



# Effect of Yoga on Management of Polycystic Ovarian Syndrome (PCOS): A Systematic Review

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## Authors' contributions

This work was carried out in collaboration among all authors. Author DS did the conception or design of the work, data collection, data analysis and interpretation and drafting the article. Authors SS and KKC reviewed the final manuscript. Author SLK did the conceptualization, expert opinion, critical revision of manuscript. All authors read and approved the final manuscript.

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## ABSTRACT

**Background:** Nowadays, the polycystic ovarian syndrome is a widespread condition that affects women at their reproductive age. Women are considered to have significantly elevated amounts of insulin resistance, obesity, and higher levels of androgens within the part of the body with PCOS. The crucial thing about overcoming these signs and symptoms of illness is weight management. It has a primary preventive and healing ability that can be accomplished by implementing lifestyle changes to fight this disease.

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Yogic interventions are the primary key that continues a person's health and modifies the endocrine system. Postures (*Asanas*), Breathing techniques (*Pranayama*) and meditation (*dhyana*) facilitate plenty in relieving the signs and symptoms of PCOS associated with an incorrect dwelling lifestyle and deep-rooted stress and holding the person high to combat with this sickness.

**Purpose:** This Review study is aimed to review the trends in research conducted over a period of time frame. Only randomized Control Trials and Clinical Trials are subjected of interest in this study. Using PUBMED, Google Scholar and other Indian databases searches were performed using keywords "Yoga and PCOS" which yielded up to 31 relevant articles showing the effect of Yoga on PCOS.

Selections were made to include only studies published in peer reviewed journals and investigating effects of regular Yogic practices on hormonal imbalances, weight loss, stress reduction and various other related aspects pertaining to PCOS in these studies.

**Summary and Outlook:** Noteworthy variance was observed between the interventional group participants on the domain of hormones, weight loss, Anxiety, Stress and physical function with better results in Yoga groups than in control group. Collectively these studies suggest that specific Yogic module may help to balance hormone, reduce body weight and released stress and it may improve the physical function of the body.

*Keywords: Yoga; stress; PCOS; hormones.*

## 1. INTRODUCTION

A very common condition, Polycystic Ovarian Disease (PCOD), also known as Polycystic Ovary Syndrome (PCOS), affects 5% to 10% of women in the 12-45 age group [1].

Polycystic ovary syndrome (PCOS) is a complex condition characterized by elevated androgen levels, menstrual irregularities, and/or small cysts on one or both ovaries. The disorder can be morphological (polycystic ovaries) or predominantly biochemical (hyperandrogenemia). Hyperandrogenism, a clinical hallmark of PCOS, can cause inhibition of follicular development, microcysts in the ovaries, anovulation, and menstrual changes [2].

Yoga is a full body and mind prescription that can eradicate the root cause of PCOS, i.e., Stress and obesity. In addition, Yoga is a fantastic tension buster stress in women's lives that can also lead to an unnecessary rise in weight. Entering a peaceful state decreases the production of cortisol, a stress hormone that is one of the most significant causes of fat accumulation in the body. Yoga ultimately advocates a move beyond the comfort zone to optimistically better understand one's self from a very different viewpoint. Ultimately, it contributes to improved quality of life [3].

Because of genetics, obesity, drugs, aging, pregnancy and lifestyle, these variables build insulin resistance. Altered metabolism of steroid hormones and lipid metabolism can develop

PCOS. Signs and symptoms of PCOS can involve menstrual disruption (primary-amenorrhea, secondary amenorrhea, oligomenorrhea). Infertility (due to lack of ovulation.), high level of masculinizing hormones (acne, hirsutism, hypermenorrhea) metabolic syndrome (obesity, resistance to insulin) and several other symptoms such as: oily skin, dandruff.

PCOS-Adolescent Diagnostic Appearance - Menstrual Irregularity, Cosmetic problems, i.e., Reproductive acne, hirsutism and hair loss-Infertility, Early Pregnancy Loss, Menopausal Syndrome, and Ca Endometrium during pregnancy (PIH and GDM) [4]. A close association between obesity, stress and PCOS exists. About 50-60 percent of PCOS women are obese. With prevalence rates ranging from 2.2 percent to as high as 26 percent, PCOS is the most common female endocrine disorder. Both genetic predisposition and life style variables are thought to contribute to PCOS etiology. Altered life pattern involving a high calorie diet and lack of exercise contributing to obesity and insulin resistance, which has been well established as an exacerbating factor for PCOS [5]. Studies have shown that sympathetic function is chronically activated as a consequence of stressful life.

### 1.1 Yoga

Yoga comes from the root, symbolizing the unification with the cosmic consciousness of one's own consciousness. Regular Yoga practice

has been shown at a functional level to promote strength, stamina, and flexibility and produce qualities of generosity, compassion, and better self-control and tranquility. Yoga practice induces a physiological state of rest and relaxation that activates the parasympathetic nervous system (instead of the flight-or-fight stress response) and can achieve a sense of equilibrium and union between the mind and body [6].

