

Integrative Therapeutic Approaches in Polycystic Ovary Syndrome: From Conventional Pharmacotherapy to Herbal Interventions

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ABSTRACT:- Polycystic ovary syndrome (PCOS) is a common multifactorial endocrine disorder affecting 8–13% of women of reproductive age. It is characterized by hyperandrogenism, ovulatory dysfunction, insulin resistance, and metabolic abnormalities. The pathophysiology involves disruption of the hypothalamic–pituitary–ovarian axis, oxidative stress, chronic low-grade inflammation, and genetic and environmental influences. Clinically, PCOS presents with irregular menstruation, hirsutism, acne, obesity, infertility, and increased risk of type 2 diabetes mellitus, metabolic syndrome, cardiovascular disease, and psychological disorders. Diagnosis is based on clinical features, biochemical parameters, and ultrasonography after excluding other endocrine conditions.

As no definitive cure exists, management focuses on symptom control and prevention of long-term complications. Lifestyle modification, particularly weight reduction through diet and exercise, remains the cornerstone of therapy. Pharmacological treatments such as combined oral contraceptives, metformin, and ovulation-inducing agents help regulate menstrual cycles, reduce hyperandrogenism, and improve fertility. In selected cases, surgical and herbal approaches may provide additional benefit.

Early diagnosis, individualized treatment, and long-term monitoring are essential to improve reproductive and metabolic outcomes in women with PCOS.

KEY WORDS:- Polycystic ovary syndrome (PCOS) , Hyperandrogenism , Insulin resistance , Metabolic syndrome , Oxidative stress , Lifestyle modification , Metformin , Herbal therapy

Introduction:-

When individuals were identified with irregular menstruation, reduced fertility, obesity, and excessive hair growth, the condition now known as PCOS was first described in 1935. The initial description mentioned "secondary amenorrhea and related infertility, along with obesity and male-pattern hair growth" [5]. The term "polycystic ovary syndrome" was first used in 1960.

This syndrome is commonly associated with elevated androgen levels, insulin resistance, enlarged and poorly functioning ovaries, and other related factors.

It is a widespread endocrine disorder in women, causing symptoms that affect the skin, mental health, heart and

metabolic functions, and reproductive health. For many years, it has been recognized that PCOS affects approximately 8–13% of women of reproductive age [3].

The fundamental causes of PCOS involve an increased ratio of luteinizing hormone (LH) to follicle-stimulating hormone (FSH) and a heightened frequency of gonadotropin-releasing hormone (GnRH) [4].

However, the exact causes and underlying mechanisms of the condition are still not fully understood.

PCOS is marked by anovulation and dysfunction of the hypothalamic-pituitary-ovarian axis.

It differs from other causes of ovulation failure, which are typically due to inadequate development of ovarian follicles or reduced production of gonadotropins (or both), conditions that are not usually detected through standard testing [5].

Endometrial hyperplasia is more common in PCOS patients. Other reproductive symptoms of PCOS include insulin resistance (IR), metabolic syndrome (MS), and persistent low-grade inflammation [6].

Recent advances have improved our knowledge of the pathophysiological mechanism, diagnosis, and treatment of PCOS. In this study, we concentrate on bariatric surgery, type 2 diabetes (T2DM) drugs, and lifestyle changes as ways to prevent and manage metabolic comorbidities in PCOS [8].

Excessive hair growth, acne, elevated insulin levels, and irregular menstrual cycles are among its symptoms [5]. PCOS affects up to 20% of women with reproductive issues, including as infertility and early pregnancy loss [9].

For the treatment of associated conditions such obstructive sleep apnea, diabetes, hypertension, depression, and anxiety, early identification of PCOS is essential (Dason et al., 2024). Although the precise etiology of PCOS is uncertain, its development is influenced by both hereditary and environmental factors [13].

The oxidative equilibrium in PCOS is upset by oxidative stress, which lowers the body's antioxidant capacity and increases the creation of free radicals.[17]. Furthermore, oxidative stress exacerbates insulin resistance, resulting in a vicious cycle of inflammation and metabolic problems.

