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Review Article

The Herbal Approachto PCOD: Efficacy, Safety, and Future Directions

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A B S T R A C T

Polycystic ovary syndrome (PCOS/PCOD) is a problem in which a woman's hormones are out of balance.The pathogenesis is not fully known. Polycystic ovary syndrome is still difficult to diagnose correctly, despite simple diagnostic criteria.The aim of this study is to provide health care as well as substantial evidence that promote the use of herbal remedies to treat Polycystic OvarianSyndrome.A thorough review of the literature was carried out to identify the most relevant information. To ensure the paper's current quality, articles were selected from PubMed, Google Scholar, and other similar databases over eight-year period (2017-2024). This study found that certain plant components contain polyphenolic substances, including isoflavones and flavonoids, that can improve reproductive health in women. Its characteristic featureswhich include irregular menstrual cycles, hirsutism, acne, and chronic anovulationare polycystic ovaries, hyperandrogenism, and infertility. High levels of androgens, or masculine hormones, and insulin resistance are associated with PCOS. Stress, a sedentary lifestyle, inactivity, dietary modifications, and inadequate sleep are additional factors that may contribute. Many plants have shown effectiveness in the treatment of PCOS, including Aloe, Punica granatum, Curcuma longa, Cinnamomum zeylanicum, Tribulus terrestris, Saw palmetto,Berberine. In this review, an attempt has been made to provide a summary of the important medicinal herbs that are used in PCOS treatment or prevention. There is a special emphasis on the role of insulin resistance and the potential benefit of insulin sensitizers in the treatment of PCOS.

Key words: Oligomenorrhoea, Polycystic ovary syndrome, herbal remedies, medicinal herbs,

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INTRODUCTION:

PCOS, also known as PCOD, is a condition where a woman's hormones are not balanced. If left untreated, it can eventually result in major health issues like diabetes and heart disease. Ignorance and a lack of awareness among young women can contribute significantly to the rise in PCOS in our society. Infertility may result from PCOS that is not identified. Approximately 5–10% of women between the ages of 15 and 44 who are of reproductive age suffer from PCOS[1]. Polycystic Ovarian Syndrome (PCOS) is the most common endocrine disorder in women.

The presence of enlarged ovaries with many small cysts and hypervascularized androgen-secreting stroma are indicators of this condition. Among the clinical indicators include irregular menstruation, polycystic ovaries, obesity, infertility, hair, acne, and hyperandrogenism. 116 million women worldwide (3.4%) suffered from PCOS in 2023, according to the World Health Organization (WHO). PCOS is a complicated disorder that affects 5–10% of women who are of reproductive age and has no known etiology[2].This condition is typified by erratic menstruation cycles, high androgen (male hormone) levels, and tiny ovarian cysts. Although the precise origin is yet unknown, PCOS is thought to be influenced by both environmental and hereditary factors[3]. Stein-Leventhal syndrome is the original name for it. The ovaries expand with numerous cysts, which are actually tiny, immature follicles, in this severe condition that affects women[4].

PCOS, which is regularly connected to barrenness, is characterized by hypergonadotropism, hirsutism, unpredictable and difficult menstrual periods, amenorrhea, various ovarian sores, and anovulation [5]. Specialists assess that 10% of Indian ladies endure from PCOS. PCOS is immovably connected to the pathophysiology of numerous specific ailments, which can be broadly classified as endocrine brokenness, regenerative brokenness, metabolic brokenness, and capacities, higher androgen discharge, and may indeed be more vulnerable to PCOS development.[2]

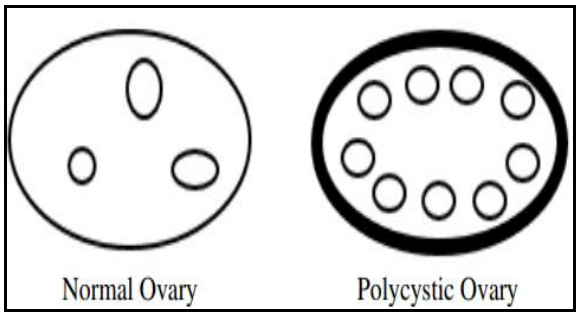

Figure 1: Normal and Polycystic Ovary

A person's biochemical brokenness.It has too been associated to mental wellbeing issues like temperament disarranges and misery. In expansion to being overweight or stout, most ladies with PCOS moreover have poorer metabolic and regenerative hereditary and natural factors are moreover connected to the advancement of PCOS. Early sexual development, early fetal improvement, and a family history of PCOS in first-degree relatives are all cases of hereditary variables.[6] Herbal drugs are getting to be more and more prevalent since of the tall costs and various negative side impacts of utilizing allopathic approaches. Home grown plants have been utilized to make therapeutic solutions since ancient times.[7] When it comes to the signs and side effects recorded over, PCOS can be unequivocally connected to certain of the Ayurvedic Classics Artavakshaya, Pushpaghani, Jataharini, and Kaphavataj Artavdushti cases. Among these, Artavakshaya is a condition when monthly cycle doesn't happen inside an interim of a month with diminished stream of Artava (menstrual blood) or stream for less length (less than 3 days) due to shortfall sum of Artava (menstrual blood/hormonal exercises) which is in ordinary science called as Oligomenorrhoea.[8]