An eightfold path to enlightenment is illustrated by *Patanjali Yoga Sutras*, from socio-emotional wellbeing to physical and mental health, ending with spiritual liberation. Through the use of the *Asanas* and *Pranayama*, *Hatha* Yoga strengthens the ability of the physical body. *Hatha* Yoga's breathing methods prolong inhalation, holding of breath, and exhalation. It is through the convergence of the *Sharira*, *Prana*, and *Mana* that blocks in the *Prana* channels are cleared when performing *Asanas*. The system then reaches equilibrium. This is particularly useful for a lifestyle condition that hinders the body's normal functioning. According to Yoga ideology, stress or psychosomatic disorders are the cause of any illness in the human body. The most prominent mental symptoms of PCOS are depression and anxiety, according to the literature, while mood and anxiety disturbances are the most prevalent clinical diagnosis of PCOS [6].

Although the system of Yoga is not developed for the purpose of treatment, it has been observed through the applied researches shows evidence that the regular practice of Yoga not only controls this disease but also promotes and maintain the healthy condition of the body and mind and prevents the disease progression. Yoga has a potential to tranquilize and balance the mind, which is the main key in the management of stress disorders [6].

### 1.2 Significance of Yoga on PCOS (Rationale)

Yoga science is based on the root cause, i.e., stress and obesity, of PCOS. Yoga is often more holistic than just the physical body level. Yoga helps profoundly accumulated stress to be released by the system, which can further strengthen PCOS symptoms.

1. Doing weight-bearing poses strengthens muscles. In fact, enhanced muscle mass leads to the fight against insulin resistance, one of the links to PCOS regulation.

2. Yoga's daily practice increases the heart rate, provides cardiovascular activity and leads to the loss of weight.
3. Hormonal balance and deep relaxation are facilitated by *asanas* and *pranayama*, helping to increase adrenal and cortisol levels.

## 2. MATERIALS AND METHODS

Search articles for this systematic review were identified by using PUBMED, Google Scholar and general Google search which yielded total 31 research papers which met our inclusion criteria. Out of which 5 were found to be duplicate articles, 5 articles include different pathies with Yoga as an intervention, one study was a clinical roundup study, 9 were review articles, one article with other language are excluded from our study. Only Randomized Control Trials and Clinical Trials are subjected to this review study. Which were published in English, had clear diagnostic criteria for PCOS Patients. Out of 12 articles available on Google Scholar, 8 articles were available on PUBMED which are short-listed (Fig. 1).

After scrutinizing 31 articles, 09 trials were selected as they met criteria for final review.

### 2.1 Inclusion Criteria

1. Studies included Randomized control trial and Clinical trial.
2. Published in English, between the years from 2001-2020.
3. Age group 12–55 years suffering from PCOS.
4. Investigating only effect of Yoga on obesity, hormones, glucose metabolism, stress and physical activity.

### 2.2 Exclusion Criteria

Studies were excluded if –

1. Studies which include other interventions like naturopathy, Ayurveda and siddha.
2. Age ranges above 55 and suffering from other menstrual disorders
3. Literary review articles.
4. Paper published before 2001.
5. Duplicate articles are excluded.

