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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/18094
DOI URL: http://dx.doi.org/10.21474/IJAR01/18094

RESEARCH ARTICLE

NATURAL WAYS TO MANAGE PCOS USING HERBS : A REVIEW

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Manuscript Info

Manuscript History
Received: 05 November 2023
Final Accepted: 09 December 2023
Published: January 2024

Key words:-
PCOS, Herbs, Insulin and Obesity

Abstract

Polycystic ovarian syndrome (PCOS) is highly prevalent endocrine-metabolic disorder characterised by polycystic ovaries, chronic an ovulation and hyperandrogenism leading to syndromes of menstrual irregularity, infertility and hirsutism. Many plants are the highly esteemed sources which have the advantages to reduce PCOS and also having hypoglycemic and anti-obesity effect. Treatment of PCOS using synthetic drugs is effective, but in cases of PCOS patients attracted towards natural remedies due to effective therapeutic effects with natural drugs. Therefore, this review prevails the role of different herbs like Chaste tree berry, Fennel, Liquorice, Spearmint, Coconut oil, Pomegranate, Cinnamon, Aloe vera, Asian ginseng, Black cohosh, Anise, Fenugreek, Ginger, Maitake Mushroom, Date palm, Hazelnut, Bamboo, Green Tea, Raspberry, White horehound and Soyabean. A review of literature showed that plants such as aloevera and chamomile improve fertility by increasing the number of ovarian follicles. Besides, vitex agnus-castus and octane reduce hirsutism by reducing testosterone and androgen levels. It has also shown that liquorice, ginseng, cinnamon and D-Chiro inositol improve the adverse effects on diabetes caused by PCOS lowering lipid and blood glucose levels. Moreover, stachys changing endometrial tissue parameters in PCOS by reducing oestrogen and hyperplasia. In this review, some of the familiar medicinal plants and their bioactive extract which plays a crucial role in treatment or prophylaxis of PCOS are summarized. It is concluded that the easily available beneficial herbs along with the lifestyle management is much effective of PCOS than allopathic treatment.

Introduction:-

Polycystic ovary syndrome (PCOS) is prevalent in today's world among women post-puberty. It affects women of all ages and is considered a hormonal disorder. It also falls under the category of metabolic disease. PCOS is the secretion of excessive male hormones in women, disrupting their reproductive or menstrual cycle[1]. The difference between a normal ovary and polycystic ovary is presented in figure 1. The symptoms of PCOS include clinical ones (menstrual disorders, hirsutism, acne, baldness and infertility), changes in endocrine hormones (increased levels of androgen, oestrogen, prolactin and decreased levels of progesterone), and metabolic disorders (insulin resistance, diabetes, dyslipidaemia and type 2 diabetes). However, in some cases, estradiol levels does not change [2]. Ovarian theca cells are much more active to convert androgenic precursors into testosterone in women with PCOS in healthy women. Indeed, theca cells produce androgen in response to luteinizing hormone (LH); therefore, the blood levels of

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androgen increase in people with PCOS [3]. The high levels of androgen especially testosterone in PCOS, their role in lack of ovulation, and disrupted synthesis of sex hormones, which causes clinical symptoms and dysfunction of genital tract in the patients, are the main reasons for infertility in reproductive-age women [4,5]. Globally, cases of PCOS in women of reproductive-age (15-49 years) were reported [6].

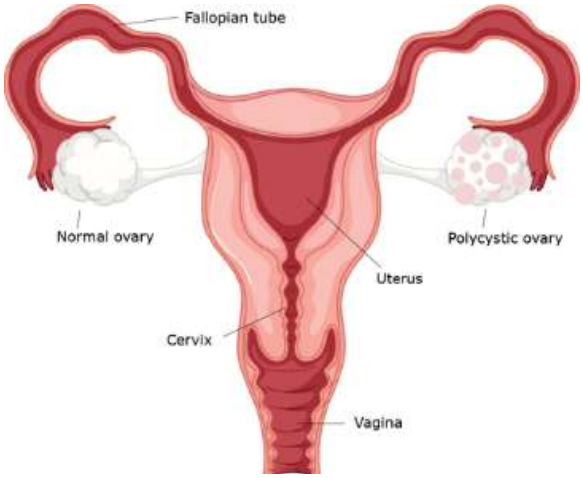

Figure. 1:- Difference between normal ovary and polycystic ovary.