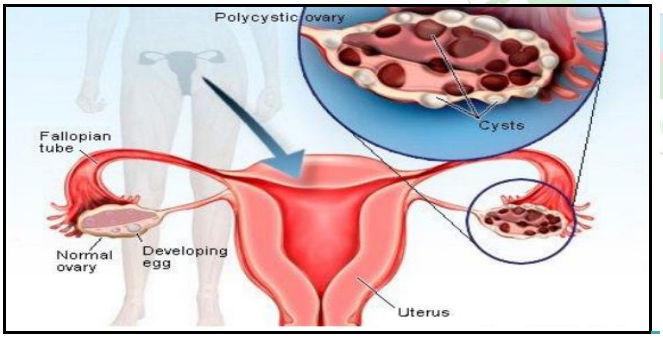

Figure 2: Inside View of Polycystic Ovaries

American research show that 15% of women suffer from cardiovascular disease and type 2 diabetic mellitus (type 2 DM), which over time exacerbated PCOS symptoms during the reproductive years. When it comes to global health, traditional herbal medicines are getting a lot of attention. There are proven roles for traditional medicine in promotion, prevention, cure, and rehabilitation. The presence of several active substances in medicinal herbs produces a potentiating effect, and herbal medicine has fewer adverse effects and is safer than conventional therapy.[9] In PCOS patients, there have been reports of a considerable decrease in follicle stimulating hormone (FSH) and estrogen, as well as increases in oxidative stress levels, inflammatory markers, LH, and androgens.[10]

HISTORY:PCOS syndrome was originally known as Stein–Leventhal syndrome because, although polycystic ovaries were first described in the 19th century, the syndrome was not recognized and named until 1935.This is because Stein-Leventhal where the first to link polycystic ovaries to amenorrhea, obesity and hirsutism in seven patients.[11]Accordingto their research, which dates back to 1721, young married women who were infertile and somewhat fat had larger-than-normal ovaries that were not recognized at the time. The sclerocystic alterations in ovaries were first described by Chereau in 1844, but Stein and Leventhal's thorough research was necessary for their recognition.

Further Adams and his colleagues conducted more study in 1985, observing polycystic ovaries with an abnormal number of follicles. They called this syndrome multifollicularly. In their opinion, polycystic ovaries are those that have more than ten peripherally organized cysts that range in diameter from 2 to 8 mm. [11]

ETIOLOGY: The three main causes of PCOS are insulin resistance, ovarian and adrenal hyperandrogenism, and aberrant gonadotropin discharges. Uncontrolled gonadotropin-releasing hormone (GnRH) regulation can lead to follicular arrest, elevated anti-Mullerian hormone (AMH), decreased FSH, increased luteinizing hormone (LH), and increased secretion of testosterone, estradiol, and dehydroepiandrosterone. An increase in circulating androgens may result from these disorders' disruption of ovarian steroid hormone synthesis, which may be particularly noticeable in women with polycystic ovarian syndrome. Insulin's propensity to increase the synthesis of androgens in the gonadal and adrenal glands is known as hyperinsulinism and hypogonadism. Hyperinsulinism is a significant risk factor for PCOS. As LH levels rose and FSH levels fell in PCOS, mature follicle formation was noted.

Likewise, there was a decrease in blood levels of aromatase and an increase in androgen synthesis. Excess abdominal fat leads to excessive androgens in PCOS, which can cause dyslipidemia and hyperinsulinemia. When hyperinsulinemia and increased cell androgen synthesis occur, sex hormone binding globulin (SHBG) is decreased, which raises the amount of testosterone in the blood. These all have the potential to hasten the course of the illness.[12]

PATHOPHYSIOLOGY: Early puberty is when PCOS first appears. However, clinical trials including adult women have provided the majority of pertinent data, with referral bias favoring the more severe phenotypes. PCOS is characterized by excessive synthesis of androgens by the ovaries andor the adrenal glands.[13]

Major Organs Involved in PCOS: The pathophysiology of PCOS involves the following organs:

- Ovary: the primary hormones progesterone and estrogen are released by the ovary, a female reproductive organ located on either side of the uterus.
- The pancreas: this organ makes insulin for our bodies.
- Adrenal gland: Situated above both kidneys, this gland overproduces adrenal hormone in PCOS patients.
- Pituitary gland: this gland regulates all hormone releases.[14]

SYMPTOMS:[9,16,13]

Women with PCOS often have ovaries that contain many small cysts, of a size seldom exceeding 0.5 cm. The symptoms of PCOS can vary from woman to woman, with some women suffering more than others.

