

Current Approaches in the Management and Treatment of Polycystic Ovary Syndrome: A Comprehensive Review

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Abstract:- Polycystic ovarian syndrome (PCOS), is a hormonal and endocrine condition among women most frequent among teenagers and young women, affecting 5-10% of women throughout their reproductive years and characterized by an imbalance of female sex hormones, a change in the menstrual cycle, and an ovarian cyst that can lead to infertility. The most prevalent symptoms of PCOS are acne, hirsutism, menstrual cycle irregularity, obesity, insulin resistance (IR), and elevated cholesterol, all of which are linked to hyperandrogenism. Because of the wide spectrum of signs and symptoms, health professionals must have a thorough understanding of the illness and how to treat it. According to prevalence surveys, 8.2 percent (RC) of Indian women and girls have PCOS. The specific cause of PCOS is unknown, however genetic and environmental factors are the primary causes. PCOS causes complications such as cardiovascular, oncology, metabolic, and barrenness in women. Traditional medicinal systems such as Ayurvedic, homoeopathic, Unani, and Siddha, as well as modern systems such as allopathic and surgical treatment, show promising results in the treatment of PCOS, regardless of whether the cause is hereditary or metabolic. Tridosha and herbal remedies are preferred in ayurvedic Panchkarma. Laparoscopic ovarian drilling surgical therapy is done in clomiphene resistant patients. PCOS can be managed by changing a woman's diet, exercising, and changing her lifestyle. Yoga asanas such as chakki,

badhakonasana, shavasna, padma sadhana, and surya namskar help to improve PCOS symptoms. Recently, PCOS has been linked to a greater incidence of covid 19 infection in women.

Abbreviation: PCOS-Polycystic ovary syndrome; RC-Rotterdam criteria

Keywords:- PCOS, hyperandrogenism, menstrual dysfunction, yoga, covid 19.

I. INTRODUCTION

According to the WHO (World Health Organization), 116 million women globally, or roughly 3.4 percent, suffer from PCOS^[1]. Polycystic ovarian syndrome (with a prevalence of 6.5–6.7%) is the most frequent endocrinopathy condition diagnosed in premenopausal women. PCOS was first characterized in 1990 at an NIH conference as a mix of oligomenorrhoea and androgen excess (clinical or biochemical)^[2]. PCOS, which was first described in 1935 by American gynecologists Irving F Stein and Michael L Leventhal, and was given the moniker Stein – Leventhal Syndrome^[3]. When estrogen and progesterone levels are out of balance in PCOS women, cysts can grow on the ovaries' outer margins, causing them to expand. (Fig.1)

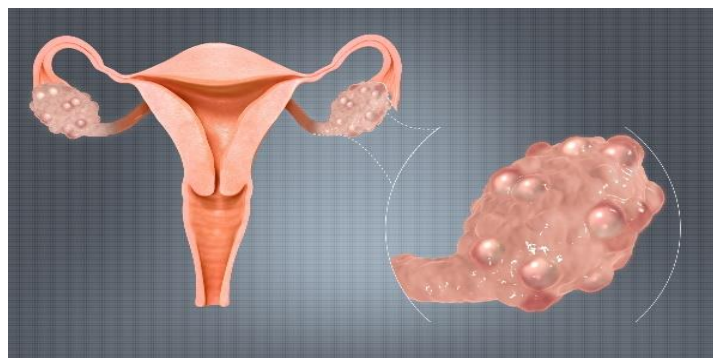


Fig. 1: Ovaries with PCOS

Hyperandrogenism is a term used to describe an overproduction of the male hormone androgen in women with PCOS. PCOS affects the majority of women of reproductive age (15-44 years) and is frequently misdiagnosed. When women are in their twenties or thirties

and have difficulty having children, they seek medical help and are diagnosed with PCOS. PCOS can strike at any age, with the most common symptoms being acne on the face, chest, or upper back, anomalies in the menstrual cycle,

excessive hair growth in regions where males are obese, and hair thinning.

Disrupts One of the indicators for identifying this disease is female HPO axis function (Fig.2). The female hypothalamic–pituitary–ovarian (HPO) axis is a complex system that regulates the female reproductive system. It involves the hypothalamus, anterior pituitary, and female

gonads, and allows the brain to connect with the ovaries via hormones, which are ultimately responsible for species survival and reproduction. The HPO axis is influenced by hormonal, neuronal (internal) and environmental variables (i.e. external factors). Through epigenetic variables, these factors have an impact on the developing brain and germ cells in the following generation at the start of pregnancy^[4].

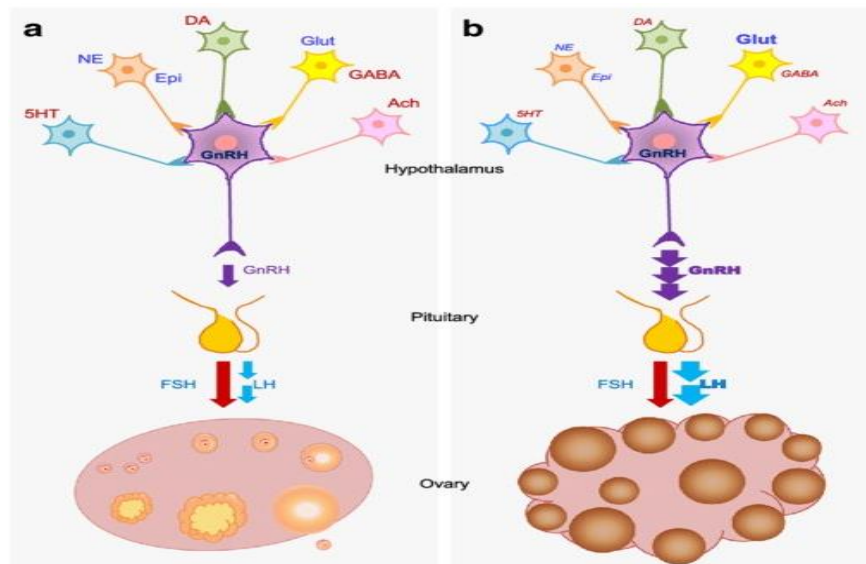


Fig. 2: (A) Hypothalamic-Pituitary-Ovarianaxis in Normal (B) In PCOS

A. Conditions:

Glutamate(Glut),Norepinephrine(NE),Epinephrine(Epi): Stimulatorymolecules;Serotonin(5HT),Acetylcholine(Ach), GABA: Inhibitory molecules; LH, GnRH, Glut: Increased in PCOS condition; 5HT, NE, Epi, Dopamine(DA),GABA, Ach : Decreased in PCOS condition.: ↓arrow: As compared to control increase in PCOS.