Enhancing the SIRT3/FOXO1/PGC-1 α pathway can reduce oxidative stress, increase mitochondrial function, and lessen inflammatory consequences.

This illness exacerbates chronic inflammation in ovarian tissue by activating inflammatory pathways like NF- κ B and JNK.

It is essential to diagnose and treat this illness accurately. Since PCOS is a very varied condition, each patient's treatment should be customized to meet their unique needs.

The current diagnostic standards and important factors for the pharmacological treatment of PCOS based on the guidelines are the main topics of this article.

Losing at least 5% of one's body weight is the most important step in managing this illness, so every woman with PCOS is advised to follow a regular exercise regimen and a diet low in fat and sugar. Maintaining a nutritious diet is very crucial. Diet is rarely a top concern for Indian women. A nutritious diet should be rich in protein and fiber.

Antiandrogen medications, insulin sensitizers, ovulation inducers, and oral contraceptives are frequently used (in combination) by doctors [4]. The United States Food and Drug Administration (USFDA) has not yet approved a medicine especially for PCOS, and all of the medications listed are used off-label.

Diagnosis:-

There is no specific test for PCOS diagnosis because it is one of the disorders that cannot be identified by standard diagnostic procedures like blood tests, cultures, and biopsies.

Based on the related studies, hyperprolactinemia, thyroid illness, Cushing's syndrome, and adrenal hyperplasia should be ruled out in order to create a differential diagnosis for PCOS.

Transvaginal ultrasound is the most accurate type, while transabdominal ultrasound is also an option. Anti-Mullerian hormone concentration is currently used in place of ultrasonography in the diagnosis of PCOS in adults.

It is not advised to utilize anti-Mullerian hormone concentration or ultrasonography to identify polycystic ovaries in adolescent females within eight years after menarche due to the possibility of over diagnosis.

Symptoms and Sign:-

PCOS symptoms vary from person to person. Not every patient will exhibit every symptom. The most typical PCOS symptoms and consequences are:-

- Menstrual disorders with irregular, painful, or heavy periods and decreased fertility: Menstrual irregularities such as amenorrhea (absence of periods) or oligomenorrhea (infrequent periods) are common in women with PCOS. About 73–74% of instances result in decreased fertility or difficulty conceiving due to these anomalies [6,13,35].
- Hirsutism: Excessive hair growth, particularly on the face, chest, back, or belly, can result from elevated androgen levels. Hirsutism, or excessive hair growth, is a typical PCOS symptom that affects 85–90% of women [13,36].
- Acne: During adolescence, women with PCOS may be more susceptible to acne.
- Oily skin and hair: Excessive oiliness of the skin and hair may be a predisposition.
- alteration in body form,
- Elevated blood sugar levels and hypertension
- Dark skin pigmentation: Some PCOS-affected women may experience dark skin patches around their armpits, groin, and anus.
- Breast pain: Some women may have breast soreness or tenderness.
- Food and sweetness desires: Some PCOS-affected women may have strong food cravings, particularly for sweets.
- Sleep issues: Some women may experience sleep disorders or difficulties.

PCOS is frequently accompanied by the following abnormalities:

- Type 2 diabetes: Women with PCOS have a 3–7 times greater frequency of metabolic problems than the overall population, particularly among Indians.
- Approximately 40% of women with PCOS have metabolic syndrome.
- Abnormal lipid levels, such as excessive cholesterol or TGs, are referred to as lipid diseases.

Treatment:-

Although there is no known cure for PCOS, there are treatments that can enhance quality of life, aid in fertility, lower the risk of endometrial cancer and/or hyperplasia, and help prevent long-term cardiovascular problems. Seeking health treatment early to address symptoms of PCOS can help women safeguard their health and well-being during and beyond their reproductive years.

In addition to helping control the menstrual cycle, combined oral contraceptives may lessen acne and excess body and face hair. Acne and excessive hair can also be treated with androgen receptor blockers. Treatment options should be based on collaborative decision-making, taking every individual's unique beliefs and preferences into account.