Symptoms can include any of the following:

- PCOS, the most prevalent cause of infertility, which results from a lack of ovulation; Depression and anxiety.
- irregular or absent menstruation, or irregular menstruation;
- heavy periods, particularly those that occur late;
- Pain in the pelvis (distention, heaviness, stabbing pain);
- Pain during ovulation or menstruation;
- Bleeding during a cycle;
- Physical changes (usually later, but not always): thinning hair (which resembles male baldness), acne, dandruff, weight gain around the waist, increased hair growth on the face, chest, stomach, back, thumbs, or toes,
- An Ultrasound revealed many Ovarian cysts[16]

PCOS can be well treated with conventional medicine, although long-term use may result in some negative effects. To deal with such infertility issues, women with PCOS may seek alternative therapies. Therefore, identifying the validated data from preclinical evaluation and summarizing the significance of herbal medications in polycystic ovarian syndrome were the main goals of the current scientific study.[15]

CAUSES OF PCOS: Following are few important causesof PCOS: [16-13]

- Genetic predisposition
- Strong stimulation in adrenals in childhood
- Raised insulin levels
- Contraceptive pills
- Hormonal imbalance
- Stress
- Strong stimulations in adrenal glands in childhood
- Accumulation of toxins
- Inflammation to uterus and ovaries.

AYURVEDIC HERBAL REMEDIES FOR PCOS: Ayurvedic medicine uses a multifaceted strategy to: Correct the hormonal balance, treat obesity and avoid high cholesterol levels, Treat insulin resistance.In order for the menstrual cycle to occur in a "normal" way, the goal of herbal treatment is to allow the body to read just the excess hormone levels to more "normal" levels.[13] Alkaloids, cardiac glycosides, anthraquinones, flavonoids, mucilage, and enzymes are all found in herbs and have a variety of pharmacological effects. PCOS can be treated with these herbs alone or in combination. This article discusses a few of the botanicals and commercial preparations.[13]

1. ALOE:

- Synonym(s): Aloe barbadensisMill, Aloe indica Royle
- Biological Source: The biological source is the dried juice from the leaves of various Aloe species.
- Family:Asphodelaceae (formerly Liliaceae).

Figure 3: ALOE

Aloe arborescens, another name for aloe vera, is a perennial herbaceous plant.VitaminA, C, and E are present in this plant. Additionally, it contains antioxidant qualities that are brought about by lowering the degree of lipid peroxidation. Aloe vera includes a range of polysaccharides, enzymes, tannins, salicylic acid, and minerals and nutrients. Water and polysaccharides (derivatives of pectin, cellulose, hemicellulose, glucomannan, and mannose) make up the majority of aloe vera gel. Aloe, asmodin, barbaloin, and poly monosaccharides such sterols and organic acids are the active components found in this plant's gel and leaves. Aloe vera gel's polysaccharide components include anti-inflammatory and anti-repair properties. These substances also possess antimicrobial and antibacterial properties. Aloe vera can have positive and supportive effects on ovarian tissue and folliculogenesis by bringing the ovary's primary germ cell count back to normal. Aloe vera gel's impact on PCOS rats was investigated in one study. Letrozole was given orally to female rats for five months, and PCOS was not induced by nonsteroidal aromatase inhibitors. After that, the animals received one milliliter of aloe vera gel for forty-five days. Rats' steroidogenic activity, glucose sensitivity, and stress cycle were assessed. The findings demonstrated that the rats' development of PCOS was inhibited by the administration of aloe vera gel in conjunction with a stimulant (letrozole). Because aloe vera gel contains plant chemicals like phytosterols and phytophenols, it has a preventive effect against PCOS by restoring ovarian steroid status and changing steroidogenic activity. Key enzymes like 3β HSD are directly impacted by aloe vera gel, which lowers enzyme activity and modifies the production of estradiol. Five groups of rats were used in another study to assess the effectiveness of aloe vera hydroalcoholic extract in treating PCOS. These groups included the control group, the PCOS group (which received a daily intramuscular dose of 4 mg/kg estradiol valerate), and treatment groups 1, 2, and 3. Each group received 100, 200, and 400 mg/kg of yellow aloe extract intraperitoneally, in addition to 4 mg/kg of estradiol valerate.In comparison to the control group, the PCOS group's estrogen concentration rose dramatically, while in therapy groups two and three, it fell significantly. In comparison to the control group, the progesterone concentration was significantly lower in the PCOS group and

all therapy groups. As a result, aloe vera appears to treat polycystic ovarian syndrome and increase fertility.[17] The PCO phenotype was stopped from developing by aloe vera gel. By restoring the ovarian steroid status and changing important steroidogenic action, the aloe vera gel formulation protects against the PCOS phenotype.[16]