Etiology:-

The major etiology behind PCOS is primary disordered gonadotropin secretions, ovarian and adrenal hyperandrogenism and disorder of insulin resistance [7]. The regulation of gonadotropin-releasing hormone (GnRH) is uncontrolled which may lead to increased luteinizing hormone (LH) and decreased follicle stimulating hormone (FSH); this may lead to the suppression of the response ovarian follicles to follicle stimulating hormone (FSH), elevated anti-mullerian hormone (AMH), follicular arrest and the increased secretion of testosterone, estradiol and dehydroepiandrosterone [8]. Disrupted ovarian synthesis of steroid hormones in these diseases may result in an increase in circulating androgens, which may be more pronounced in women with PCOS [9]. Hyperinsulinism and hypogonadism are considered as the compatibility of insulin to stimulate gonadal and androgen production, and this hyperinsulinism is also one of the major risk factors of PCOS [10]. In PCOS, immature follicle development was observed due to increased LH levels and decreasing levels of FSH. Similarly, the increased production of androgen and reduced blood levels of aromatase were observed. Excessive androgen in PCOS is due to elevated abdominal fat and this may lead to hyperinsulinemia and dyslipidemia. An increase in cell androgen production and hyperinsulinemia reduces sex hormone binding globulin (SHBG) to increase circulating testosterone levels. All these factors may aggravate the diseases progression [11].

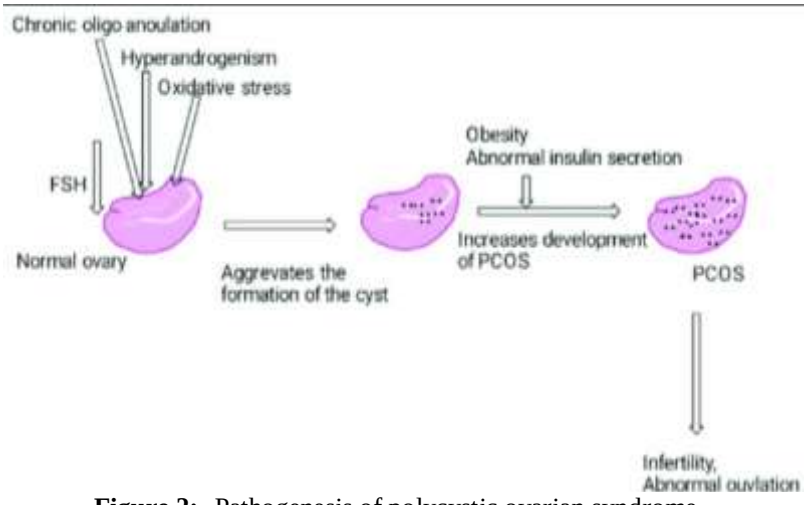

Figure 2:- Pathogenesis of polycystic ovarian syndrome.

Herbs:-
The above herbs enlisted are having different activities like increase ovulatory cycles, anti-androgenic property, glucose sensitivity, oestrogen cyclicity and enzyme activity, which are used to promote FSH and decrease LH secretion and effective ovulation induction agents.

Chaste tree berry:

Scientific name – Vitex agnus-castus. **Family –**Lamiaceae

The most important chemical compounds in the woody limbs, leaves and fruits of the vitex agnus-castus are iridoids, flavonoids, alkaloids, glycosides and steroids. Its extracts has anti-inflammatory, wound healing and antimicrobial effects [12]. It can correct hormonal imbalances and improve fertility. It increased progesterone levels and decreased testosterone levels, but did not effectestradiol and DHEA levels. The plant extract may also increases the activity of aromatase enzyme and reduce testosterone levels by aromatizing it to estradiol [13].