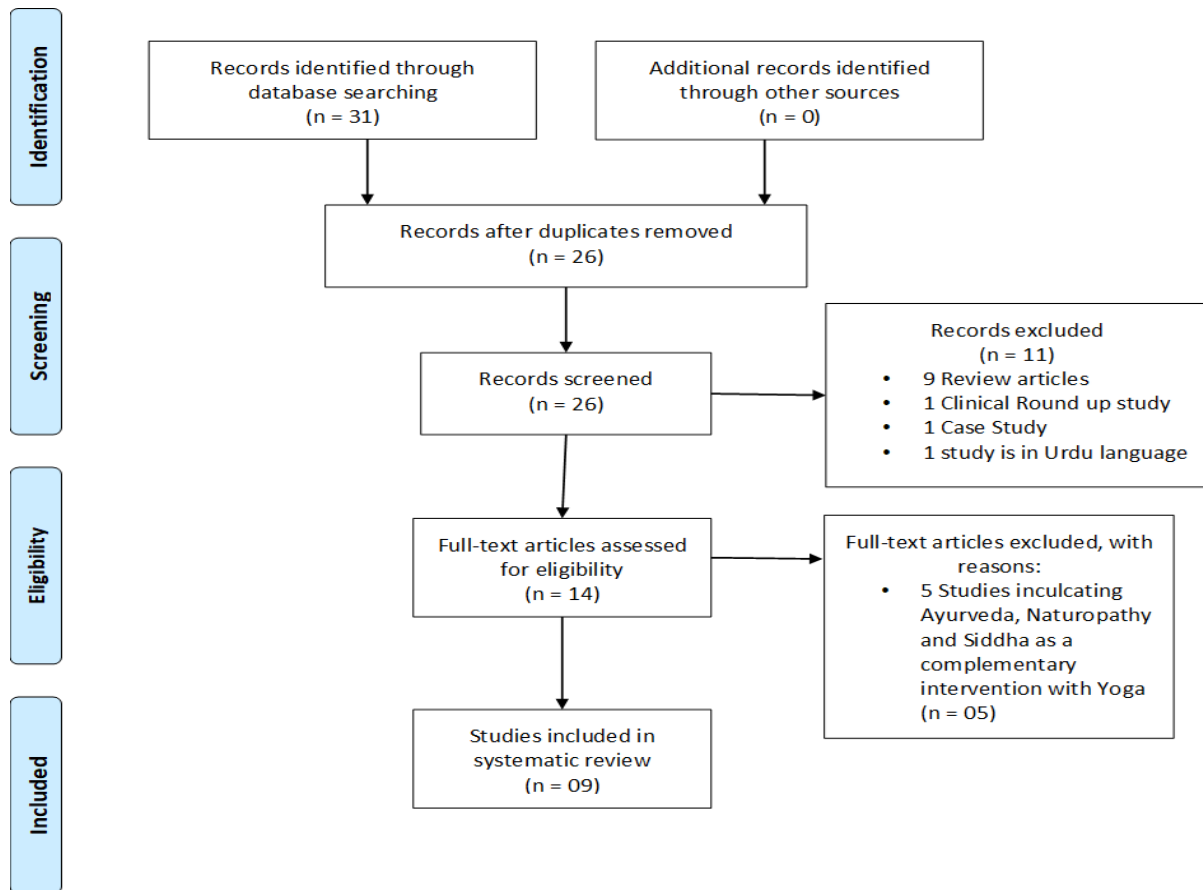


Fig. 1. Schematic representation of study searching and selection as per criteria

### 3. RESULTS AND DISCUSSION

#### 3.1 Results

Search yielded a total of 31 trials, of which 09 met criteria for final review which shows a significant difference between Yoga group and control group in terms of hormones, weight balance, stressed level and physical activity. Yoga was found to be more effective than conventional physical exercises in improving glucose, lipid, and insulin values, including insulin resistance values.

Yoga can play important role in the prevention & management of PCOS. Yoga can maintain the Physiology of H-P-O axis.<sup>17</sup> Yoga is one of the important refreshing and rejuvenating modalities which can content and even root out stress completely. Since stress is playing important factor in exaggerating PCOS, Yoga help to regulate the endocrine glands in body there by beneficial in balancing of hormones Yoga is effective in keeping your ovary & Uterus healthy. Yoga is precious gift which can enrich human

life. In PCOS, Yoga plays a crucial role in regulating hormones by reducing androgens and promoting the development of eggs. Yoga relieves stress it promotes weight loss and also increases fertility and with the help of Yoga gastrointestinal imbalance is also improve. Asana help to stretch the pelvic area and pranayama and meditation sooth the mind. Asanas (Yoga postures) for polycystic ovary syndrome help to loosen up the pelvic region and facilitate relaxation, and pranayamas (breathing exercises) are important strategies that help to calm the mind. Coupled with few calming meditations that act at a very deep level and enable the whole system to De-toxify and de-stress.

Researches have shown very significant changes in Yogic intervention group. Yoga: -

- Reduced distress feelings
- Increased sensitivity to insulin
- Equilibrated amounts of androgen
- Enhanced Hirsutism
- Led to significant regularity of menstruation

## 3.2 Discussion

### 3.2.1 Literature review

The Randomized control Study conducted by Chattha R et al. Hot flushes and night sweats could enhance by holistic approach to Yoga therapy. Cognitive functions such as remote memory, mental control, attention and concentration, delayed and immediate recall, verbal retention and tests for identification may also be improved [7]. The randomized controlled study by Laxmi et al. which objectifies to analyze and discuss about the impact of Yoga on women's suffering from PCOS. And the result of this study shows that Symptoms such as weight gain, cysts or fibroids in the uterus, irregular menstrual cycle, unwanted facial hair, and emotions are reduced after 3 months of Yoga practice. The overall quality of life improvement is reflected in the form of symptoms such as weight reduction, reduction in unusual hair loss, elevated menstrual bleeding, cramps, fat, constipation, and the reduction of emotional disturbances [8]. hence this study has shown the very significant impact of Yoga on females. Study by Ram Nidhi et al. shows that: A 12-week holistic Yoga program is considerably better than physical activity in minimizing AMH, LH, and testosterone, mFG hirsutism ranking, and non-significant menstrual frequency enhancement. In adolescent PCOS, improvements in bodyweight, FSH, and prolactin [6].

In the 2 groups of study by Ram Nidhi et al. on the effect of glucose metabolism and body lipid level in adolescent's girls with PCOS, the changes in fasting insulin, fasting blood glucose, and homeostasis model evaluation of insulin resistance were substantially different. Yoga in adolescent girls with PCOS individual with anthropometric improvements was found to be more effective than conventional physical exercises in improving glucose, lipid, and insulin values, including insulin resistance values [9].