Treatments for infertility related to PCOS include lifestyle modifications, medications or surgery to induce ovulation. Other assistive reproductive methods, such as in-vitro fertilization (IVF), may also be employed. Although they can be encouraged to become pregnant, women with PCOS typically have a higher risk of pregnancy difficulties, which calls for closer observation.

Life Style Management:-

50% of women with PCOS are obese, which can have detrimental effects on their skin, metabolism, reproductive system, and mental health.

Exercise alone or in conjunction with diet, exercise, and behavioral techniques can improve metabolic health in women with PCOS, especially with regard to central obesity and lipid profiles.

In order to enhance general health, body composition, quality of life, and weight management, as well as to avoid weight gain or encourage weight loss in overweight or obese individuals, a healthy lifestyle is recommended for all PCOS women.

Although adherence is still difficult, dietary strategies like the Mediterranean and ketogenic diets can improve metabolic results.

Ketogenic Diet:-

The KD (keto diet) is a high-fat, low-carb diet that promotes nutritional ketosis by emphasizing a high fat intake (more than 70% of total calories) and a low carbohydrate intake.

Its antiepileptic qualities are widely acknowledged in the treatment of refractory epilepsy.

By using calorie restriction alone to induce therapeutic ketosis, the KD has been demonstrated to improve PCOS outcomes in a short amount of time.

This non-pharmacological method improves metabolic and anthropometric profiles and could be used in addition to pharmaceutical treatments for PCOS.

By inducing ketosis, KD can improve metabolic outcomes in PCOS and may be useful as an adjuvant treatment for a number of neurological conditions.

Drugs:-

Combined Oral Contraceptives:-

For the majority of women with PCOS who do not wish to become pregnant, combined oral contraceptives (COCs) and lifestyle changes are regarded as the first-line treatment.

They are used to enhance clinical indicators of hyperandrogenism and control the menstrual cycle.

The estradiol component of combination oral contraceptives lowers serum-free androgen levels by increasing SHBG levels, while the progestin component suppresses LH secretion to prevent the generation of ovary androgens.

Some progestins prevent androgens from attaching to their receptors or prevent the 5- α reductase enzyme from functioning.

Therefore, we came to the conclusion that combination oral contraceptives and lifestyle changes help women with PCOS manage their menstrual cycles and reduce the symptoms of hyperandrogenism.

Metformin:-

This kind of biguanide drug lowers intestinal absorption, improves insulin sensitivity, and lessens the liver's production of glucose, all of which effectively lower blood sugar levels.

Metformin is crucial for managing PCOS because it lowers insulin levels, which in turn lowers androgen and luteinizing hormone levels.

Women's menstrual periods are regulated by this return to normal hormone levels. Physicians should inform premenopausal women that taking metformin increases the risk of getting pregnant.

Clomid citrate:-

The main drug used to promote ovulation in teenagers with polycystic ovarian syndrome (PCOS) is clomid citrate (CC).

It inhibits the hypothalamus's estrogen receptors (anti-estrogen).

This action causes the anterior pituitary's GnRH pulse width to increase, which in turn causes an increase in FSH production.

Starting at 50 mg daily and escalating to 150 mg daily, it is taken for five days, from the second to the fifth day of the menstrual cycle.

For PCOS patients who do not respond to CC alone, CC is administered in combination with metformin.

Inositol:-

A nutritional supplement called inositol functions as an insulin sensitizer and is believed to increase the absorption of glucose and decrease the production of androgens in ovarian granulosa cells.

myo-inositol and D-chiro-inositol, the two most widely utilized forms of inositol, may not be very beneficial for some metabolic outcomes in PCOS, such as decreased fasting insulin levels and elevated insulin sensitivity.

Although metformin has greater side effects, including gastrointestinal side effects, it seems to be better than inositol for hirsutism and central obesity.

Surgical Intervention:-

Patients who are extremely obese should be offered bariatric surgery since it is a successful treatment for obesity and PCOS symptoms when all other choices have been exhausted (100). However, there are dangers, such as nutritional and surgical issues, and pregnancy should not be attempted within a year after the procedure.