Fennel:

Scientific name – Foeniculum vulgare. **Family –** Apiaceae

Fennel has been used in traditional medicine for various purposes, including as a treatment for symptoms iof polycystic ovary syndrome (PCOS) such as hormonal balance, insulin sensitivity and anti-inflammatory effects [14]. Fennel contains 1-3% volatile oil composed of approximately 50-60% of anethole and 20% defenchone. Other compound present in fennel are dalphaphellantherene, dipentene, methyl chavicol, feniculum anisaldehyde and anise acid [15]. This compounds that help to regulate estrogen levels and balance harmone, which may help in irregular periods and infertility. It may improve sensitivity, regulate blood sugar and reduce diabetes risk. Its anti-inflammatory properties improve acne and hirsutism [16].

Liquorice:

Scientific name – Glycyrrhiza glabra. **Family -** Fabaceae

Liquorice contains sugar, starch, bitters, resins, essential oils, tannins, inorganic salts and low levels of nitrogenous constituents such as proteins, individual amino acids and nucleic acids [17]. Liquorice also known as liquorice, that help to regulate hormones and improve insulin sensitivity , whuch are common issues in women with (PCOS) [18,19].

Flaxseed:

Scientific name : Linum usitatissimum. **Family –** Linaceae

The flaxseed contain 35-45% oil, which contains 9-10% of saturated fatty acids, about 20% monounsaturated fatty acids and more than 70% alpha-linolenic fatty acids [20]. Flaxseed has potential health benefits for women which reduce inflammation, regulate hormones and improve insulin sensitivity [21]. As it contains anti-inflammatory compounds lignans and can help with menstrual regularity and also contains omega-3 fatty acid that reduce cholesterol levels [22].

Spearmint:

Scientific name – Mentha spicata. **Family-** Lamiaceae.

The main component of spearmint is carvone and cis-carveol, followed by limonene, 1,8 cineol, cis-dihydrocarvone, carvyl acetate and cis-sabinene hydrate [23]. The drinking spearmint is reduced testosterone levels and improved insulin sensitivity also [24,25].

Coconut oil.

Scientific name- Cocos nucifera (L.). **Family-** Arecaceae (palm family).

Coconut oil is compound of the fatty acids, caprylic acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid and linoleic acid [26]. Coconut oil has high in medium-chain triglycerides (MCTs) content may improve insulin sensitivity and reduce insulin resistance , and it also contains anti-inflammatory compounds may reduce inflammation in the body, which can contribute to the development of PCOS [27]. It contains lauric acid, which has been shown to modulate hormones levels and improve menstrual regularity in women with PCOS. Coconut oil is high in calories and saturated fat and consuming too much can leads to weight gain and other health problem [28].

Pomegranate:

Scientific name -Punica granatum.**Family –**Punicaceae

Pomegranate is a potent antioxidant. This fruit is rich in flavonoids, anthocyanins, punicic acid, ellagitannins, alkaloids, fructose, sucrose, glucose, simple organic acids [29]. Pomegranate may also use to reducing androgen levels. It may improve insulin sensitivity, ovarian health and reduce the risk of developing type 2 diabetes in women with PCOS. Pomegranate may have a positive effect on ovarian health, including reducing the size cysts and improving ovulation [30,31].

Cinnamon:

Scientific name – Cinnamomum verum. **Family-** Lauraceae

Cinnamon consists of a variety of resinous compound including cinnamaldehyde, cinnamate, cinnamic acid and numerous essential oils [32]. Cinnamic may benefit for women by improving insulin sensitivity, regulating hormones, reducing anti-inflammation and oxidation stress, and regulate menstrual cycles [33,34].

Aloe Vera:

Aloe vera contains 75 potentially active constituents are vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids and amino acids [35]. Aloe vera, a succulent plant. It has potential health for women with polycystic ovary syndrome (PCOS). It may help to reduce inflammation and oxidative stress associated with PCOS, regulate hormones, improve insulin sensitivity and boost the immune system. Aloe vera is also reducing androgen levels [36,37].

