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ROLE OF PLANT BASED REMEDIES FOR POLYCYSTIC OVARIAN SYNDROME: A REVIEW

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ABSTRACT: The most common, intricate, and variable endocrine disorder known as polycystic ovarian syndrome (PCOS) in women is influenced by both genetic and environmental factors. It's also associated with metabolic disorders like insulin resistance, glucose intolerance (diabetes) and symptoms of acne, hirsutism, obesity. In addition to lifestyle changes, it can be treated with allopathic, ayurvedic, natural, or herbal treatments. Due to several factors, including expensive cost, the adverse effects associated with using allopathic treatment, and cultural traditions, people have continued to use herbal items for their health benefits. Different plant species, including Liquorice, Cinnamon, Ginseng Saponin, Flaxseed, Spearmint tea, Danggui, Chaste berries, White peony, and Milk thistle, contain both estrogenic and non estrogenic phytochemicals which are both efficient and safe. It has been discovered that herbal remedies are highly regarded, cost-effective, proficient sources of management and treatment for PCOS.

INTRODUCTION: Plant-based products are typically sold as a plant, a plant part, or an extract from a plant that is used for aroma, or therapeutic purposes. Conventional herbal remedies have been employed for treating a variety of ailments since they are naturally occurring ingredients that have undergone little or no industrial processing ¹. These methods are currently attracting a lot of discussion in global health. It has established its role in promotion, prevention, treatment, and rehabilitation. Now it came to a turning point. The need to demonstrate that herbal therapy can compete with other medical specialties in terms of the depth of its scientific research and its application in real-world settings has arisen.

Stein-Leventhal syndrome was the initial name for the polycystic ovarian syndrome (PCOS). The ovaries expand and develop numerous "cysts" of immature follicles in this severe condition that affect women ². Anovulation, infertility, insulin resistance, endometrial cancer, high cholesterol and cardiovascular disease are linked to this condition. It also associated with hirsutism, acne, and weight gain ³. This review's goal is to undertake an extended literature search to study plant-based elements and their benefits in polycystic ovarian syndrome.

Mechanism of Action of PCOS: Polycystic ovary syndrome (PCOS) is the complex endocrinopathy in female at the age of childbearing ⁴. The Rotterdam Consensus (2003) defines PCOS as at least two of the following characteristics:

- Hyperandrogenism
- Lack or absence of Ovulation / Oligoanovulation

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➤ Ultrasound of Polycystic ovaries

Diagnostic methods have been projected, based on the features of imbalance of androgen, FSH, LH, and insulin. Most of the patients have Insulin resistance (IR), with compensatory hyperinsulinemia contributing to excessive secretion of androgens *via* initiation of ovarian androgen

production and inhibition of hepatic sex hormone-binding globulin secretion⁵. Dysfunction of Adipose tissue acts as a contributor to the insulin resistance observed in PCOS. **Fig. 1** showed the relationships with irregular menstrual cycle, hyperandrogenemia, and hyperinsulinemia⁶. It may lead to infertility in the affected women.

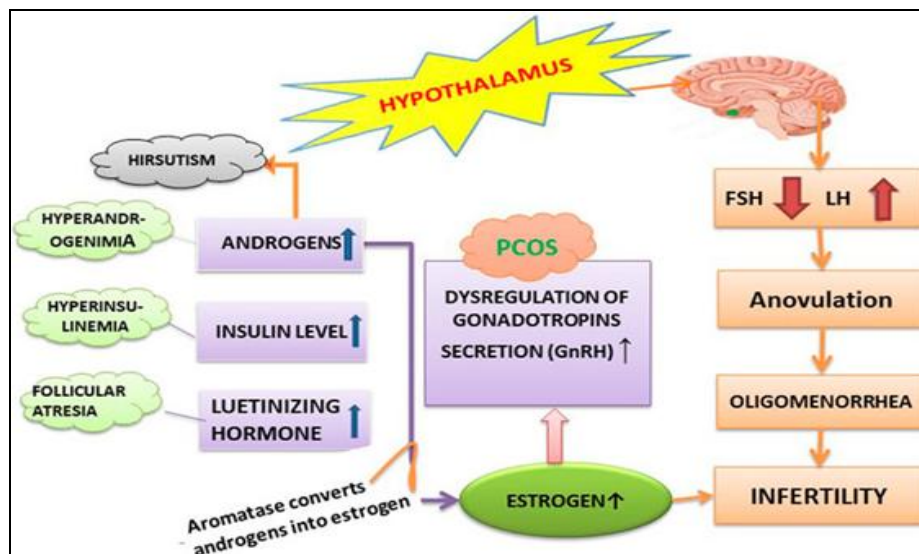


FIG. 1: HORMONAL IMBALANCE ASSOCIATED WITH PCOS⁶

Major Pathophysiology of PCOS:

Oligoanovulation was triggered by the higher GnRH pulsations by reducing circulating progesterone; this might be a faster GnRH mechanism that leads to hyperandrogenism in the ovaries. The granulosa cells of the ovaries secrete estrogen by aromatase and androstenedione by the theca cells in another mechanism to cause the excess androgen⁷.