B. PCOS as menstrual disorder:

The ovaries in a woman's body produce an egg and release it every month as part of the normal menstrual cycle. Ovulation is the name for this process. This continues till the conclusion of the period when women are fertile. Normally, eggs are released at ovulation, however in a woman with PCOS, the egg may not be released during this time. The progesterone hormone is not produced because ovulation does not occur. Progesterone aids in the preparation of the uterus lining (endometrium) to receive the egg if it is fertilised by a sperm. As a result, irregular menstrual cycles become a concern^[5].

C. Development of PCOS:

A historical history of PCOS, with the term PCOS being applied to ovarian morphology. Disturbances in menstrual cycle, undesired male pattern hair growth, and enlarged ovaries with many tiny follicles are common traits shared by seven women^[6]. Lateral investigators confirmed that bilateral cystic ovaries formed as a result of inappropriate hormonal stimulation. Because of the availability of clomiphene and follicle-stimulating hormone (FSH), medicinal treatment has surpassed surgical ovary excision^[7]. When surgical treatment, such as laparoscopic surgery, became more common and preferred. PCOS diagnosis from

an ovary image has gotten easier because to ultrasound technology.Many women with polycystic ovaries who had moderate or no other symptoms of PCOS experienced an unexpected outcome^[8]. This gave rise to the term polycystic ovarian morphology, whose importance is still up for discussion. The universal adoption of the Rotterdam criterion has been contested^[9].which includes oligo-anovulatory women with polycystic ovarian morphology but no clinical or biochemical indications of hyperandrogenism, is premature and will result in unwarranted diagnosis, laboratory testing, and perhaps lifetime consequences for these women^[10]. Even after so many years, the actual aetiology of this condition is still unknown, and it is currently thought to be multifactorial, with a strong genetic component. Despite the fact that it is routinely detected in patients, insulin resistance (IR) is not included in any diagnostic criteria.

II. ETIOPATHOPHYSIOLOGY

A. Etiology of PCOS:

The actual origin of PCOS is unknown; it is thought to be a multifaceted disorder with a hereditary component. In normal persons, approximately 4-6 percent of women have PCOS, but 20–40 percent of first-degree female relatives of women with PCOS develop PCOS^[11].

The fundamental causes of PCOS: ^[12]

- Genetic inclination
- Personality
- Environmental considerations
- Boost insulin levels
- androgen content

- Estrogen concentration
- Periods of disruption
- A weakened protective structure
- Dietary beads

- Unhealthy food
- Hormonal discord
- Inflammation

B. Signs and Symptoms:

The Women with PCOS have signs and symptoms^[12] given in Table I.

Symptoms	Associate with
Acne Hirsutism LH hypersecretion	Hyperandrogenium
Infertility Miscarriage rates are high. There are no periods. Bleeding excessively during periods Ovulation does not occur in eggs. Periods of inconstancy	Disrupted menstrual cycles
Insulin sensitivity Intolerance to glucose Obesity Hyperlipidaemia Diabetes type 2 Cardiovascular problems	Metabolic disturbance
Enlarged ovary with cyst	Ovaries
Anxiety /Depression Irritation Mood swings	Mental health

Table 2: Association of symptoms in PCOS

III. DIAGNOSIS

Two definitions are commonly used- oligoovulation/anovulation and Excess of androgen in criteria for diagnosis^[1,9,13,14].The diagnostic criteria of PCOS are given in Table II.

Definition	Year	Sponsored by	Criteria
NIH	1990	NIH/NICHD	1. The oligoovulation process 2.Signs of androgen excess (clinical or biochemical) 3 Other illnesses that can cause menstrual irregularities and testosterone excess have been ruled out. Both conditions 1 and 2 must be met.
Rotterdam	2003	ESHRE/ASRM	1.Anovulation or oligoovulation 2.Excessive androgen production 3.Polycystic ovarian syndrome (by gynecologic ultrasound 12 follicles and 2-9mm in each ovary) Two out of the three criteria must be met.
Androgen Excess PCOS Society	2006	AE-PCOS	1.Excessive androgen production 2.Polycystic ovaries or oligoovulation/anovulation 3.All other substances that could increase androgen activity are ruled out. Both conditions 1 and 2 must be met.
NIH 2012 extension of Rotterdam 2003	2012	NIH/ESHRE/ASRM	1.Androgen excess 2.Oligoovulation 3.Polycystic ovarian syndrome 4. Identifying phenotypes: A:OV+AE+PCO B: AE+OV C:AE+PCO D: OV+PCO Two of the three requirements must be met, as well as phenotypic identification.

Table 2: Diagnostic criteria for PCOS

ESHRE: European Society for Human Reproduction and Embryology; ASRM: American Society of Reproductive Medicine; NIH: National Institute of Health; NICHD: National Institute of Child Health and Human Development; ESHRE: European Society for Human Reproduction and Embryology; ASRM: American Society of Reproductive Medicine OV: Oligoovulation; AE: Androgen Excess; PCO: Polycystic Ovaries; AE-PCOS: Androgen Excess and PCOS Society; OV: Oligoovulation; AE: Androgen Excess; PCO:

IV. ASSESMENT OF PCOS

PCOS is diagnosed in women who have irregular periods, hirsutism, acne, dry skin, and thin hair. Endocrine state, pelvic ultrasonography, thyroid disorder, adrenal disorder, hyperprolactinemia, and ovarian morphology should all be part of the proper evaluation. If PCOS is diagnosed, additional metabolic testing is required if metabolic impairment is present. (Table III). Adults and adolescents should be tested with a 2-hour oral glucose tolerance test and a fasting lipid profile after being diagnosed with PCOS, according to the AES^[15]

Laboratory testing	Radiology Imaging	After diagnosis of PCOS
(a) Urine or serum hCG; (b) FSH, LH, estradiol; (c) TSH; (d) prolactin; (e) total and free testosterone; (f) DHEA-S; (g) 17-OHP;	(a) transabdominal or transvaginal pelvic ultrasonography	(a) fasting and 2hour oral glucose tolerance test; (b) fasting insulin; (c) lipid panel

Table 3: Diagnosis based on laboratory testing, radiology imaging and after diagnosis ofPCOS

hCG stands for human Chorionic Gonadotropin; FSH stands for Follicle Stimulating Hormone; TSH stands for Thyroid Stimulating Hormone; LH stands for Luteinizing Hormone; DHEA-S stands for dehydroepiandrosterone sulphate; OHP stands for hydroxyprogesterone.

For the evaluation of symptoms of PCOS in adolescents some tests are recommended^[16]

Some laboratory parameter of PCOS in Adolescence are given in Table IV^[17].