According to study conducted by Nidhi r. et al., A holistic Yoga program for adolescent with PCOS for 12 weeks is significantly better than a physical exercise program for reducing symptoms of anxiety [10].

Women that had completed the mindful thrice-week intervention of Yoga in randomized controlled study of Patel V et al. had resulted slightly lower levels of free testosterone. Improved testosterone, lower trend in

dehydroepiandrosterone levels. In addition, improvements in depression and anxiety interventions were observed [11].

After the intervention of study conducted by Selvaraj V et al., psychological factors such as the menstrual cycle, blood flow during periods of cramps, pimples, hair fall, fatigue and weight gain have improved. Most girls showed more energy and were relieved from depression. It is also essential that exercise and Yoga, since it includes both body and mind, can undoubtedly enhance the psychological aspects of any person [11].

Sode JA et al. Yoga therapy among women suffering from infertility may be potentially useful in improving anxiety scores [12]. Vanitha A et al. After Yoga training, the degree of stress and depression is low relative to the pre-test state (Before Yoga training) [13].

### 3.2.2 Mechanism of yoga

Diverse therapeutic modalities have been developed to treat polycystic ovarian syndrome as a result of various pathophysiologic processes. Although pharmacological therapies for this condition have been proposed, there are no indications of the safety and security of these medications, particularly when used over an extended period of time. Additionally, none of these medications have been given the go-ahead for use in treating polycystic ovarian syndrome by the American Food and Drug Administration [14].

One of the most significant and secure forms of therapy that has always been regarded as the starting point for treatment is lifestyle modification, it may be mentioned. A mix of behavioral (lowering psychosocial stresses), dietary, and exercise therapy make up lifestyle modification [14]. Dietary adjustments and physical activity are examples of lifestyle alterations that lower the prevalence of obesity and hormonal issues in these people [15]. Exercise and weight loss together can lower insulin levels and testosterone levels, which can help patients' symptoms [16]. It is widely known that 5–14% weight loss with dietary restriction and exercise can enhance hormonal features and reproductive function in obese and overweight women with polycystic ovary syndrome [16].

It is widely known that 5–14% weight loss with dietary restriction and exercise can enhance

**Table 1. Recommended yoga practices**

<b>Shatkarma</b>	<b>Vaman Dhauti, Kapalbhati</b>
Asana	<ol style="list-style-type: none"> <li>1. Standing– <i>Tiryaktadasana, katichakrasana</i></li> <li>2. Sitting–<i>Padmasana, Bhadrasana, Ustrasana, Malasana</i></li> <li>3. Prone - <i>Bhujangasana , Dhanurasana, Makarasana</i></li> <li>4. Supine – <i>Setubandhasana, Ardhalasana, Shavasana</i></li> </ol>
Pranayama	❖ <i>Anulom Vilom ,Bhramari , and Ujjayi</i>
Mudra	❖ <i>Vipreetkarani Mudra</i>
Dhyana /Yog Nidra	❖ <i>Om Meditation</i>

hormonal features and reproductive function in obese and overweight women with polycystic ovary syndrome [17]. Yoga poses that focus on the body's flexibility and muscular power can also aid to enhance blood circulation and the supply of oxygen to the reproductive organs. In addition, yoga enhances the autonomic nervous system, lowers blood pressure and lipids, controls respiration, and regulates emotions. By controlling the endocrine system, lowering stress levels, and harmonizing neuronal hormones, yoga enhances reproductive function. By boosting cortisol excretion, yoga also lowers blood cortisol levels, which can relieve PCOS symptoms [16].

Today, yoga is used as a treatment for various conditions such as hypertension, multiple sclerosis, asthma, low back pain, and arthritis, as well as pain and stress management. The results of various studies have shown that doing yoga exercises in women with polycystic ovary syndrome has led to improved insulin sensitivity and lipid indexes [18]. Furthermore, in the latest systematic review studies conducted in 2020, it was stated that although regular exercises have helped improve hormonal, metabolic, and clinical parameters among these patients, there is the need for better and more accurate studies in this regard [18].

#### 4. CONCLUSION

The most common health issue in women of reproductive age is polycystic ovarian syndrome. Women diagnosed with PCOS have profound resistance to insulin, obesity and elevated androgen levels. The main key to keeping people safe is the Yoga therapies listed in several trials. After studying these papers, we may conclude the following practices that may help in PCOS and may improve their other comorbidity like stress, hypertension etc.:

#### 4.1 Supportive Basis of Certain Practices Taken in above Protocol

*Shatkriya* (cleansing practices) helps to detoxify the impure toxins from the body and is very effective in the management of obese person. *Asanas* (physical postures) helps to balance the whole endocrine system by direct massaging the ovarian glands and improve the blood circulation there by regulates the menstruation cycle. *Pranayama* (*breathing regulation*) helps to balance both the brain hemispheres and induces relaxation of mind & body [19]. *Mudra* (*gestures*) helps to redirect the *prana* within the affected body organ and improves flow of *prana* and blood there. *Yoga Nidra / Dhyana* (*Meditation*) Both Meditation and Yoga Nidra assist in the activation of the calming reflex and the enhancement of nervous system and endocrine system function, which affects hormones, as well as decreasing anxiety and enhancing mood.