Hyperinsulinemia may initiate by increasing 17 α hydroxylase activity in theca cells and promoting androstenedione and testosterone production, encouraging LH- and IGF1-stimulated androgen production, and increasing free testosterone by lowering sex hormone binding globulin production (SHBG)^{7,8}.

Nutraceuticals as Functional Foods: Foods and nutrients play a critical part in the body's appropriate functioning. Therefore nutraceuticals are considered as functional foods. They support a person's continued health and lower the risk of contracting certain ailments. Nutraceuticals are therapeutic foods that help preserve wellbeing, improve health, modulate immunity, and

consequently prevent and treat certain diseases⁹. Nutraceuticals' effectiveness in treating and preventing a variety of illness conditions has been scientifically demonstrated and is supported by several research publications⁹.

Plant-Based Medicine: Herbs have been used to treat both acute and chronic illnesses since the dawn of human civilisation. They are as old as civilization itself. Most of foods, including whole grains, beans, fruits, vegetables, and herbs, contain phytonutrients or phytochemicals¹⁰.

These components, either separately or in a combination, have a great deal of therapeutic potential in the treatment of diverse diseases. Phytochemicals and nutraceuticals found in food are of utmost importance on human health and ability to provide defence against a wide range of illnesses and disorders including cancer, coronary heart disease, diabetes, high blood pressure, inflammation, microbial, viral, parasite infections, and endocrine disorders¹¹. Table 1 shows the Medicinal plants and their phytochemical components for polycystic ovarian syndrome¹²⁻²⁵.

TABLE 1: MEDICINAL PLANTS AND THEIR PHYTOCHEMICAL COMPONENTS FOR POLYCYSTIC OVARIAN SYNDROME

Botanical Name	Name	Chemical Components Present
<i>Glycyrrhiza</i>	Liquorice	Flavonoids: flavanones, isoflavanes chalcones, flavones. Saponin: Glycyrrhizic acid. Triterpenes: glycyrrretol, isoglabrolide, liquiritic acid, glabrolide, licorice. Phenolic Compounds: liquiritin, flavonoids, isoliquiritin, isoprenoid-substituted f, liquiritin apioside, chromenes, dihydrostilbenes. Coumarins: liqucoumarin, G. herniarin, glabra glabro coumarone A and B, umbelliferone. Other secondary metabolites: glucose, sucrose, starch, polysaccharides, fatty acids, phenol, guaiaicol, asparagines, and sterols (β -sitosterol, dihydro stigmasterol) ^{12, 13}
<i>Cinnamomum zeylanicum</i>	Cinnamon	Resinous compounds: cinnamic acid, cinnamaldehyde, cinnamate, Essential oils: eugenol, trans-cinnamaldehyde, cinnamyl acetate, α -terpineol, L-borneol, caryophyllene oxide, β -caryophyllene, L-bornyl acetate, α -thujene, E-nerolidol, α -cubebene, terpinolene ^{15,16}
<i>Linum usitatissimum</i>	Flaxseed	Omega 3-fatty acids, Dietary fibres, Proteins, Micronutrients (vitamin E and minerals), Lignans ¹⁷
<i>Panax ginseng</i>	Ginseng Saponin	triterpene glycosides, (saponins)/ insenosides, sugar residues – glucose, xylose, arabinose, rhamnose ^{18, 19}
<i>Mentha spicata</i>	Spearmint tea	α -pinene, camphene, sabinene, β -pinene myrcene, 3-octanol, p-cymene, limonene cineole (Z)- β -ocimene cis-sabinene hydrate, linalool cis-p-menth-2-en-1-ol, cis-limonene oxide, trans-limonene oxide, borneol, δ -terpineol, β -elemene β -caryophyllene 4-terpineol α -terpineol, dihydrocarveol cis-dihydrocarvone, trans-carveol, cis-carveol pulegone, carvone isobornyl acetate, iso-dihydrocarveol acetate β -bourbonene germacrene D germacrene A spathulenol caryophyllene oxide monoterpene hydrocarbons oxygenated monoterpenes sesquiterpene hydrocarbons oxygenated sesquiterpenes ^{20,21} ferulic acid Z-ligustilide, and AS polysaccharides ^{22,23}
<i>Angelica sinensis</i>	Danggui	flavonoids, neolignans, terpenoids, glyceride, phenolic compounds ²⁴
<i>Vitex agnus-castus</i>	Chaste berries	
<i>Paeonia lactiflora</i>	white peony	albiflorin, paeoniflorin, pentagalloylglucose [PGG], gallic acid, benzoic acid, catechin, methyl gallate, and paeonol ²⁵
<i>Silybum marianum</i>	Milk thistle	Flavonoid, Silymarin flavonolignan - silybins A and B, silychristin A, isosilychristin, isosilybins A and B, silydianin ²⁶

Liquorice (*Glycyrrhiza*): A leguminous plant called licorice (*Glycyrrhiza*), whose roots have traditionally been utilised in industry as a source of flavour and medicine. Triterpene, saponins, and flavonoids are main components, and each of them reveals a variety of biological activity ¹¹.