HORMONES	METABOLIC MARKERS
TESTOSTERONE ↑/=	AI apolipoprotein ↓
FREE ANDROGEN INDEX (FAI) ↑	Cholesterol =/↑
SEX HORMONES BINDING GLOBULIN (SHBG) ↓	HDL/LDL Cholesterol ratio ↓
D4-ANDROSTENDIONE=/ [↑]	Triglycerides =/↑
DHEAS =/ [↑]	Insulin ↑/=
LH =/ [↑]	Hba1c ↑/=
LH/FSH RATIO =/ [↑]	

Table 4: Laboratory features in PCOS

Symbol- Normal: =; Elevated: ↑; Decreased: ↓;

A. Complexities in PCOS

Early term, long term and obstetric complexities are seen in PCOS women which are given Table V.

Early term	Obstetric	Long term
Fruitlessness	prescription for fruitlessness	a cardiovascular risk
Messy adoration	Various Pregnancies	Oncology danger
Oligoanovulation	IR chubbiness and metabolic dysfunction	metabolic risk
Vanity	Exacerbation	
Barrenness	Adjusting the placenta	

Table 5: Early term, obstetric and long term complexities^[12]

B. Pathophysiology

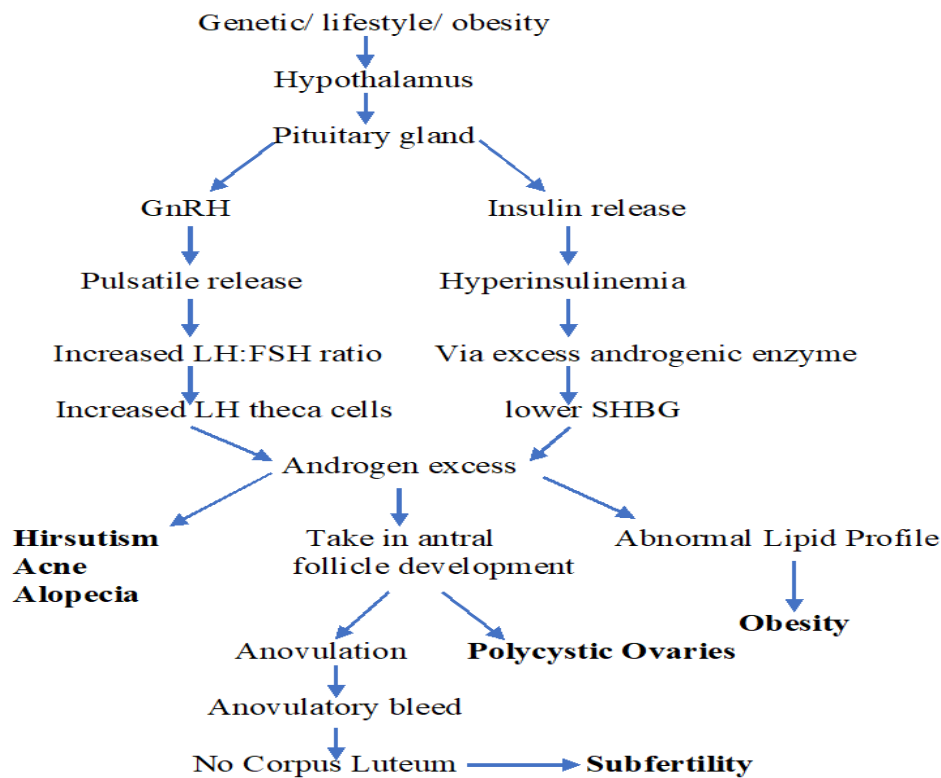


Fig. 3: Pathophysiology of PCOS

C. Prevalence studies

Data of prevalence studies given in Table VI.

Study	N	Location	Year	Age	Prevalence %	References
Balaji et al	126	Tamil Nadu	2015	12-19	18(RC)	[19]
Gupta M et al	385	India	2018	17-24	8.2 (RC)	[20]
Joshi et al	441	Mumbai	2014	15-24	22.5(RC) 10.7(AES)	[21]
Gill et al	1520	Lucknow	2012	18-25	3.7(NIH)	[22]
Nidhi et al	460	Bengaluru	2011	15-18	9.13(RC)	[23]
Vidhya Bharathi et al	random	Chennai	2017	random	6 (RC)	[24]
Ramanand Sunita et al	460	Maharashtra	2011	15-18	22.5(RC) 10.7(AES)	[25]

Table 6: Prevalence Studies on Polycystic Ovary Syndrome in Indian Women/Girl^[18]

N-no of girls/womens; RC-Rotterdam; NIH-National institute of Health; AES-Androgen Excess Society;

V. TREATMENT

A. PCOS Ayurvedic Therapy:

Ayurveda offers a variety of unique and tailored remedies to help alleviate and eliminate the symptoms of PCOS. Treatment in Ayurveda includes nutrition, herbal

medicine, and lifestyle changes. According to Ayurveda, PCOS is comprised of doshadhatu and up dhatu, and it does not correlate the condition of a single disease, but rather symptoms that are comparable to those of yonivyapad (arajaska, lohitakshayav, hyapuspaghni and jatiharini)^[26].

B. Tridosha for PCOS

Detail about tridosha given in Table VII.

Vatta	Pitta	Kapha
Depraved in menstrual irregularities and pain Shatavari is utilised to rectify hormonal influence, follicular maturity, and satapushpa is used to offset menstrual irregularity as an analgesic ^[27] . medicine- Satapushpa Shatavari powder (SSP), ShatavariGrita (SSG) and Matravasti (therapeutic enema	hirsutism,acne,cardiovascular, and heart difficulties. Manjistha and Ashoka were used to treat hirsutism, whereas neem and kutki were used to treat acne ^[28] .	Weight gain, cyst growth, and depression are all symptoms of this condition. Shatavari, Chandra Prabha, Shatapushpa, Manjistha, and Guggul are examples of herbal medicines ^[29] . medicine - enema or Bastis with Triphala- For treating obesity ^[30]

Table 7: Ayurvedic tridosha i.e., vatta, pitta, kapha

C. Panch Karma for PCOS:

Pancha Karma, an Ayurvedic approach, is utilised in the treatment of PCOS. It consists of five therapies for clearing ama and balancing agni^[31]. Vamana, virechana, basti, oleation-fomentation, and nasya are examples of panchakarma (Table VIII)

Panch Karma	Uses
Vamana, (emesis therapy)	In the therapy of weight loss, it aids in the evacuation of extra Kaphadosha ^[32] .
Virechana(purgation therapy)	It balances hormones by removing heat from the small intestine and liver, which decreases pitta ^[33] .
Basti(enema)	Both Uttara and rectal Basti are useful in treating vaginal and uterine illness in women ^[34] . Basti cleanses and nourishes the reproductive system ^[35] .
Olation (massage) and fomentation (sweat Producing)	Facilitate bodily cleansing and purification.
Nasya	It helps to regulate the menstrual cycle by stimulating the limbic system and the olfactory nerve, which control the secretion of Gonadotropin Releasing Hormone (GnRH) in the hypothalamus ^[36] .

