment of polycystic ovarian syndrome (PCOS). Asian Journal of Pharmaceutical Research and Development. 2021;9(3):76-81.
6. Kalam S, Chaure R, Dapke P, Gorade S, Kale S, Khore T, *et al.* Formulation and evaluation of herbal tablets for the treatment of PCOD using Kanchnar and Shatavari. Asian Journal of Pharmaceutical Research and Development. 2024;12(4):37-42.
7. Purohit A, Jain S, Nema P, Jain DK, Vishwakarma H, Jain PK. A comprehensive review on tailoring an herbal approach for treatment of polycystic ovarian syndrome. Asian Journal of Dental and Health Sciences. 2022;2(1):27-32.
8. Meher K. An Ayurvedic approach of PCOD: a review article. World Journal of Pharmaceutical Research. 2023;12(12):231-237.
9. Kumari R, Singh RK, Garg A. Herbal plants used in the treatment of PCOS-a comprehensive review. International Journal of Pharmacognosy and Pharmaceutical Research. 2024;15(1):57-71.
10. Sheeraz M, Iqbal A, Islam N, Rasheed A, Quraishi HA, Rather S, *et al.* Rational approach towards the role of *Kalawnji* (*Nigella sativa* Linn) in Marz-e-Akyas Khusyatur Rehm (polycystic ovarian syndrome) - a review. Indo American Journal of Pharmaceutical Research. 2018;8(5):1089-1096.

11. Satyanarayana V, Reddy DB, Prathima K, Prasanthi G, Sowmya L. A review on PCOD in pregnant women. World Journal of Clinical and Medical Pharmaceutical Research. 2019;1(4):113-115.
12. Pachiappan S, Matheswaran S, Saravanan PP, Muthusamy G. Medicinal plants for polycystic ovary syndrome: a review of phytomedicine research. International Journal of Herbal Medicine. 2017;5(2):78-80.
13. Temkar V, Menon S. Combination of phytochemicals in the management of polycystic ovarian syndrome induced in rats. Pharmacognosy Communications. 2022;12(4):148-153.
14. Kundarti FI, Komalyna IN, Riyadi BD. Effect of turmeric herbal on polycystic ovary syndrome: a systematic review. International Journal of Current Science Research and Review. 2023;6(9):6473-6481.
15. Sharma N, Kumar V, Langeh U, Singh C, Singh A. A review on the pharmacological potential of Indian spices in polycystic ovarian syndrome. Journal of Reproductive Health and Medicine. 2023;4(1):1-8.
16. Mishra S, Rajput AS. Polycystic ovary syndrome (PCOS) - hormonal change in reproductive women. Journal of Women's Health. 2020;9(3):1-5.
17. Shermin S, Noor A, Jahan S. Polycystic ovary syndrome: a brief review with recent updates. Delta Medical College Journal. 2019;7(2):84-99.
18. Jagtap P, Chavan S, Memane P, Patil R. A comprehensive review on polycystic ovary syndrome (PCOS). International Journal of Pharmacognosy and Pharmaceutical Research. 2020;17(2):350-363.
19. Goswami PK, Khale A, Ogale S. Natural remedies for polycystic ovarian syndrome (PCOS): a review. International Journal of Pharmacy and Phytopharmacological Research. 2012;1(6):396-402.
20. Ingale KS, Sangade TS, Shah FA. Therapeutic effect of herbal plants on polycystic ovarian syndrome. World Journal of Pharmaceutical Research. 2023;12(16):399-422.
21. Chakraborty K. Therapeutic implication of *Aloe barbadensis* Mill. (*Aloe vera*) for the management of polycystic ovarian syndrome (PCOS): a systematic review. Journal of Biochemistry International. 2022;9(1):22-26.
22. Priyadarsini J, Mohanty A, Samal PK. Ayurvedic review on PCOD. World Journal of Pharmaceutical Research. 2024;13(2):367-372.
23. Havaldar VD, Jadhav NY, Shinde SS, Mali SS, Mali KK, Shinde AA, *et al.* A review on PCOS: its causes, symptoms, pathogenesis and management. World Journal of Advanced Pharmaceutical and Medical Research. 2024;7(1):14-21.
24. Patel A, Jacob A, Thomas R. A comprehensive review on treatments for polycystic ovarian syndrome (PCOS). Nursing and Primary Care. 2024;8(1):1-17.
25. Chandak MK. A brief review on PCOD according to Ayurveda and modern. World Journal of Pharmaceutical Research. 2022;11(3):2476-2483.
26. Khanage SG, Subhash TY, Bhaiyyasaheb IR. Herbal drugs for the treatment of polycystic ovary syndrome (PCOS) and its complications. Pharmaceutical Research. 2019;2(1):5-13.
27. Neve VV, Undale V, Bhalchim V, Shinde A, Patil G, Kutal P. Combine impact of Shatavari and Shatpushpi on polycystic ovarian syndrome (PCOS). Journal of Pharmaceutical Negative Results. 2022;13(6):431-437.
28. Dhondiba GS, Ayu HM. Review of PCOS and its management in Ayurveda. World Journal of Pharmaceutical Research. 2022;11(8):114-119.