Priyanka Kantivan Goswami *et al.*, showed, total serum testosterone level was dropped subsequent liquorice consumption. 17-hydroxysteroid dehydrogenase and 17-20 lyase are blocked, it can lower serum testosterone levels. Hence it's highly helpful to treat the hirsutism of polycystic ovarian syndrome women ^{13, 14}.

Cinnamon - (*Cinnamomum zeylanicum*): The use of Cinnamon as a spice in day-to-day life has never been associated with any negative effects. It is made up of a number of organic components, including cinnamaldehyde, cinnamate, cinnamic acid, and a number of essential oils ¹⁵. By enhancing the insulin signalling pathway's phosphatidylinositol 3-kinase activity and so potentiating the impact of insulin, cinnamon extract

has been established in both *in-vitro* and *in-vivo* experiments to diminish insulin resistance ¹⁶.

Flaxseed (*Linum usitatissimum*): Flaxseed has beneficial nutritional and functional aspects. It contains dietary fibres, essential amino acids, polyunsaturated fatty acids, lignans and vitamin E ^{17, 21}. It's a source to gather fundamental requirements in the human diet and for maintaining good health. Nowak DA *et al* showed the effects of flaxseed supplementation on the considerable decline in androgen levels and hirsutism found in individuals ¹⁸.

Ginseng saponin - (*Panax ginseng*): Ginseng has primarily been consumed as a tonic to stimulate weak bodies and help in homeostasis restoration. However, recent *in-vivo* and *in-vitro* research have demonstrated its therapeutic effects in a variety of clinical situations, including cardiovascular disease, cancer, immunological deficiency, antioxidant, anti-inflammatory, antiapoptotic, immunostimulant activities, and liver toxicity. However some Chinese medicinal research speculates *Ginseng*

Total Saponin treatment significantly reduced NGF expression in the ovaries¹⁹.

Spearmint Tea (*Mentha spicata*): *Mentha spicata* produce a variety of commercially valuable volatile oils with complex mixtures of monoterpenoids, which are commonly used in the pharmaceutical, food, flavour, cosmetic, beverage, and allied industries. These volatile oils have an essential oil composition, and they are regarded as industrial crops²⁰.

Different ecotypes, phenophases, temperatures, relative humidity, photoperiods, irradiances, genotypes, and agronomic conditions play a role in the oil content and composition variations (harvesting time, plantage, crop density)²⁰.

According to Mina Mehraban *et al.*, study, it was hypothesised that consuming spearmint tea for 30 days reduced testosterone levels and hirsutism count. LH and FSH were consequently raised. It has been proven and verified that spearmint possesses anti-androgenic effects²¹.

Danggui (*Angelica sinensis*): Danggui is a species of the *Apiaceae* family. AS polysaccharides, ferulic acid, and Z-ligustilide are bioactive substances that can be isolated from AS roots²². Anti-inflammatory, anti-cancer, immunomodulatory, anti-cardiovascular, neuroprotective, anti-oxidative and anti-hepatotoxic effects of *Angelica sinensis* extract or its chemical components was confirmed. It has been used to treat irregular menstrual cycles as a blood tonic²³.

Chaste berry (*Vitex agnus-castus*): The *Lamiaceae* family includes chaste berry. It contains phenolic components, neolignans, terpenoids, and flavonoids as phytochemicals. According to the research of Mina Cheraghi Niroumand *et al.*, Chaste berries helped to enhance mid-luteal progesterone and stabilised menstrual periods.²⁴

White peony (*Paeonia lactiflora*): White peony is used since traditional Chinese medicine and is still widely used today. It has different stimulatory effects on the hypothalamus-pituitary axis, as well as agonist activity on steroidogenesis and the ovulatory progression within the ovary²⁵. Hence, it can be used to retrieve menstrual irregularity and other ovarian dysfunctions.

Milk thistle (*Silybum marianum*): *S. Marianum* contains flavonoids and silymarin flavonolignan. These substances have hepatoprotective, anticancer, anti-inflammatory, immunomodulatory, neuroprotective, and lactogenic properties²⁶. Taher MA and Atia YA speculate that a progesterone level was significantly increased after the course of Milk thistle treatment. In conclusion, the treatment of PCOS patients with silymarin in addition to metformin has improved the results for patients' hormonal disturbances and ovulation rates²⁷.

CONCLUSION: Herbal medications used among women have surged during the previous ten years. Allopathic medicine does not completely cure PCOS; hence the major disadvantage of using allopathic medicine is that, it takes more time and money. Moreover, there is a need for better treatment choices for polycystic ovary syndrome. Based on their overall synergistic benefits in clinical trials, herbal medications are preferred for the treatment of PCOS. This review revealed that the polycystic ovarian syndrome may be impacted more positively by liquorice, cinnamon, ginseng Saponin, flaxseed, Spearmint tea, Danggui, Chaste berries, White peony, and Milk thistle. Understanding the value of herbal therapeutic plants in the treatment of PCOS is made possible by this literature evaluation. Most of the readily available and affordable herbal medications with the potential to reduce PCOS symptoms have been covered in this review. Based on this endeavour, it is proposed to use natural drugs as treatment for PCOS in the future.

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