Table 8: Panch karma therapies for PCOS

D. Aartava-kshaya

Aartava kshaya is an illness caused by vayu and kapha imbalances, which induce increased menstrual flow and pain. Dhatwangi and Bhutangi cause Rakta to be metabolised, resulting in the formation of Upadhatu from Rasa within a month. It is one of the menstrual cycle disorders. Aartava is an Upadhatu that forms in a month from Rasa^[27]. As a result, PCOS can be defined in terms of Dosha, Dhatu, and Upadhatu participation.

E. PCOS natural cures from Ayurveda:^[37]

Ayurvedic medicine is a multi-pronged approach to healing. -

- Therapy of hormonal imbalance,
- Avoidance of excessive cholesterol and obesity treatment,
- Treatment of insulin resistance
- Herbs used in treatment of PCOS with their sources are given in Table IX.

Sr no	Herbs	Source (Botanical name/ family)	Use
1	Liquorice (rhizome)	Glycyrrhiza glabra / Leguminosae.	Metabolism of androgen ↓Testosterone Adjuvant therapy in hirsutism
2	Aloe vera (leaf)	Aloe barbadensis / Liliaceae.	Show steroidogenic activity helps ovary to restore its steroid activity
3	Flax Seed (seed)	Linum usitatissimum / Linaceae.	↓ Body Mass Index (BMI), ↓ insulin, ↓ total serum testosterone and free serum testosterone levels. ↓ hirsutism ↓ androgen levels

4	Gymnema (leaf)	Gymnema sylvestre / Apocynaceae	Antidiabetic, Hypoglycemic, Lipid lowering agent Weight reduction.
5	Fennel (seeds)	Foeniculum vulgare / Apiaceae	Antihirsutism Decrease androgen
6	Cinnamon (bark)	Cinnamomum zeylanicum / Lauraceae.	Reduce insulin resistance
7	Chaste berry (berry)	Vitex agnus -castus / Lamiaceae	Hormone imbalances Pituitary gland function is to stimulate and stabilize the body.
8	Stinging Nettle (root)	Urtica dioica / Urticaceae	↑ SHBG level (sex hormone-binding globulin)
9	Red clover (flower and legume)	Trifolium pratense / Leguminosae	Acne
10	Black Cohosh (root)	Actaea racemose / Ranunculaceae	Reduce the production of luteinizing hormone Effective for hormone-related symptoms and severe menstrual cramps ^[38]
11	Green tea (leaf and buds)	Camellia sinensis / Theaceae	Antioxidants ↓hormones that cause ovarian cysts
12	Amla (berry)	Phyllanthus emblica / Phyllanthaceae	Detoxification and cholesterol reduction. It has anti-inflammatory and free radical scavenger properties to help restore hormone balance.
13	Sesame (seeds)	Sesamum indicum / Pedaliaceae	Nutritional Supplements for PCOS Control blood glucose levels.
14	Pumpkin (Seeds)	Cucurbita maxima / Cucurbitaceae	Maintain healthy cholesterol and insulin levels. Treat hirsutism, acne, weight gain, and androgen excess ^[39]
15	Tulsi (leaf)	Ocimum tenuiflorum / Lamiaceae	Maintain a healthy balance of androgens and insulin. Antioxidant
16	Curcumin (rhizome)	Curcuma longa / Zingiberaceae	Induction of ovulation

Table 9: Herbs used in treatment of PCOS

F. Unani therapy

Unani system includes medications originating from ancient plants, animals, and mineral sources. In the allopathic and Unani systems, the reasons for infertility in PCOS and obese women are different based on the cellular and hormonal principles. According to the medication database, megabrand like Tams, Or, and Sue are mostly useful in treating PCOS, but efficacy proof is still pending. A doctor will ask about your menstrual cycle, diet, sleep, bowel movements, physical activity, mental/emotional state, medicines, and addiction. PCOS is classified by Hakim as qillate tams, ehtebase tams, and uqr. Infertility is at an advanced stage. The medications of choice in this system are Withania somnifera (Ashwagandha) and Tribulus Terrestris Linn. (Kharekhask). After numerous studies, this medication was reported for Asgard^[51]

As remedial measures, the Golden Unani principle is applied.

- Elimination of existing causes (metabolic correction)/ Islahe jigar
- Sue Mizaj Barid has been corrected.
- Taking After Asbab Zarooriyah Sitta
- Ilaj Bil Tadbeer is number four (Regimenal therapy)

G. Siddha therapy

PCOS is classified as a Kapham condition of mukkutram in the Siddha medical system. Menstruation physiology in the siddha system includes vaatham, kapham, and pitham. Vaatham aids in ovum rupture and release, as well as follicle maturity and migration. Pitham demonstrates the nature of hormones that aid in follicle rupture (energy of transformation). Kapham is good for the reproductive system. PCOS occurs when movement and transformation are hindered by Kapham's obstruction of Vaatham and Pitham. Vaatham and Kapham govern the normal menstrual cycle. Amenorrhoea is the result of a hormonal imbalance

caused by a blocked channel. Reduced in Vaatham causes amenorrhoea, dysmenorrhoea, and constipation. Obesity is

caused by an overabundance of Pitham and Vaatham in the body.