#### 5. STUDY LIMITATION

Studies have been carried out in different demographic areas, which prompt the issue of the study's findings being generalizable. However, the fact a randomized control trial with a large sample participating in each arm provides evidence for the intervention being more effective. Our searches were limited to few databases only, wide range of databases are needed in this context Studies should consider a longer period of follow to check long term efficacy & long-term acceptability to observe the Changes in the number of ovaries and follicle size. A lot of studies are not Pub Med indexed. They are to be searched from various sources. This consumes a lot of time.

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This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## CONSENT AND ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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**APPENDIX-1**

S.no.	1st author ,Year, Place	Design	Objective	Sample size	Intervention for experimental group (with duration)	Measurable outcome & results	Limits & recommendation
1	Vishesha Patel et al.,2020,Erie County, Pennsylvania,U.S	Randomized Control Study	Regular Mindful Yoga Practice as a Method to Improve Androgen Levels in Women With Polycystic Ovary Syndrome	<ul style="list-style-type: none"> <li>➤ 30 females suffering from PCOS.</li> <li>➤ Sampling method was purposive sampling</li> <li>➤ Age range was 25-35 years.</li> </ul>	(3-part Yogic breath): 1. Ujjayi breath, 2. Alternate nostril breathing, and 3. Breath of fire, ➤ Vinyasa flow Yoga, ➤ Restorative Yoga <i>asanas</i> , ➤ Guided meditation imagery of healing energy and mindful “I am” statements. (For 3 Months.)	<ul style="list-style-type: none"> <li>➤ ↓ Free testosterone levels</li> <li>➤ ↓ Dehydroepiandrosterone Levels.</li> </ul>	NIL
2	Valarmathi Selvaraj et al.,2020,Tamil nadu	A comparative study with pre and post design	To identify the adolescent school girls with risk for (PCOS), assess their risk status, and evaluate the impact of lifestyle	<ul style="list-style-type: none"> <li>➤ A total of 204 (control-102; experimental-102) girls Of AP.</li> </ul>	Yoga and exercise (for two months.) 1. Pranayama, 2. Meditations, 3. <i>Bhadrasana</i> (Butterfly pose), 4. <i>Chakki Chalanasana</i> (moving the grinding wheel). Brisk walking exercise for control group.	<ul style="list-style-type: none"> <li>➤ Yoga and exercise were beneficial in minimizing PCOS risk, as reflected in the risk assessment score.</li> </ul>	NIL

S.no.	1st author, Year, Place	Design	Objective	Sample size	Intervention for experimental group (with duration)	Measurable outcome & results	Limitation & recommendation
3	Vanitha .A et al.,2018, Tamil Nadu	Intervention-al Study	Effect of <i>Yoga nidra</i> on resting cardiovascular parameters in polycystic ovarian syndrome women	<ul style="list-style-type: none"> <li>➤ Study includes 40 PCOS women.</li> <li>➤ Age between 18 and 35years</li> </ul>	<i>Yoga nidra</i> intervention (in the lying position daily once for the period of 40 min ;for 12 weeks)	Show favorable changes in: <ul style="list-style-type: none"> <li>➤ BP,</li> <li>➤ HR, and</li> <li>➤ Other Anthropometric parameters</li> </ul>	Larger sample size Would be better study design.
4	Laxmi etal.,2018,Patanjali, Haridwar	Randomized control study	The objective of the study is to analyze and discuss about the impact of Yoga on Women's (PCOD) & their quality of life.	<ul style="list-style-type: none"> <li>➤ Selected 32 Subjects of PCOD out of 409 infertility patients.</li> <li>➤ Two groups are formed 16 in each of experimental and control groups.</li> <li>➤ The experimental group followed 40 min Yoga practices daily for 6 days in a Week for 12weeks.</li> </ul>	<p>Asana Time (in mins) for 12weeks</p> <ul style="list-style-type: none"> <li>➤ <i>Padmasana/sukhsana</i> - 5</li> <li>➤ <i>Suryanamkar</i>(sun posture) -15</li> <li>➤ <i>Bhadrasana</i>(Butterfly posture)-5</li> <li>➤ <i>Savasana</i> (corpse posture ) - 5</li> <li>➤ <i>AnulomVilome</i>(Alternate Nostril breathing)-5</li> <li>➤ <i>Bhramari</i> (Humming bee sound) - 5</li> </ul>	Those who practiced Yoga have significantly: <ul style="list-style-type: none"> <li>➤ ↓Weight,</li> <li>➤ ↓No. of cysts,</li> <li>➤ ↓Irregular menstrual cycle</li> <li>➤ ↓Emotional disorders</li> </ul>	Results encourages Further research work in the field of PCOD.