2. CINNAMON:

Figure 4: CINNAMON

- Synonym(s): *Kalmi-Dalchini*, Ceylon cinnamon
- Biological Source: Cinnamon consists of dried inner bark of shoots of coppiced trees of Cinnamomum zeylanicum Nees
- Family: Lauraceae.

One of the best natural treatments for PCOS and its symptoms is cinnamon. Around the world, the bark of the Dalchini tree has been utilized as a culinary spice and for a number of traditional and contemporary medical purposes. There are cinnamon trees all over the world, and there are at least 250 species of Dalchini known to date.[18]Because of its high fiber content, it can help stabilize the monthly menstrual cycle and reduce unexpected hunger sensations. Often used as a spice, cinnamon has several health benefits, but its ability to improve insulin sensitivity is what makes it effective in treating PCOS. It aids in blood sugar regulation promotes weight loss.[19] It was discovered that cinnamon extract greatly enhanced insulin activity and improved IR. By raising P13-K activity and so lowering insulin resistance, it primarily affects the insulin-signaling pathway. A randomized study trial examined its impact. In this study, 15 PCOS-afflicted women were chosen and given 333mg of Cinnamon extract in the form of oral capsules three times a day, followed by a placebo for eight weeks.The drug-treated group's insulin resistance was found to be much lower, but the placebo group exhibited no change.[14,17] Dalchini lowers irregularities in the menstrual cycle and provides effective treatment without side effects, thus it can be used to treat PCOS in women, according to the study. The study also shows that the herb's extract can be used to treat irregular ovulation and menstrual periods when compared to a placebo group. The study found that cinnamon extract improves lipid profiles and has antioxidant properties. Women with PCOS consequently encounter fewer risk factors and adverse effects'[18]

3. TRIBULUS TERRESTRIS (Thorny vine):

- Synonyms: goat's head, bullhead, bindii, burra gokharu, bhakhdi, caltrop, puncture vine, tackweed, and devil's eyelashes.
- Biological source: Tribulus terrestris is an annual plant that is native to warm temperate and tropical regions in southern Eurasia and Africa.
- Family:Zygophyllaceae

Figure 5: Tribulus Terrestris

Tribulus terrestris's fruits and aerial parts are recommended for PCOS in order to encourage regular ovulation and lessen ovarian cysts. In rats with PCOS produced by estradiol valerate, a 10 mg dose of T. terrestris hydroalcoholic extract effectively eliminates ovarian cysts and restores normal ovarian activity while also normalizing monthly irregularities and hormonal changes. It could have a luteinizing effect on follicular cysts or be connected to gonadotropin-like activities. T. terrestris's antiestrogenic effect is the primary cause of the suggested mechanism for restoring hormonal balance and ovulation in PCOS.[5] T. Terrestris is a member of the Tribulus genus, which has roughly 20 species. The three main species in India are Tribulus alatus, Tribulus cistoides, and Tribulus. One of the three species is gokhru, a therapeutic herb used in both Ayurvedic and Western medicine. Because of its high saponin content, gokhru is used industrially to make feed-based additives and medication compositions. When consumed as a dry extract of the medicinal plant, the herb's many different compoundssuch as glycosides, flavonoids, alkaloids, etc.have a wealth of biological importance. Recent research findings suggest that the medicinal plant may influence and improve female sexual dysfunction and reproduction. One possible alternative treatment for polycystic ovarian disease is gokhru.Once ovarian cysts have been removed, ovarian activity can be resumed with a potent Gokhru extract. It is believed that the medicinal extract influences the folliculogenesis of women with PCOS. Because they are more cost-effective, have low negative effects, and are good for your health, herbal medications are utilized more often than synthetic ones. Additionally, they can be taken for an extended length of time. It is believed that gokhru can help women with PCOS by acting as an ovarian stimulant and fertility tonic. It is therefore a recommended herb for PCOS.[18] Many herbalists believe that tribulus is an excellent choice for women with polycystic ovaries since it is a strong, all-purpose ovarian stimulant and female fertility tonic.[20]

4. FENNEL:

- Synonyms: Feukel, Fructus foeniculum.
- Biological source: It consists of dried ripe fruit of plant of Foeniculum vulgare
- Family:Umbellifera.