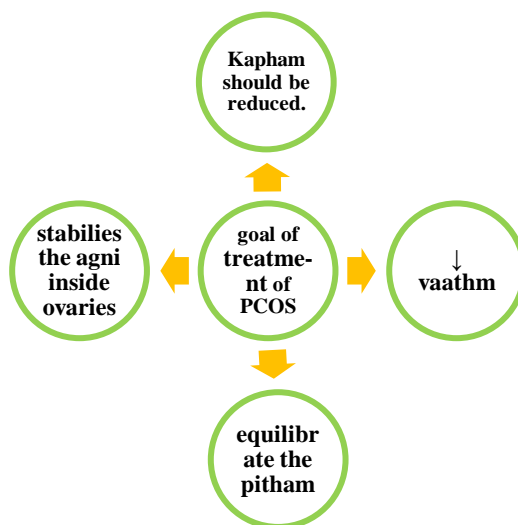


Fig. 4: Goal of treatment of PCOS

For the treatment and management of PCOS, several Siddha formulations are employed, which are further categorised into herbal and herbomineral categories based on nature^[40]. (See Tables X and XI)

Herbal	Herbomineral
1. Lehgyam Kumari 2. Nei Senkottai 3. Kumatty chooranam (Kumatty Chooranam) 4. Chooranam Nilakadambu 5. Mezhugu Gunma Kudori	1. Chitiramoola Kuligai 2. Arumuga Chenduram 3. Agasthiyar Kuzhambu 4. Rasagandhi Mezhugu 5. Navauppu Mezhugu 6. Nandhi Mezhugu 7. Siddhathi Ennai 8. Vaankumari Lehgyam 9. Pattu Karuppu

Table 10: Herbal and Herbomineral Formulation for Treatment of PCOS^[41,42,43]

Condition	Formulation used
Amenorrhoea	Chukku thylam, Agasthiyar kuzhambu, Malai vembadhi thylam, Karunjeeraha chooranam, Thirikadugu chooranam, Gunmauppu chooranam;
Menorrhagia	Aswagandha balalakshaddi thylam, Asokapattai Chooranam, Ayachendooram, Padigapoongavi chendooram, Neeradimuthu vallathy cap, Kombarakku chooranam;
Infertility	Aswagandha balalakshaddi thylam, Agasthiyar kuzhambu, Karpooradhi Chooranam, Nilakadambbu Chooranam, Naga parpam, Karisalai karpam tablet;
Obesity	Kazharchi Cooranam, Panjadeepakini Leghyam, Kaphasura Kudineer Chooranam, Gunmauppu Chooranam, Inji Chooranam; Amukkara Chooranam, Annabedhhi Chendooram, Thalisedhi Chooranam, Naga Parpam, Karisalai Karpa Chooranam;

Table 11: In PCOS, several formulations are used to treat amenorrhoea, menorrhagia, infertility and obesity. ^[44]

H. Homeopathic therapy

Homeopathic remedies are tailored to each patient's specific medical situation. Homeopathy treats the cause of disease rather than just the symptoms. If used correctly, homeopathic remedies have no negative effects. For PCOS, there are over 150 highly effective homeopathic medicines. Because PCOS involves several organs and complicated systems, a holistic approach is the best way to treat it. Homeopathic remedies aid in the normalisation of the menstrual cycle and the induction of ovulation. Early homeopathic medication prevents the emergence of a well-known PCOS problem. Homeopathy is a natural,

compassionate, and effective technique to eliminate PCOS-related difficulties to conception. Homeopathy aids in the restoration of the most wonderful gift of parenthood to any woman who has been denied it owing to PCOS remedies^[45].

Homeopathic treatments are tailored to a person's personality, habits, requirements, and individuality. The following are some excellent homeopathic medicines for PCOS:

- Lycopodium—excessively lengthy menses with right abdominal pain

- Pulsatilla- in light, sensitive women, menses are irregular or missing for months at a time.
- Thuja- worried women's menses are light, dark, clotted, and painful.
- Sepia- late and infrequent menses, with bearing down aches made worse by the least amount of movement.

- Kreosotum- heavy menses with dragging in the back that is alleviated by movement.

I. Allopathic therapy

PCOS treatment is not available anywhere in the cosmos. Clomiphene citrate and metformin are currently the most popular and effective allopathic treatment options^[46]. Table XII lists the tools utilised in PCOS treatment.

Therapeutic Tools	Drugs	Treatment
Old therapeutic Oral contraceptives Antiandrogen ^[48]	ethinyl estradiol(35mg) + cyproterone acetate(2mg) combination is usually administered ^[49] Spironolactone Flutamide Eflornithine Hydrochloride Glucocorticoids Cyproterone Acetate	↓Hyperandrogenemia, ↓Hirsutism ↓Acne ^[50,51] Acne, hirsutisma, reduction of adrenal gland testosterone Acne and hirsutism Hirsutism Low-dose cutaneous benefit for patients with hyperandrogenemia ↓Hirsutism
New therapeutic Insulin sensitizer	Metformin Thiazolidinediones (Rosiglitazone and Pioglitazone) ^[52,53]	Ovulatory infertility ↓Insulin resistance ↓Glucose level ↓Hyperadrogenaemia ↓Insulin resistance ↓Hyperandrogenaemia Ovulation restoration
Emergingtherapeutic Statins Acupuncture Dietary products and nutrients.	Simvastatin ^[54] For manual or electrical sensory stimulation of somatic afferent nerves needle are innervating the skin and muscles. Vitamin D Vitamin B12 and folate Advanced Glycated End products (AGEs) low diet	↓Insulin resistance ↓Hyperlipidemia ↓Oxidative stress ↓Hyperandrogenemia ↓Systemic inflammation ↓Testosterone levels in circulation Menstrual irregularities get better ↑ Insulin sensitivity Improved insulin resistance and lipid profile Improves insulin resistance ↓ Atherosclerosis risk
Others therapeutic	Clomiphene citrate Tamoxifen Aromatase Inhibitor (Letrozole and anastrozole) Gonadotropics Assisted Reproductive technology (IVF-in vitro fertilization) Incretins DPP-4 inhibitors(sitagliptin) GLP-1 agonist (Exenatide) Acarbose Inositol stereoisomers (Myo-inositol) Opioid receptor antagonist (Naltrexone) Orlistat	Manage normogonadotropic anovulation ↑FSH release Infertility Ovulatory infertility Improve ovulation Achieve pregnancy Regulate insulin response Glycemic control ↓Weight Effect on insulin sensitivity Promotes proper insulin utilization Balance ovarian hormone function Regularies menstrual cycle Improves fertility Increase insulin sensitivity. Increase insulin sensitivity

Table 12: Therapeutics tools for the treatment of PCOS^[47]

J. Surgical treatment

- Ovarian drilling laparoscopically (laser, electrocautery, multiple biopsy) [55]
Clomiphene-resistant women
The mechanism is unknown.
It could be due to stroma destruction (produce androgen)
- Oophorectomy (removal of the ovaries) (rarely done)
When you don't want to have children and your symptoms are severe,
Resection of the ovarian wedge (rarely done)

VI. MANAGEMENT OF PCOS

Diet, exercise therapy, and lifestyle changes can all help with PCOS management.

A. Diet

PCOS can be controlled by eating a low-carb, high-fat diet. Insulin promotes androgen synthesis while inhibiting sex hormone binding globulin formation. Eucaloric acid has a higher concentration of monounsaturated fatty acids. Following a low-carbohydrate diet resulted in a slight loss in body weight and a reduction in insulin fasting levels. Within

16 days, 45 percent of women increased their fat metabolism by following a low carbohydrate, low cholesterol, high fibre diet. The ketogenic diet lowers blood insulin levels and growth factor-1 (IGF-1).