S.no.	1st author ,Year, Place	Design	Objective	Sample size	Intervention for experimental group(with duration)	Measurable outcome & results	Limitation & recommendation
5	Jaimala.A Sode et al.,2017, maharashtra	Comparative study with pre and post design	To study the Effect of Yoga on Level of Depression among Females suffering from Polycystic Ovarian Syndrome (PCOS)	<ul style="list-style-type: none"> <li>➤ 30 females suffering from PCOS.</li> <li>➤ Sampling method was purposive sampling.</li> <li>➤ The age ranges between 25 –35 Years.</li> </ul>	<p>Yoga Training was conducted for a month’s period:</p> <ol style="list-style-type: none"> <li>1.<i>Bhadrasana</i> (Butterfly pose)</li> <li>2.<i>Bharadvajasana</i>(Bharadvja’s Twist)</li> <li>3.<i>Bhujangasana</i> (Cobra pose)</li> <li>4.<i>Naukasana</i> (Boat pose)</li> <li>5.<i>Padmasana</i></li> <li>6.<i>Dhanurasana</i> (Bow pose)</li> <li>7.<i>ViparitaShalabhasana</i> (Superman pose)</li> <li>8.<i>Chakki Chalanasana</i> (moving the grinding wheel)</li> <li>9.<i>Sun Salutation</i> (Surya Namaskar)</li> <li>10.<i>Shavasana</i> (Corpse pose)</li> <li>11.<i>Bhramri Pranayama</i></li> <li>12.Meditation</li> </ol>	<ul style="list-style-type: none"> <li>➤ ↓ Level of depression</li> </ul>	NIL

S.no.	1st author, Year, Place	Design	Objective	Sample size	Intervention for experimental group(with duration)	Measurable outcome & results	Limitation & recommendation	
6	Ram Nidhi et al. 2012, Andhra Pradesh	Randomized Control Study	To study the effect of holistic Yoga program on anxiety symptoms in adolescent girls with polycystic ovarian syndrome	<ul style="list-style-type: none"> <li>➤ Adolescent girls aged 15 to 18 years of AP.</li> <li>➤ Satisfied Rotterdam criterion (2/3 of the features) for PCOS.</li> <li>➤ 90 participants were randomly divided into 2 study arms:                             <ul style="list-style-type: none"> <li>➤ 1 arm practiced Yoga and the other arm practiced conventional physical exercises for the same Duration.</li> </ul> </li> </ul>	<p>Both groups practiced their respective set of practices, 1 h daily, 7 days a week for 12 weeks:</p> <ol style="list-style-type: none"> <li>1. Group lecture</li> <li>2. Lectures in the form of cognitive restructuring based on spiritual philosophy underlying Yogic concept.</li> <li>3. Surya namaskar sun salutation</li> <li>4. Prone Asanas:                             <ul style="list-style-type: none"> <li>• Cobra pose (<i>Bhujangasana</i>)</li> <li>• Locust pose (<i>Shalabhasana</i>)</li> <li>• Bow pose (<i>Dhanurasana</i>)</li> </ul> </li> <li>5. Standing Asanas:                             <ul style="list-style-type: none"> <li>• Triangle Pose (<i>Trikonasana</i>)</li> <li>• Twisted Angle Pose (<i>Parshava Konasana</i>)</li> <li>• Spread leg intense stretch. (<i>Prasarit Padottanasana</i>)</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>6. Supine Asanas:                             <ul style="list-style-type: none"> <li>• Shoulder Stand (<i>Sarvangasana</i>)</li> <li>• Plough Pose (<i>Halasana</i>)</li> </ul> </li> <li>7. Sitting Asanas:                             <ul style="list-style-type: none"> <li>• Sitting Forward Stretch (<i>Paschimottanasana</i>)</li> <li>• Fixed angle pose (<i>Badhha konasana</i>)</li> <li>• Garland Pose (<i>Malasana</i>)</li> </ul> </li> <li>8. Guided Relaxation (<i>Shavasana</i>)</li> <li>9. Breathing techniques (<i>Pranayama</i>)                             <ul style="list-style-type: none"> <li>• Sectional breathing (<i>Vibhagiya Pranayam</i>)</li> <li>• Forceful exhalation (<i>Kapalbhati</i>)</li> <li>• Right Nostril breathing (<i>Suryanulom vilom</i>)</li> <li>• Alternate Nostril breathing (<i>Nadi Shuddhi</i>)</li> </ul> </li> <li>10. OM Meditation (<i>OM Dhyana</i>).</li> </ol>	Holistic Yoga program is better than physical exercises	A randomized control trial with a large sample participating in each arm provides evidence for this intervention being effective.