29. Lakshmi JN, Babu AN, Kiran SM, Nori LP, Hassan N, Ashames A, *et al.* Herbs as a source for the treatment of polycystic ovarian syndrome: a systematic review. BioTech. 2023;12(1):1-21.
30. Diamanti-Kandarakis E. Polycystic ovarian syndrome: pathophysiology, molecular aspects and clinical implications. Expert Reviews in Molecular Medicine. 2008;10(3):1-21.
31. Hoeger KM, Dokras A, Piltonen T. Update on PCOS: consequences, challenges, and guiding treatment. The Journal of Clinical Endocrinology and Metabolism. 2021;106(3):e1071-e1083.
32. Yang J, Chen C. Hormonal changes in PCOS. Journal of Endocrinology, 2024;261(1): 1-14.
33. Joshi A, Muthal A, Namdeo A, Shinde V. Integrative approaches for the management of PCOS: A review. International Journal of Herbal Medicine, 2023;11(2): 18-32.
34. Vani PS, Raj SP, Pallav P, Ramya C, Swathi D. A review on the assessment of the efficacy of the diet in women with polycystic ovary disorder. American Journal of Pharmaceutical Health Research, 2018;6(1): 31-50.
35. Kwon CY, Cho IH, Park KS. Therapeutic effects and mechanisms of herbal medicines for treating polycystic ovary syndrome: A review. Frontiers in Pharmacology, 2020;11: 1-17.
36. Mehra N, Tamta G, Nand V. A review on nutritional value, phytochemical and pharmacological attributes of *Foeniculum vulgare* Mill. Journal of Pharmacognosy and Phytochemistry, 2021;10(2): 1255-1263.
37. Meena M, Sharma M, Dhakar A, Singh C, Sharma L, Purvia RP. Role of *Foeniculum vulgare* in PCOS - A review article. World Journal of Pharmaceutical Research, 2019;8(10): 344-350.
38. Poly TS. A review of herbal medicines used in the treatment of PCOS: A breakthrough in modern era [Doctoral dissertation]. Brac University, 2021;1-55.
39. Zambare KK, Thalkari AB, Tour NS, Reddy KV. Herbal remedies for treatment of polycystic ovary syndrome. Asian Journal of Pharmaceutical Technology, 2019;9(2): 1-3.
40. Wal A, Wal P, Saraswat N, Wadhwa S. A detailed review on herbal treatments for treatment of PCOS - Polycystic Ovary Syndrome (PCOS). Current Nutraceuticals, 2021;2(3): 192-202.
41. Sarodea S, Bhosalea M, Banga P. Exploring herbal remedies: Managing polycystic ovary syndrome (PCOS) and its complications. International Journal of Ayurveda Gynecology, 2024;1(1): 10-13.
42. Sumara A, Stachniuk A, Montowska M, Kotecka-Majchrzak K, Grywalska E, Mitura P, Saftić Martinović L, Kraljević Pavelić S, Fornal E. Comprehensive review of seven plant seed oils: Chemical composition, nutritional properties, and biomedical functions. Food Reviews International, 2023;39(8): 1-21.
43. Kshama, Ray N. From nature to nurture: A review of herbal approaches to polycystic ovary syndrome (PCOS). Obstetrics and Gynecology Forum, 2024;34(3 Suppl): 1142-1152.
44. Deepthika SH, Karunagoda KP, Perera PK. Medicinal effects of *Nigella sativa* in gynaecological disorders: A

systematic review. International Journal of Pharmaceutical Sciences and Research, 2022;13(8): 2977-2987.
45. https://images.app.goo.gl/fFdBJaRyMemHpMhY7
46. https://images.app.goo.gl/K8JSiELXwYCsSHDh6
47. https://images.app.goo.gl/X7DQhw7t4JatMoqQA
48. Jyotsna T, Sameet M. A review on lifestyle modification: The mainstay in polycystic ovarian syndrome. International Journal of Research in Ayurveda and Pharmacy, 2018;9(3): 1-6.
49. Szczuko M, Kikut J, Szczuko U, Szydłowska I, Nawrocka-Rutkowska J, Ziętek M, Verbanac D, Saso L. Nutrition strategy and lifestyle in polycystic ovary syndrome - Narrative review. Nutrients, 2021;13(7): 1-18.
50. Mahapatra D, Baro J, Das M. Advantages of seed cycling diet in menstrual dysfunctions: A review-based explanation. The Pharma Innovation Journal, 2023;12(4): 931-939.
51. Chandrasekar R, Sivagami B. Edible seeds - Medicinal value, therapeutic applications and functional properties: A review. International Journal of Pharmacy and Pharmaceutical Sciences, 2021;13(7): 1-18.
52. https://images.app.goo.gl/bExzCwKEQ9xhrmTk8
53. Irfan T, Seher K, Rizwan B, Fatima S, Sani A. Role of seed cycling in polycystic ovarian syndrome: Seed cycling in PCOS. Pakistan BioMedical Journal, 2021;4(2):
54. https://images.app.goo.gl/RuWrLWNJzCqAjM8c6
55. Bajpai N, Roy A, Sen B. Polycystic ovarian syndrome and endometrial receptivity: current perspectives and solution through Ayurveda - a review. An International Journal of Research in Ayush and Allied Systems. 2023;10(4): 26-35.