B. Exercise

Regular aerobic exercise helps to control PCOS. Without losing weight, aerobic exercise reduces insulin resistance and ovarian morphology in women with PCOS. Exercise causes changes in visceral fat and ectopic lipid in non-fatty tissues. Aerobic exercise performed for a short period of time at a moderate intensity improves ovulation and menstrual cycle management while also lowering weight and IR in young women with PCOS[26,56].

C. Lifestyle modifications

FSH, FAL, SHBG, total testosterone androstenedione levels are improved by a lifestyle intervention. Metformin and a healthy lifestyle appear to help with weight loss and menstrual cyclicity[57].

D. Yoga

Some asanas are recommended to improve PCOS are: [30]

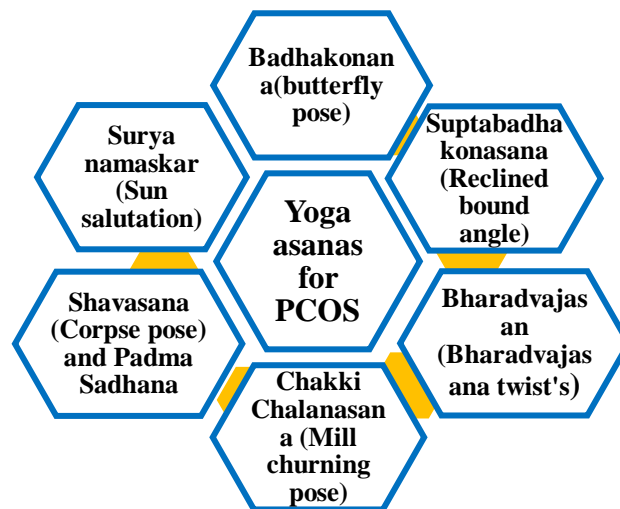


Fig. 5: YOGA ASANAS FOR PCOS

To improve functioning of endocrine gland and boost the health of uterus and ovaries practicing these asanas is important.(Fig.6)





Fig. 6: 1- Badhakonasana; 2- Suptabhadhakonasana; 3- Bharadvajiasana; 4-Chakki Chalanasana; 5- Shavasana; 6- Padma Sadhana; 7- Surya Namaskar;

VII. COVID 19 INFECTION IN WOMEN WITH PCOS

Obesity, hypertension, type 2 diabetics, metabolic syndrome, ethnic minority group, high cytokine level, high androgen level, low vitamin D level are all frequent risk factors for increased covid 19 severity and cardio-metabolic illnesses in PCOS^[58].

Vitamin D has a strong link to the severity of several PCOS symptoms, including high testosterone, insulin resistance, and cardiometabolic illness^[59,60]. Furthermore, according to statistical analysis data, vitamin D administration may dramatically lower total testosterone and C reactive protein circulating levels in women with PCOS^[61,62]. Following the analysis of the data, it appears that PCOS women have a high risk of severe COVID19 due to low vitamin levels, which may be exacerbated by reduced sun exposure due to COVID19 quarantine measures.

VIII. CONCLUSION

Endocrine disorders such as Polycystic ovary syndrome (PCOS) are the most common in women of adulthood in the twenty-first century. PCOS has become a big hazard to women's health as a result of hereditary and environmental factors. Hirsutism, acne, cystic ovaries, obesity, and hair loss are all common symptoms. It shares several characteristics with the metabolic syndrome, including insulin resistance, obesity, and diabetes. The incidence in Indian girls and women was estimated to be between 3.7 and 22.5 percent. The prevalence of PCOS was shown to be more or less depending on the criteria utilised, which could be the obvious reason for the disparity in prevalence estimates between research. PCOS can be efficiently anticipated, reduced, relieved, and treated with Ayurvedic, homoeopathic, unani, and allopathic therapy. Unani, homoeopathy, siddha, and Ayurvedic treatments, in compared to allopathic therapy, produce good results with minimal or no adverse effects. All systems of treatment help women with PCOS, however not all symptoms improve. In PCOS, allopathic medication produces faster results than Ayurvedic, homoeopathic, and Unani treatments. PCOS can be managed with a healthy diet, frequent exercise, lifestyle changes, and medications. Yoga practise has been shown to help ladies with PCOS.

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REFERENCES

- [1.] Bulsara J, Patel P, Soni A, Acharya S. A review: Brief insight into Polycystic Ovarian syndrome. *Endocrine and Metabolic Science*. 2021;3:100085. <https://doi.org/10.1016/j.endmts.2021.100085>
- [2.] Diamanti-Kandarakis E. Polycystic ovarian syndrome: Pathophysiology, molecular aspects and clinical implications. *Expert Review in Molecular Medicine*. 2008;10(3):1–21.
- [3.] Kabel A. Polycystic Ovarian Syndrome : Insights into Pathogenesis, Diagnosis, Prognosis, Pharmacological and non Pharmacological treatment. *Pharmaceutical bioprocessing*. 2016;1(1):1–5.
- [4.] Witchel SF, Oberfield SE, Peña AS. Polycystic Ovary Syndrome: Pathophysiology, Presentation, and Treatment with Emphasis on Adolescent Girls. *Journal of the Endocrine Society*. 2019;3(8):1545–73.
- [5.] Begum M, Das S, Sharma HK: Menstrual Disorders: Causes and Natural Remedies . *Journal of Pharmaceutical, Chemical and Biological Sciences*. 2016;307–20. http://jpcbs.info/2016_4_2_20_Monawara.pdf
- [6.] Stein IF, Leventhal ML: Amenorrhea associated with bilateral polycystic ovaries. *American Journal of Obstetrics Gynecology*. 1935;29(2):181–91.
- [7.] Wang CF, Gemzell C: The use of human gonadotropins for the induction of ovulation in women with polycystic ovarian disease. *Fertility and Sterility*. 1980;33(5):479–86. [http://dx.doi.org/10.1016/S0015-0282\(16\)44711-4](http://dx.doi.org/10.1016/S0015-0282(16)44711-4)
- [8.] Swanson M, Sauerbrei EE, Cooperberg PL: Medical implications of ultrasonically detected polycystic ovaries. *Journal of Clinical Ultrasound*. 1981;9(5):219–22.
- [9.] Fauser BCJM, Tarlatzis, Fauser, Chang, Aziz, Legro, et al : Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. *Human Reproduction*. 2004;19(1):41–7.
- [10.] Azziz R. Diagnostic criteria for polycystic ovary syndrome: A reappraisal. *Fertility and Sterility*. 2005;83(5):1343–6.
- [11.] Pate KA, Sirmans SM : Epidemiology, diagnosis, and management of polycystic ovary syndrome. *Clinical Epidemiology*. 2014;20:1–13.
- [12.] Morang MD, Chasta P, Chandrul MKK : A Review on “Polycystic Ovary Syndrom PCOS.” *International Journal of Trend in Scientific Research and Development*. 2019;Volume-3(Issue-4):60–6.