Figure 6: Fennel

It possesses antipyretic, analgesic, diuretic, and antioxidant qualities. In an experimental PCOS female rats,*Sadrefoza et al*. investigated the renoprotective efficacy of Foeniculum vulgare extract. There were five animal groups employed. Three groups were given estradiol to cause PCOS, while the other two groups did not develop PCOS. One of the non-PCOS groups was treated with an extract from Foeniculum vulgare, while the other group was used as a control. A Foeniculum vulgare extract was administered to two of the rats PCOS groups. After four weeks, the rats were killed, and their kidneys were prepared for light microscopy and their serum biochemical characteristics were assessed.The results indicated that when PCOS rats were given 150 mg of foeniculum vulgare per body weight, their serum urea levels had dropped. In PCOS rats, the histopathological alterations of kidney samples were similar between groups that received the extract treatment. At a dose of 150mg per kilogram of body weight, foeniculum vulgare aqueous extract improved the renal function of PCOS rats.[13]Transanethole, a chemical that has been introduced as an estrogenic active agent, is the most significant and prevalent component found in fennel. Estrogole, fenchine, dianethole, photoanethole, and p-anisaldehyde are among the other aromatic chemicals found in fennel that function as physiologically active estrogenic substances.[14]PCOS can be well managed with the use of foeniculum vulgare seeds as a supplement. Phytoestrogens are abundant in them. Foeniculum vulgare seed extract's anti-fertility impact was investigated. The main active ingredient in fennel oil, anol or anethole, is thought to be a potent estrogenic agent because of its structural similarity to the synthetic estrogen diethylstilbesterol. It was discovered that the extract raised the concentrations of proteins and nucleic acids in both tissues, as well as the weights of the organs. The phytoestrogens found in fennel aid in lowering inflammation and insulin resistance in PCOS. Additionally, it is thought to lessen the cellular imbalance that causes PCOS's metabolic problems. Oral fennel extract taken for 10 days has been shown to have estrogenic effects on the weight of the female genital organs, such as the cervix, vagina, mammary glands, oviduct, endometrium, and myometrium. Because it contains phytoestrogen compounds, fennel is thought to help treat polycystic ovarian syndrome (PCO). Fennel extract decreased the thickness of uterine epithelial cells and serum estrogen levels in PCOS while increasing endometrial thickness and serum progesterone levels.[21]

Fennel and metformin were tested on uterine tissue and progesterone and estrogen blood levels in rats with PCOS.Forty female rats were split into five groups: (1) a control group that was given normal food and water; (2) a PCOS group that was given an intramuscular injection of estradiol valerate at a dose of 4 mg/kg body weight to induce PCOS; (3) a PCOS group that was given 150 mg/kg body weight of fennel following the induction of polycystic ovary syndrome; (4) a PCOS group that was given 100 mg/kg body weight following PCOS induction; and (5) a PCOS group that was given metformin at a dose of 111 mg/kg body weight. Following a 63-day course of treatment, all rats had their uterine tissue removed for histological examination and their blood samples collected for biochemical analysis. In rats with PCOS, the findings demonstrated that fennel boosted progesterone and uterine endometrial thickness while decreasing estrogen and uterine epithelial thickness. Rats with PCOS may therefore benefit from fennel's protective effects on their uterine tissue. [14]

5. SAW PALMETTO:

- Synonyms: shrub palmatto, Juzhong, and palmier
- Biological source: Saw palmetto is a botanical extract that comes from the fruit of the Serenoa repens palm tree, which is native to the southeastern United States
- Family:Palm family (Arecaceae)

Figure 7: Saw Palmatto

For PCOS, saw palmetto (Serenoa repens) is a very good hormone balancer.[17] It also helps both men and women's genitourinary health which means it helps with chronic nonbacterial prostatitis, pelvic pain syndrome and sexual vigor.[5]Research has been done on the effects of saw palmetto plant extract on PCOS. addressing particular signs and symptoms of the illness. It has androgenic qualities that can reduce androgen activity, according to studies. These characteristics increase the likelihood of conception by lowering testosterone levels, improving balance, and encouraging regular ovulation. This may help reduce hirsutism and other androgen-related symptoms in individuals with PCOS. Inflammation is not the cause of PCOS, although it might make the symptoms worse. Studies on saw palmetto in rodents have shed light on how herbal medicines affect variables associated with PCOS. By reducing inflammation and PCOS symptoms, saw palmetto's antioxidant qualities may improve overall health.[22] According to research on animals, saw palmetto normalizes the suppression of follicle maturation, ovulation, and cyst formation in the PCOS ovary caused by increased prolactin. By blocking the ovarian prolactin receptor and lowering the K+ channels and protein kinase C basal activity involved in the prolactin transduction signals, saw palmetto inhibits the high prolactin-induced ovarian alterations. Furthermore, women with PCOS may benefit from saw palmetto extract's anti-inflammatory qualities inthe fight against bloating, pelvic pain, and low-grade systemic inflammation.[5]

6. BERBERINE:

- Synonyms: Berberina,Umbellatine.