Scientific name – Aloe vera.**Botanical name –** Aloebarbadensis
Family – Asphodelaceae(Liliaceae)

Asian ginseng:

Scientific name – Panax ginseng. **Family –** Araliaceae

Asian ginseng is including ginseng saponins, Ginseng oils and phytosterol, carbohydrates and sugars, organic acids, nitrogenous substance, amino acids and peptides, vitamins and minerals, and certain enzymes [38]. Asian ginseng may be beneficial by improving insulin sensitivity, regulating hormones (including reducing androgen levels), and having anti-inflammatory properties [39,40].

Black cohosh:

Scientific name – Actaea racemose. **Family –** Ranunculaceae

The major phenolic constituents of black cohosh are the hydroxycinnamic acids,caffeic acids, ferulic acids,and isoferulic acid, as well as their condensation products with glycolyl phenylpropanoids, commonly known as cimicifugicacids (e.g. fukinolic acid) [41]. Black cohosh is an herb that has been traditionally used for various medicinal purposes which can help to regulate hormones and reduce androgen levels, promote menstrual regularity, and reduce inflammation and oxidative stress [42]. It has also been used to relieve symptoms of menopause [43].

Anise:

Scientific name – Illicium verum (star anise).**Family-** Schisandraceae

A total of 49 compounds were separated and identified in the essential oil including trans-anethole, limonene, chavicol and anisaldehyde [44]. Anise is an herb which may regulate hormones, reduce androgen levels, regulate menstrual cycles, reduce inflammation and oxidative stress, and relieve digestive discomfort including bloating, gas and indigestion [45,46].

Fenugreek:

Scientific name – Trigonella foenumgraecum. **Family-**Fabaceae

The major constituents that are present in fenugreek seeds are carbohydrates, proteins, lipids, alkaloids, flavonoids, fibres, saponins, steroidal saponins, vitamins and minerals, nitrogen compounds [47]. Fenugreek is an herb which may improve insulin sensitivity, regulating hormones, reducing inflammation, and potentially increasing milk production in breast feeding women, but it may also help to regulate the menstrual cycles [48,49].

Ginger:


Scientific name -Zingiber officinalis. **Family –** Zingiberaceae

Ginger is rich in various chemical constituents, including phenolic compounds, terpenes, polysaccharides, lipid, organic acids and raw fibres [50]. Ginger is a spice with potential benefits for women which is improving insulin sensitivity, reducing inflammation and oxidative stress, regulating menstrual cycles and relieving digestive discomfort i.e. bloating, gas and indigestion [51,52]

Maitake mushroom:

Scientific name - Grifolafrondosa.**Family –** Grifolaceae

Maitake mushroom is composed of proteins and glycoproteins, which shown antitumor, immunomodulation, antioxidant and other activities. A number of small organic molecules such as sterols and phenolic compounds has also been isolated from the fungus and have shown various bioactivities [53]. Maitake mushroom has potential benefits which is improving insulin sensitivity, reduce inflammation and oxidative stress, regulating hormones and boosting immunity [54,55].

Date palm:

Scientific name - Phoenix dactylifera. **Family -** Arecaceae

The chemical composition of P. dactylifera seeds found is ash, oil, protein content, total carbohydrates and moisture. The major nutrients determined were: potassium, magnesium, calcium and phosphorus [56]. Dates have been traditionally used for their health benefits including menstrual irregularities in PCOS [57]. PCOS is complex hormonal disorder that requires treatment from healthcare provider. While dates have been studied for potential health benefits, self-treating PCOS with unproven remedies can be dangerous [58].