- [13.] Teede H, Deeks A, Moran L. Polycystic ovary syndrome: A complex condition with psychological, reproductive and metabolic manifestations that impacts on health across the lifespan. *BMC Medicine*. 2010;8.
- [14.] Azziz R. Diagnosis of polycystic ovarian syndrome: The Rotterdam criteria are premature. *J Clin Endocrinol Metab*. 2006;91(3):781–5.
- [15.] Salley KES, Wickham EP, Cheang KI, Essah PA, Karjane NW, Nestler JE. Position statement: Glucose intolerance in polycystic ovary syndrome - A position statement of the androgen excess society. *Journal of Clinical Endocrinology and Metabolism*. 2007;92(12):4546–56.
- [16.] Rackow BW: Polycystic ovary syndrome in adolescents. *Current Opinion in Obstetrics and Gynecology*. 2012;24(5):281–7.
- [17.] Fedorcsák P, Dale PO, Storeng R, Tanbo T, Åbyholm T: The impact of obesity and insulin resistance on the outcome of IVF or ICSI in women with polycystic ovarian syndrome. *Human Reproduction*. 2001;16(6):1086–91.
- [18.] Aggarwal A, Mehta S, Gupta D, Sheikh S, Pallagatti S, Singh R, et al: Clinical & immunological erythematosus patients characteristics in systemic lupus Maryam. *Journal of Dental Education*. 2012;76(11):1532–9. <http://www.ncbi.nlm.nih.gov/pubmed/23144490>
- [19.] Balaji S, Amadi C, Prasad S, Bala Kasav J, Upadhyay V, Singh AK, et al : Urban rural comparisons of polycystic ovary syndrome burden among adolescent girls in a hospital setting in India. *Biomed Research Internation*. 2015;2015.
- [20.] Gupta M, Singh D, Toppo M, Priya A, Sethia S, Gupta P: A cross sectional study of polycystic ovarian syndrome among young women in Bhopal, Central India. *International Journal of Community Medicine and Public Health*. 2017;5(1):95.
- [21.] Joshi B, Mukherjee S, Patil A, Purandare A, Chauhan S, Vaidya R: A cross-sectional study of polycystic ovarian syndrome among adolescent and young girls in Mumbai, India. *Indian Journal of Endocrinology and Metabolism*. 2014;18(3):317–24.
- [22.] Gill H, Tiwari P, Dabadghao P: Prevalence of polycystic ovary syndrome in young women from North India: A Community-based study. *Indian Journal of Endocrinology and Metabolism*. 2012;16(8):389–92.
- [23.] Nidhi R, Padmalatha V, Nagarathna R, Amritanshu R.: Prevalence of Polycystic Ovarian Syndrome in Indian Adolescents. *Journal Pediatric and Adolescent Gynecology*. 2011;24(4):223–7. <http://dx.doi.org/10.1016/j.jpap.2011.03.002>
- [24.] Vidya Bharathi R, Swetha S, Neerajaa J, Varsha Madhavica J, Janani DM, Rekha SN, et al: An epidemiological survey: Effect of predisposing factors for PCOS in Indian urban and rural population. *Middle East Fertility Society Journal*. 2017;22(4):313–6. <http://dx.doi.org/10.1016/j.mefs.2017.05.007>
- [25.] Ramanand S, Ramanand J, Ghanghas R, Ghongane B, Jain S, Patwardhan M: Clinical characteristics of polycystic ovary syndrome in Indian women. *Indian Journal of Endocrinology and Metabolism*. 2013;17(1):138.
- [26.] Harrison CL, Lombard CB, Moran LJ, Teede HJ: Exercise therapy in polycystic ovary syndrome: A systematic review. *Human Reproduction Update*. 2011;17(2):171–83.
- [27.] Bhat IA. Comprehension, Management, and Treatment of Polycystic Ovarian Syndrome via Allopathic, Unani and Ayurvedic Perspectives. *Journal of Gynecology and Womens Health*. 2021;21(1).
- [28.] Bhatted S, Thakar A, Shukla V, Bhatt N. A study on Vasantika Vamana: (therapeutic emesis in spring season) - A preventive measure for diseases of Kapha origin. *AYU (An International Quarterly Journal of Research in Ayurveda)*. 2011;32(2):181.
- [29.] Sangeeta S: Management of PCOS Through Shodhana (Bio-Purification) A Panchkarma Modality- A Single Case Study. *International Journal of Ayurvedic and Herbal Medicine*. 2018;6:2973–6.
- [30.] Verma A, Dhiman K. Management of PCOS: A Psychosomatic Disorder by Yoga Practice Systematic review of researches on Female infertility View project Management of PCOS: A Psychosomatic Disorder by Yoga Practice. *International Journal of Innovative Research and Development*. 2015;(January). <https://www.researchgate.net/publication/319082083>
- [31.] Kadam DR, Shinde DK, Kadam DR, Kulkarni DM, Dimple D: Contemporary and Traditional Perspectives of Polycystic Ovarian Syndrome (PCOS): A Critical Review. *IOSR Journal of Dental and Medical Sciences*. 2014;13(9):89–98.
- [32.] Chaganti S, Prasad BS. Analysis of Virechana karma with Danti avaleha: A retrospective study. *Journal of Ayurveda and Integrative Medicine*. 2015;6(4):300–4.
- [33.] Khandelwal R, Dipti SN: An Ayurvedic Approach to PCOS: A Leading Cause of Female Infertility. *International Journal of Ayurveda Medical Science*. 2016;1(3):77–82.
- [34.] Ramani VD, Chuhan S, Joshi J, Ghelan T: *Pharma Science Monitor*. *Pharma Science Monitor*. 2011;2(4):1135–51.
- [35.] Mahavir Khot DB: Clinical Efficacy Of Ayurveda Treatment On Polycystic Ovarian Syndrome. *IOSR Journal of Pharmacy*. 2013;03(04):21–5.
- [36.] A P: Role of Panchakarma in the Management of Polycystic Ovarian Syndrome. *International Journal of Advanced Research*. 2019;7(9):131–4.
- [37.] Gajanan Khanage S, Yogita Subhash T, Rahat Bhaiyyasaheb I, Gajanan Khanage Principal S :Herbal Drugs for the Treatment of Polycystic Ovary Syndrome (Pcos) and Its Complications. *Pharmaceutical Resonance*. 2019;2(1):1.
- [38.] Dehghan A, Esfandiari A, Bigdeli SM: Alternative treatment of ovarian cysts with tribulus terrestris extract: A rat model. *Reproduction in Domesti Animals*. 2012;47(1):12–5.
- [39.] Reddy PS, Begum N, Mutha S, Bakshi V : Beneficial effect of Curcumin in Letrozole induced polycystic ovary syndrome. *Asian Pacific Journal of Reproduction*. 2016;5(2):116–22. <http://dx.doi.org/10.1016/j.apjr.2016.01.006>
- [40.] Mohamed Ajmal S, A RR: Literature Review on Siddha Medicines Available for the Management of