S.no.	1st author ,Year, Place	Design	Objective	Sample size	Intervention for experimental group(with duration)	Measurable outcome & results	Limitation & recommendation
7	Ram Nidhi et al.;2012, AndraPradesh	Randomized Control Study	Effect of a Yoga program on glucose metabolism and blood lipid levels in adolescent girls with PCOS.	➤ Recruited 90 adolescents aged between 15 to 18 years who met the Rotterdam criteria for PCOS.	➤ A yoga group Practiced <b>suryanamaskara, asanas, pranayama, and meditation</b> 1 hour per day each day for 12 weeks. ➤ While another group practiced <b>conventional physical exercises</b> . The <b>Mann Whitney U test</b> was used to compare score changes between the 2 groups.	Yoga is better than physical exercise in:- ➤ Improving glucose, ➤ Lipid, and ➤ Insulin values, including insulin resistance values.	NIL

S.no	1st author, Year, Place	Design	Objective	Sample size	Intervention for experimental group (with duration)	Measurable outcome & results	Limitation & recommendation
8	Ram Nidhi et al.;2012, Andra Pradesh	Randomized Control Study	The objectives of this trial were to compare the effects of a holistic Yoga program with the conventional exercise program in adolescent polycystic ovarian syndrome (PCOS).	Ninety (90) adolescent (15–18 years) girls	<ul style="list-style-type: none"> <li>➤ Yoga group practiced a holistic Yoga module:                             <ol style="list-style-type: none"> <li>1. Group lecture</li> <li>2. Lectures in the form of cognitive restructuring based on spiritual philosophy underlying Yogic concept.</li> <li>3. <i>Surya namaskar</i> sun salutation</li> <li>4. Prone Asanas:                                     <ul style="list-style-type: none"> <li>➤ Cobra pose (<i>Bhujangasana</i>)</li> <li>➤ Locust pose (<i>Shalabhasana</i>)</li> <li>➤ Bow pose (<i>Dhanurasana</i>)</li> </ul> </li> <li>5. Standing Asanas:                                     <ul style="list-style-type: none"> <li>➤ Triangle Pose (<i>Trikonasana</i>)</li> <li>➤ Twisted Angle Pose (<i>Parshava Konasana</i>)</li> <li>➤ Spread leg intense stretch. (<i>Prasarit Padottanasana</i>)</li> </ul> </li> </ol> </li> <li>6. Supine Asanas:                             <ul style="list-style-type: none"> <li>➤ Shoulder Stand (<i>Sarvangasana</i>)</li> <li>➤ Plough Pose (<i>Halasana</i>)</li> </ul> </li> <li>7. Sitting Asanas:                             <ul style="list-style-type: none"> <li>➤ Sitting Forward Stretch (<i>Paschimottanasana</i>)</li> <li>➤ Fixed angle pose (<i>Badhha konasana</i>)</li> <li>➤ Garland Pose (<i>Malasana</i>)</li> </ul> </li> <li>8. Guided Relaxation (<i>Shavasana</i>)</li> <li>9. Breathing techniques (<i>Pranayama</i>)                             <ul style="list-style-type: none"> <li>➤ Sectional breathing (<i>Vibhagiya Pranayam</i>)</li> <li>➤ Forceful exhalation (<i>Kapalbhati</i>)</li> <li>➤ Right Nostril breathing (<i>Suryanulom vilom</i>)</li> <li>➤ Alternate Nostril breathing (<i>Nadi Shuddhi</i>)</li> </ul> </li> <li>10. OM Meditation (<i>OM Dhyana</i>).</li> </ul> <ul style="list-style-type: none"> <li>➤ The control group practiced a matching set of physical exercises (1 hr/day, for 12 weeks).</li> </ul>	Yoga is helpful in : <ul style="list-style-type: none"> <li>➤ AMH, LH, and testosterone, mFG score for hirsutism.</li> <li>➤ Improving menstrual frequency.</li> </ul>	NIL

S.no	1st author, Year, Place	Design	Objective	Sample size	Intervention for experimental group (with duration)	Measurable outcome & results	Limitation & recommendation
9	Chattha R et al.,2008, S VYASA ,Bangalore	Randomized control study	To assess the efficacy of an integrated approach of Yoga therapy (IAYT) on cognitive abilities in Climacteric syndrome.	➤ Women between 40 and 55years with follicle-stimulating hormone level $\leq 15$ miu/ml. 120perimenopausal women were randomly allotted into the Yoga and the control groups.	Yoga group practiced a module comprising. ➤ Breathing practices, ➤ Sun Salutation and ➤ Cyclic Meditation,	Yoga: ➤ Improve hot flushes and night sweats. ➤ Improve cognitive functions	Restricted to English speaking women's