Hazelnut:

Scientific name – Corylus avellana L. **Family -** Betulaceae

The chemical composition of hazelnut kernels and their COX-2 inhibitory, antimicrobial and 2,2'– diphenyl-1-picrylhydrazyl (DPPH) and 2,2'-azino-bis (3ethylbenzothiazoline-6-sulfonic acid) (ABTS) radical scavenging activities were investigated [59]. PCOS is a hormonal disorder that affects women and can cause irregular menstrual periods, excessive hair growth and gain weight [60]. Therefore, the use of hazelnut which are a good source of healthy fats, fibres, vitamins E and magnesium which may help to manage symptoms and improve overall health. Hazelnut should be consumed in moderation as part of a balanced diet [61].

Bamboo:

Scientific name – Bambusatulda. **Family –** Bambusoideae

Cellulose, hemicellulose and lignin are the three major chemical compositions of bamboo, and they are closely associated in a complex structure. They contribute about 90% of the total bamboo mass. The minor components are pigments, tannins, protein, fat, pectin and ash [63]. Bamboo are a nutritious food for maintain balanced diet, exercise, stress management and lifestyle changes can also be helpful for managing PCOS symptoms [63,64].

Green Tea:

Scientific name – Camellia sinensis. **Family –** Theaceae

The chemical composition of green tea is proteins, carbohydrates' amino acids, lipids, sterols, vitamins, xanthic bases, pigments, volatile compound, minerals and trace elements such as calcium, magnesium, chromium, iron, copper, zinc, sodium, cobalt etc [65]. Green tea may have benefits for women with PCOS, as it may help to improve insulin sensitivity, regulate hormones and reduce oxidative stress [66]. Green tea is a good source of antioxidants, such as catechins, which may help to reduce oxidative stress and inflammation in the body [67]. This, in turn, may help to reduce the risk of certain health problems, such as heart disease and certain cancers.

Raspberry:

Scientific name – Rubus idaeus. **Family –** Rosaceae

The raspberry fruit contains a number of phenolic compound, the predominant being anthocyanins and ellagitannins, accompanied by significantly lower concentrations of flavonoids, phenolic acids and flavan-3-ols [68]. Raspberries may have potential health benefits for women, including regulating hormones , improving insulin sensitivity, reducing inflammation and supporting weight management. However, they should be consumed as part of a balanced and nutritious diet [69,70].

White horehound:

Scientific name – Marrubium vulgare. **Family –** Lamiaceae (Mint family)

White horehound contains a number of constituents, including alkaloids, flavonoids, diterpenes (e.g. marrubiin), and trace amount of volatile oils. The major active constituent in horehound is marrubiin, which is thought to be responsible for the expectorant (promotion of coughing up of mucus) action of the herb [71]. White horehound is an herb which may regulate hormones, relieve symptoms and reduce inflammation [72]

Soyabean:

Scientific name – Glycine max. **Family –** Fabaceae

Soyabean consist of carbohydrates, water ash. Soyabean compromise seed coat or hull, cotyledons and hypocotyl axis or germ [73]. Soyabean may have potential health benefits for women with PCOS, including regulating hormones, improving insulin sensitivity, reducing inflammation and supporting weight They should be consumed as part of a balanced and nutritious diet [75].

Table 1:- The specification of the medicinal plants.