- PCOS - A Review. *International Journal of Current Research in Medical Science*. 2017;3(6):45–50.
- [41.] The Siddha Formulary of India. volume 1. The controller of publication; 36,60, 68,69,70,71,72,104,132,156.
- [42.] SKM Anubhavamurai. Ist editio. 1998. 38 p.
- [43.] Dr. Kuppusamy mudaliyar. Siddha Vaidhiya Thirratu. 6th editio. 2016. 63,200,201,215.
- [44.] Dr. Sharaf Nisha: Polycystic Ovarian Disease, Siddha treatment for PCOS hand book, National seminar for prevention and management of PCOS. 2017. 21,22.
- [45.] Rath P: Management of PCOS through Homoeopathy- A case report. *Indian Journal of Research in Homoeopathy*. 2018;12(2):95.
- [46.] M G V, K PS, Abhijit MN, R PS, S DN, Rahul GK: Female infertility and its treatment by alternative medicine: A review. *Journal of Chemical and Pharmaceutical Research*. 2009;1(1):148–62.
- [47.] Bargiota A, Diamanti-Kandarakis E: The effects of old, new and emerging medicines on metabolic aberrations in PCOS. *Therapeutic Advances in Endocrinology and Metabolism*. 2012;3(1):27–47.
- [48.] Kanchan Choudhary, Ranjan Singh, Ajay Garg, Nitesh Verma, Anjali Purohit, Deepika Deora: an Updated Overview of Polycystic Ovary Syndrome. *Innovare Journal of Medical Science*. 2019;(October):1–13.
- [49.] Tsikouras P, Spyros L, Manav B, Zervoudis S, Poiana C, Nikolaos T, et al: Features of Polycystic Ovary Syndrome in adolescence. *Journal of Medicine and Life*. 2015;8(3):291–6.
- [50.] Vuguin PM: Interventional studies for polycystic ovarian syndrome in children and adolescents. *Pediatric Health*. 2010;4(1):59–73.
- [51.] Falsetti L, Gambera A, Tisi G: Efficacy of the combination ethinyl oestradiol and cyproterone acetate on endocrine, clinical and ultrasonographic profile in polycystic ovarian syndrome. *Human Reproduction*. 2001;16(1):36–42.
- [52.] Stabile G, Borrielli I, Artensio AC, Bruno LM, Benvenga S, Giunta L, et al: Effects of the insulin sensitizer pioglitazone on menstrual irregularity, insulin resistance and hyperandrogenism in young women with polycystic ovary syndrome. *Journal of Pediatric and Adolescent Gynecology*. 2014;27(3):177–82
<http://dx.doi.org/10.1016/j.jpog.2013.09.015>
- [53.] Romualdi D, Guido M, Ciampelli M, Giuliani M, Leoni F, Perri C, et al: Selective effects of pioglitazone on insulin and androgen abnormalities in normo- and hyperinsulinaemic obese patients with polycystic ovary syndrome. *Human Reproduction*. 2003;18(6):1210–8.
- [54.] Cassidy-Vu L, Joe E, Kirk JK: Role of Statin Drugs for Polycystic Ovary Syndrome. *Journal of Family and Reproductive Health*. 2016;10(4):165–75.
- [55.] Gomel V, Yarali H: Surgical treatment of polycystic ovary syndrome associated with infertility. *Reproductive Biomedicine Online*. 2004;9(1):35–42.
[http://dx.doi.org/10.1016/S1472-6483\(10\)62107-4](http://dx.doi.org/10.1016/S1472-6483(10)62107-4)
- [56.] Saidunnisa G, Begum GS, Shariff A, Ayman G, Mohammad B, Housam R, et al: Assessment of Risk Factors for development of Polycystic Ovarian Syndrome Clinical Skills-teaching made effective View project Assessment of Risk Factors for development of Polycystic Ovarian Syndrome View project Assessment of Risk Factors for developmen. *International Journal of Contemporary Medical Research*. 2017;4(1):2454–7379.
- [57.] Naderpoor N, Shorakae S, De Courten B, Misso ML, Moran LJ, Teede HJ: Metformin and lifestyle modification in polycysticovary syndrome: Systematic review and meta-analysis. *Human Reproduction Update*. 2015;21(5):560–74.
- [58.] Kyrou I, Karteris E, Robbins T, Chatha K, Drenos F, Randeve HS: Polycystic ovary syndrome (PCOS) and COVID-19: An overlooked female patient population at potentially higher risk during the COVID-19 pandemic. *BMC Medicine*. 2020;18(1):1–10.
- [59.] Muscogiuri G, Mitri J, Mathieu C, Badenhoop K, Tamer G, Orio F, et al: Mechanisms in endocrinology: Vitamin D as a potential contributor in endocrine health and disease. *European Journal of Endocrinology*. 2014;171(3):R101–10.
- [60.] Reis GVOP dos, Gontijo NA, Rodrigues KF, Alves MT, Ferreira CN, Gomes KB: Vitamin D receptor polymorphisms and the polycystic ovary syndrome: A systematic review. *Journal of Obstetric and Gynaecology Research*. 2017;43(3):436–46.
- [61.] Hosseini Marnani E, Mollahosseini M, Gheflati A, Ghadiri-Anari A, Nadjarzadeh A: The effect of vitamin D supplementation on the androgenic profile in men: A systematic review and meta-analysis of clinical trials. *Andrologia*. 2019;51(9):174–9.
- [62.] Akbari M, Ostadmohammadi V, Lankarani KB, Tabrizi R, Kolahdooz F, Heydari ST, et al: The Effects of Vitamin D Supplementation on Biomarkers of Inflammation and Oxidative Stress among Women with Polycystic Ovary Syndrome: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Hormone and Metabolic Research*. 2018;50(4):271–9.