In order to restore balance and enhance ovarian function in PCOS, laparoscopic ovarian drilling involves destroying ovarian tissue with a laser beam or a surgical needle using minimally invasive laparoscopic procedures.

Although the surgery is not frequently performed, it is still an option for ovaries that are resistant to clomiphene citrate and when letrozole is not available because of off-label use.

In contrast to medical ovulation induction alone, laparoscopic ovarian drilling may actually lower the live birth rate in women with ovulatory PCOS and clomiphene citrate resistance, even though it lowers the risk for ovarian hyperstimulation syndrome and the number of multiple pregnancies (101). It's important to keep in mind that women who undergo laparoscopic ovarian drilling are equally susceptible to the dangers of surgery, including anesthesia-related problems, infection, and adhesions.

Herbal Drugs In The Management Of PCOS:-

A prevalent endocrine condition that affects women of reproductive age is called polycystic ovarian syndrome, or PCOS. Despite the widespread use of traditional drugs like metformin, hormonal contraceptives, and anti-androgens, many patients turn to alternative therapy because they are worried about long-term use and negative effects. Herbal remedies, which come from traditional systems like Ayurveda and Unani, are becoming more and more well-liked due to their perceived safety, low cost, and comprehensive effects on metabolism, hormone control, and reproductive function.

Numerous medicinal plants have had encouraging results in lowering the symptoms of PCOS, including ovarian cysts, insulin resistance, irregular menstruation, and obesity. The following table lists the main herbs that are frequently used in traditional medicine systems to treat PCOS:

S No	Plant name	Part used	Known Benefits in PCOS
1	<i>Aloe barbadensis</i>	leaves	Regulates menstruation, improves insulin sensitivity
2	<i>Saricaasoca</i>	bark	Uterine tonic, regulates menstrual cycle
3	<i>Terminalia arjuna</i>	bark	Cardioprotective, supports lipid metabolism
4	<i>Solanum nigrum</i>	leaves	Anti-inflammatory, detoxification support
5	<i>Withaniasomnifera</i>	fruits	Adaptogen, reduces stress, balances hormones
6	<i>Nardostachysjatamansi</i>	root	Nervine tonic, reduces anxiety, balances endocrine function
7	<i>AmbromaAugusta</i>	Root/ root bark	Emmenagogue, promotes menstrual flow
8	<i>Ficus glomerata</i>	Leaves, bark, fruit	Astringent, reduces excessive bleeding, anti-diabetic
9	<i>Symplocosracemosa</i>	Bark	Uterine tonic, regulates ovulation
10	<i>Parmeliaperlata</i>	Flower	Cooling agent, used in menstrual irregularities
11	<i>Mimosa pudica</i>	Whole plant	Anti-inflammatory, anti-diabetic, supports fertility

CONCLUSION:-

Polycystic ovary syndrome (PCOS) is a complex hormonal disorder that commonly affects women of reproductive age. It is characterized by features such as excess androgen levels, irregular ovulation, insulin resistance, and metabolic issues. The condition is linked to various health problems, including oxidative stress, chronic low-grade inflammation, and disturbances in the hypothalamic-pituitary-ovarian axis. These factors contribute to reproductive, metabolic, and psychological challenges. Women with PCOS are at a higher risk of developing infertility, type 2 diabetes, metabolic syndrome, and cardiovascular diseases.

Since there is no known cure, the focus of care is on managing symptoms and preventing long-term complications.

Lifestyle modifications, especially weight management and regular physical activity, remain the primary approach. Medications such as insulin sensitizers, metformin, clomiphene citrate, and combined oral contraceptives are used to regulate menstrual cycles, reduce excess androgens, and improve fertility outcomes. In some cases, surgical options and new herbal treatments may also be considered.

Early diagnosis, individualized treatment strategies, and continuous monitoring are essential for improving quality of life and reducing the risk of associated health complications in women with PCOS.

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