- Biological source:Berberine (BBR) is a phytogenous alkaloid that can be isolated from many vegetable species including barberry (Berberis), meadow rue (Thalictrum), celandine (Chelidonium), goldenseal (Hydrastis canadensis L.), and Phellodendron amurense.
- Family: Berberidaceae

Figure 8: Berberine

Berberine has been endorsed by clinicians in trusts of making strides the affront resistance that may be experienced by PCOS patients.[23]Thechronicled utilization of berberine in conventional medication and recounted reports of its restorative potential in decreasing androgens incited the logical examination of this plant-based compound in patients with polycystic ovary disorder. *Rondanelli et al.* conducted a consider in which twelve patients with PCOS experienced berberine treatment. Their comes about appeared a factually noteworthy diminish in free testosterone level, free androgen file, and expanded sex hormone-binding globulin. Strikingly, the creators were the to begin with to survey skin break out status utilizing Worldwide Skin break out Reviewing Framework (Chokes) and the Cardiff Skin break out Incapacity File frameworks, two broadly acknowledged devices for measuring skin break out seriousness and its effect on patients' lives. The enhancement in skin breakout status, as prove by a decrease from Direct to Gentle in Chokes and from Tall to Moo in CADI, is of noteworthy significance for PCOS patients, as the obvious impacts of hyperandrogenism can have a negative effect on their mental well-being and different angles of their lives. These discoveries propose that berberine may hold guarantee as a potential treatment for dermatological pathologies in patients with PCOS.[24] The levels of different androgens in patients with PCOS are raised, counting T, pro-androgens androstenedione (A4) and dehydroepiandrosterone sulfate (DHEAS). In expansion, the level of a few androgen-activating chemicals such as 3β-hydroxysteroid dehydrogenase (3β-HSD) too expanded. The sum of androgen created by the theca cells in patients with PCOS is 20 times higher than in typical individuals. Ponders appeared that not as it were the work of theca cells is changing in PCOS patients, but too the affectability of the pituitary organ for gonadotropin-releasing hormone increments drastically, coming about in expanded discharge of LH, which actuates the follicular layer cells to create a expansive sum of androgens and ruin the development of follicles. Excess androgens can be caused by IR and hyperinsulinemia as they lead to a diminish in SHBG levels, coming about in a consequent increment in free androgens and antagonistic metabolic conditions. A huge number of thinks about have proposed that the key media for the event and advancement of PCOS are androgens and their impacts through androgen receptor (AR). Human or creature considers utilizing AR opponents or long-term blocking of AR signals and ponders in transgenic mouse models with noiseless androgen impacts have affirmed androgen-driven impacts, especially AR interceded neuroendocrine mechanisms.BBR has been affirmed to diminish androgen levels in mice and ladies with PCOS.[25]

7. GINGER:

- Synonyms: Rhizoma zingiberis, Zingibere, Ginger Officinale
- Biological source: The ginger is the rhizomes of Zingiber officinale, Roscose are dried in the sun.
- Family**:** Zingiberaceae.

Figure 9: GINGER

The common name for Zingiber officinalis is ginger. Ginger essential oil has between 60 and 65 different components. Ascorbic acid, β-carotene, p-coumaric acid, geraniol, gingerol, curcumin, α-curcumene, geranial, neral, linalool, zingiberon, shogaol, and caffeic acid are the main active phytochemicals. Ginger also includes phenolics and flavonoids, which are good for PCOS.

Gingerol, shogaol, zingerone, and a trace amount of oily resin ginger are strong antioxidants that have been found to have an anti-prostaglandin action by preventing the generation of prostaglandins and reducing the creation of arachidonic acid. The weight of the testes and seminal vesicles, the quantity and motility of sperm in males, the fertility index, and the testosterone level in serum will all increase with ginger. Ginger's flavonoids and phenolic components have their own pharmacological and physiological effects and may also regulate blood sex hormones while assisting in the maintenance of progesterone and estrogen balance. PCOS may be treated using ginger's phytoestrogen component, which balances the estrogen to progesterone ratio.[12]

8. TURMERIC:

- Synonyms: Curcuma domestica, Saffron Indian, and Haldi (Hindi).
- Biological source: Turmeric comes from the dried rhizome of the Curcuma longa plant.
- Family:Zingiberaceae