Medicinal Plants	Scientific name	Family	Mechanism of action	Effects on PCOS
Chaste tree berry	vitex agnus-castus	Lamiaceae	Antiandrogen and phytoestrogen	Decreased serum level of testosterone and increased serum level of progesterone
Fennel	Foeniculum vulgare	Apiaceae	Antiandrogen and phytoestrogen)	Decreased LH and increased concentration of FSH
Liquorice	Glycyrrhiza	Fabaceae	Antiandrogen and phytoestrogen	Improves the adverse effect of hyperandrogenism
Flaxseed	Linum usitatissimum	Linaceae	Antiandrogen and antioxidant	Decreasing androgen and hirsutism
Spearmint	Mentha spicata	Linaceae	Antiandrogen	Reducing testosterone and blood sugar level
Coconut oil	Cocos nucifera(L.)	Arecaceae	Antioxidant and antiandrogen	Regulate blood sugar level and insulin secretion level
Pomegranate	Punica granatum	Punicaceae	Antioxidant	Improving level of testosterone, androstenedione and estrogen
Cinnamon	Cinnamomum verum	Lauraceae	Improves insulin sensitivity	Increasing glucose uptake, glycogen production and insulin receptor phosphorylation, improving insulin sensitivity and reducing lipid and blood glucose levels
Medicinal plants	**Scientific name**	**Family**	**Mechanism of action**	**Effect on PCOS**
Aloe vera	Aloe barbadensis miller	Asphodelaceae	Antiandrogen	Decreasing levels of testosterone and insulin through improving the levels of progesterone
Asian ginseng	Panax ginseng	araliaceae	Anti-inflammation and antioxident	Increase serum estradiol and reduced FSH and LH level of serum
Black cohosh	Actaea racemosa	Ranunculaceae	Phytoestrogen, antioxidant and anti-inflammation	Induce the hypothalamus to reduce the release of GnRH
Anise	Illicium verum	Schisandraceae	Antiandrogen	Decrease the hormonal i.e. FSH,

				LH, estradiol and progesterone
Fenugreek	Trigonella foenum-graecum	Fobaceae	Improved insulin sensitivity	Slows down digestion and absorption of sugars from carbohydrates
Ginger	Zingiber officinalis	Zingiberaceae	Antioxidant and anti-inflammation	Lowering excess levels of and increasing level LH production
Maitake mushroom	Grifolafrondose	Grifolaceae	Improved insulin sensitivity and anti-inflammation	Reduced cholesterol level and restore normal insulin level
Date palm	Phoenix dactylifera	Arecaceae	Antiandrogen	Decreased levels of estrogen and LH, increased levels of progesterone and FSH
Medicinal plants	**Scientific name**	**Family**	**Mechanism of action**	**Effects on PCOS**
Hazelnut	Corylus avellana L.	Betulaceae	Antiandrogen	Regulating serum lipid profile, steroids and gonadotropins
Bamboo	Bambusatulda	Bambusoideae	Antioxidant and antidiabetic	Decreasing blood glucose level and levels of cholesterol, LDL and improving cystic ovaries
Green tea	Camellia sinensis	Theaceae	Antioxidant	Decrease in serum LH levels and increase insulin resistance
Raspberry	Rubus idaeus	Rosaceae	Antioxidant	Decrease in testosterone, estradiol, LH and increase in progesterone and FSH
White horehound	Marrubium vulgare	Lamiaceae	Antiandrogen and phytoestrogen	Decrease in LH and testosterone
Soyabean	Glycine max	Fabaceae	Antioxidant, antiandrogen and phytoestrogen	Reducing diestrus phase and testosterone

Conclusion:-

Polycystic ovarian syndrome (PCOS) is one of the most common reproductive disorder in female. PCOS is an endocrine disorder that leads to female infertility. PCOS is the most common hormonal illness in women from adolescence to premenopause, with a variety of complications, including infertility, metabolic and cardiovascular issues and long-term health issues that can last a lifetime. PCOS treatments are mainly focused on the ovary for normalising its functions. Medications are used to regulate, menstrual cycles, stimulate ovulation and insulin resistance, hyperandrogenism and obesity associated PCOS. Different drugs are used in the management of PCOS with different symptoms, but effective treatment to manage PCOS is still a challenging. Various studies have shown that herbal medicines with minimal side effects play an important role in the treatment of PCOS, although more time is required to treat PCOS with herbal medicines. The effect of herbs in the treatment of PCOS can be attributed to the strengthening to immune system and the reulation of the menstrual cycle without changes in hormonal levels.

This review shows some medicinal plants have multi-potential beneficial effects in polycystic ovarian syndrome, insulin resistance, hyperandrogenism, oligo/amenorrhea and obesity. Hence more pre-clinical and clinical studies are required to explore the effectiveness of herbal medicines in PCOS. This review is helpful in understanding the effectiveness of medicinal plants for the better treatment and management of polycystic ovarian syndrome.

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