Figure 10: Turmeric (Curcuma Longa)

Curcumin, the bioactive component of turmeric, has been investigated for potential health advantages, such as anti-inflammatory, antioxidant, and metabolic qualities. Despite not being a direct treatment for PCOS, curcumin has been linked to a number of illnesses. Its strong anti-inflammatory qualities can help reduce PCOS symptoms, and its potent antioxidant benefits helps fight the oxidative stress linked to PCOS. Some research suggests that curcumin enhances insulin sensitivity and helps regulate blood sugar levels. Those with PCOS who are insulin-resistant and at risk for type 2 diabetes should pay particular attention to this [22]. The rhizomes of Curcuma longa contain curcumin. It is a dietary additive with anti-inflammatory, anti-oxidant, antihyperlipidemic, and hypoglycemicqualities [15].

In addition to successfully bringing the lower levels of progesterone back to normal, curcumin was able to regulate serum testosterone levels.[4] In 2016, *Reddy* and colleagues assessed the effectiveness of curcumin in PCOS-afflicted female Wistar rats. The animals were divided into five groups. To cause PCOS, letrozole was utilized. The mice were administered curcumin, and the results were compared to those of clomiphene citrate, a medication used to treat PCOS. Lipid profile, glycosylated hemoglobin, and fasting blood glucose were all biochemically assessed. The antioxidant activity of curcumin was assessed with the use of superoxide dismutase and catalase. Curcumin decreased serum levels of glycosylated hemoglobin and fasting blood glucose, according to the results. Additionally, it restored normalcy to the serum lipid and sex steroid profiles. In female Wistar rats with letrozole-induced PCOS, curcumin shown positive effects.[15]

9. POMEGRANATE:

- Synonym(s):Punica granatum.
- Biological source:The pomegranate (Punica granatum) is a deciduous shrub or small tree.
- Family:Punicaceae

Figure 11: Pomegranate

Among the fruits, pomegranates have a variety of therapeutic uses. Folic acid, sugars, pantothenic acid, vitamins B2, C, and B1, and organic acids are all present in the fruit. According to reports, the seed contains both saturated and unsaturated fatty acids. Adult female rats in the control and PCOS groups were used to test the impact of pomegranate extract on PCOS management or control. The experimental group's hormone levels, including free testosterone, serum estrogen, and androgen, were tracked. Pomegranate extract may have a preventive impact against polycystic ovarian syndrome's hormonal abnormalities, according to the study. The extract contains phytosterols and phenolic substances that help to improve PCOS issues. Consuming the extract is advised by the study to lessen PCOS-related issues [26]. Serum estrogen, free testosterone, and androstenedione hormone levels returned to normal in women who regularly ate Punica granatum. Punica granatum has been the subject of numerous studies, and the results indicate that using the plant helps patients with PCOS [12]. The antioxidant and anti-inflammatory properties of the seeds and bright red juice of Punica granatum are attributed to polyphenols, which include flavonoids, tannins, anthocyanins, and punicalagins. These ingredients help neutralize free radicals and fight stress associated with PCOS. Because PCOS is characterized by persistent inflammation, pomegranates' anti-inflammatory properties can help reduce PCOS symptoms. Pomegranates may improve heart health and lower blood pressure, according to some research. reduce the chance of problems and raise cholesterol levels. It might help control blood sugar levels. Including pomegranates in a PCOS treatment plan may be beneficial for those with the condition, who frequently experience insulin resistance and are at risk of type 2 diabetes.[22]

10. MACA (Lepidium meyenii):

- Synonyms: Lepidium peruvianum, Ayak Chichira, Maka
- Biological source: Maca is a herbaceous biennial plant that grows at elevations of 13,000–14,800 feet. Maca's fleshy hypocotyl is fused with a taproot, and it's typically dried and used as a powder or flour.
- Family:Brassicaceae

Figure 12: MACA

A traditional herbal remedy for menopausal symptoms, Lepidium meyenii, a member of the Brassicaceae family, also acts as a natural hormone balancer, stimulates the endocrine system, and has no negative side effects.[5]Maca may promote a healthy menstrual cycle by balancing the body's levels of progesterone and estrogen. In addition to its traditional use as an energy-producing plant that increases libido and lowers stress, maca also includes 50 phytochemicals that are proven to balance hormone levels. Maca is thought to aid women with PCOS by regulating their body's estrogen levels. A woman may have trouble ovulating and getting pregnant if her estrogen levels are either high or too low. Therefore, it is crucial to balance a woman's production of estrogen and the corresponding production of progesterone in order to improve fertility and reproductive health and reduce PCOS symptoms including irregular menstrual cycles and excessive hair growth.[27] Male testosterone levels are restored by Lepidium meyenii [28].

11. FLAX SEED:

- Synonym: linseed or oilseed flax.

- Biological source: Linseed is dried, ripe seed of Linum usitatissimum Linn. Linseed oil is obtained by expression of linseeds.
- Family: Linaceae

Figure 13: Flax Seed

Conventional medicine uses flax, botanically known as Linum usitatissium, to cure a variety of illnesses. Additionally, the seeds are used in food items. For three months, Fatima et al. conducted an open-label interventional trial. Thirty-two women who met the inclusion criteria and had polycystic ovarian syndrome were chosen. Following the trial, flaxseed decreased the number of follicles and ovarian volume. Therefore, flaxseed can be investigated further as it shows promise as a potential source for a new PCOS medication.[29]The effects of a 40-gram flax seed supplement taken daily on the hormone levels of a 41-year-old woman with PCOS were seen in a study. The patient consumed 83% of the prescribed amount of flaxseed over the course of four months. Weight-to-height ratios and fasting blood samples taken at baseline and six months showed significant changes in body mass index (BMI), free serum testosterone levels, total serum testosterone, and insulin levels.The patient also reported that her hirsutism had lessened by the end of the research. According to the case study, there was a clinically significant drop in testosterone levels and a contemporaneous decrease in hirsutism [30].

12. SHATAVARI (ASPARAGUS RACEMOSUS):

- Synonym(s): Asparagu,Satmuli, Sukshmapatra, Pivari, Indivari, Abhiru, Bahumula, and Jatamula.
- Biological source:Asparagus racemosus commonly known as Shatavari or Kurilo is a spinous shrub with tuberous roots found commonly in the tropical and subtropical regions
- Family:Liliaceae

Figure 14: Shatavari (Asparagus Racemosus)

An Asparagus racemosus-related medicinal plant is known by its Sanskrit name, shatavari. The dried roots of the plant are used as medicine because of its phytoestrogen. The female reproductive system is revitalized, the menstrual cycle is regulated, and ovarian follicle production is stimulated. Mucosal resistance and cytoprotection are enhanced by the roots' diuretic, tonic, and therapeutic properties. Moreover, it helps dissolve cysts, alleviate hyperinsulinemia, and stop new cysts from growing.[13] Shatavari is a traditional Ayurvedic plant that is a member of the Asparagaceae family. Women use the medicinal plant to treat infertility, menstrual cycle management, ovarian follicle development, and optimal functioning. The phytoestrogen, a naturally occurring plant-based estrogen, is thought to be present in the plant and helps women's reproductive systems recover. When hyperinsulinemia occurs, it also aids in the body's insulin regulation. In young women with PCOS, the Shatavari effect emerged. A study suggests that the herb may stimulate folliculogenesis by boosting the follicle-stimulating hormone. Numerous studies have suggested that the weight of the ovaries may also rise. It is also thought to be the best herb for issues related to menstruation. Many of the ingredients in shatavari assist treat menstrual issues, such as menorrhagia, which is painful bleeding during the period, irregular bleeding, etc. Shatavari's main ingredient, saponin, aids in uterine motility and is hence beneficial for uncomfortable premenopausal bleeding. Infertility is another issue that women deal with. The plant promotes the process of folliculogenesis, which helps alleviate infertility issues. It lowers the risk of miscarriages and prepares the womb. Shatavari roots are also utilized to strengthen the muscles of the uterus and in abortion instances. Since Shatavari contains phytoestrogen, it can also be used to rectify the underlying hormonal balances. In women of reproductive age, phytoestrogens aid in the control of the ovarian cycle. The herb also helps with premenstrual symptoms and heavy bleeding. This medicinal herb also lowers stress levels in females.[31]

CONCLUSION:

Despite extensive research over the last 50 years, we still know very little about the complicated etiology of PCOD, a widespread condition. Nonetheless, we now know a great deal more about the diagnosis and effects of this illness. The ultimate goal of all gynecologists is to provide women with reproductive health care that is positive. Alternative treatment approaches have been used in this context to enhance quality of life. Among the possible Unani medicine treatments are Idrar Haiz, Tadeel Mizan, Loss of weight, Certain medications, such as insulin sensitizers, can help patients suffering from this debilitating illness.

Additionally, some studies found that the medicinal plants used to treat PCOS have no significant side effects because they contain phytoestrogens, which are weak antagonists of estrogen. These phytoestrogens have stronger estrogenic effects when the body's estrogen levels are low in PCOS patients, making them safe and suitable for widespread use in PCOS treatment. Herbs' ability to improve the immune system and regulate the menstrual cycle without altering hormone levels is what makes them effective in treating PCOS.

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