## APPENDIX – 2

S.no.	1st author ,Year, Place	Intervention for experimental group
1	Vishesh Patel et al.,2020,Erie County, Pennsylvania,U.S	<ol style="list-style-type: none"> <li>1. Ujjayi breath,</li> <li>2. Alternate nostril breathing, and</li> <li>3. Breath of fire,</li> </ol> <ul style="list-style-type: none"> <li>➤ Vinyasa flow yoga,</li> <li>➤ Restorative yoga asanas,</li> <li>➤ Guided meditation imagery of healing energy and mindful “I am” statements.</li> </ul>
2	Vanitha .A et al.,2018,Arumbakkam, Chennai,Tamil Nadu	<i>Yoga nidra</i>
3	Laxmi et al.,2018,Patanjali, Haridwar	<ul style="list-style-type: none"> <li>➤ <i>Padmasana/sukhsana</i> - 5</li> <li>➤ <i>Suryanamkar</i>(sun posture) -15</li> <li>➤ <i>Bhadrasana</i> (Butterfly posture)-5</li> <li>➤ <i>Savasana</i> (corpse posture ) - 5</li> <li>➤ <i>AnulomVilome</i> (Alternate Nostril breathing)-5</li> <li>➤ <i>Bhramari</i> (Humming bee sound) - 5</li> </ul>
4	Jaimala.A Sode et al.,2017, maharashtra	<ol style="list-style-type: none"> <li>(i)Bhadrasana (Butterfly pose)</li> <li>(ii) Bharadvajasana (Bharadvja’s Twist)</li> <li>(iii) Bhujangasana (Cobra pose)</li> <li>(iv) Naukasana (Boat pose)</li> <li>(v) Padmasana</li> <li>(vi) Dhanurasana (Bow pose)</li> <li>(vii) ViparitaShalabhasana (Superman pose)</li> <li>(viii) Chakki Chalanasana (moving the grinding wheel)</li> <li>(ix) Sun Salutation (Surya Namaskar)</li> <li>(x) Shavasana (Corpse pose)</li> <li>(xi) Bhramri Pranayama</li> <li>(xii) Meditation</li> </ol>



S.no.	1st author ,Year, Place	Intervention for experimental group
5	Ram Nidhi et al.,2012, Andhra Pradesh	<ol style="list-style-type: none"> <li>1. Group lecture</li> <li>2. Lectures in the form of cognitive restructuring based on spiritual philosophy underlying yogic concept.</li> <li>3. Surya namaskar sun salutation</li> <li>4. Prone Asanas: <ul style="list-style-type: none"> <li>• Cobra pose (Bhujangasana)</li> <li>• Locust pose ( Shalabhasana)</li> <li>• Bow pose (Dhanurasana)</li> </ul> </li> <li>5. Standing Asanas: <ul style="list-style-type: none"> <li>• Triangle Pose (Trikonasana)</li> <li>• Twisted Angle Pose (Parshava Konasana)</li> <li>• Spread leg intense stretch ( Prasarit Padottanasana)</li> </ul> </li> <li>6. Supine Asanas: <ul style="list-style-type: none"> <li>• Shoulder Stand ( Sarvangasana)</li> <li>• Plough Pose ( Halasana)</li> </ul> </li> <li>7. Sitting Asanas : <ul style="list-style-type: none"> <li>• Sitting Forward Stretch (<i>Paschimmottanasana</i>)</li> <li>• Fixed angle pose ( <i>Badhha konasana</i>)</li> <li>• Garland Pose ( <i>Malasana</i>)</li> </ul> </li> <li>8. Guided Relaxation ( <i>Shavasana</i>)</li> <li>9. Breathing techniques ( <i>Pranayama</i>) <ul style="list-style-type: none"> <li>• Sectional breathing ( <i>Vibhagiya Pranayam</i>)</li> <li>• Forceful exhalation ( <i>Kapalbhati</i>)</li> <li>• Right Nostril breathing ( <i>Suryanulom vilom</i>)</li> <li>• Alternate Nostril breathing ( <i>Nadi Shuddhi</i>)</li> </ul> </li> <li>10. OM Meditation (<i>OM Dhyana</i>).</li> </ol>
6	Ram Nidhi et al.;2012, Andhra Pradesh	<ul style="list-style-type: none"> <li>➤ <i>Suryanamaskara,</i></li> <li>➤ <i>Asanas,</i></li> <li>➤ <i>Pranayama,</i> and</li> <li>➤ <i>Meditation</i></li> </ul>

S.no.	1st author ,Year, Place	Intervention for experimental group
8	Valarmathi Selvaraj et al.;2020 ,Tiruvallur district of Tamil nadu	<ol style="list-style-type: none"> <li>1. <i>Pranayama</i>,</li> <li>2. Meditations,</li> <li>3. <i>Bhadrasana</i> (Butterfly pose),</li> <li>4. <i>Chakki Chalanasana</i> (moving the grinding wheel).</li> </ol>
9	Ram Nidhi et.al.;2012,Andra Pradesh	<p>➤ Holistic yoga module for Yoga group:</p> <ol style="list-style-type: none"> <li>1. Group lecture</li> <li>2. Lectures in the form of cognitive restructuring based on spiritual philosophy underlying Yogic concept.</li> <li>3. <i>Surya namaskar</i> sun salutation</li> <li>4. Prone <i>Asanas</i>: <ul style="list-style-type: none"> <li>• Cobra pose (<i>Bhujangasana</i>)</li> <li>• Locust pose (<i>Shalabhasana</i>)</li> <li>• Bow pose (<i>Dhanurasana</i>)</li> </ul> </li> <li>5. Standing <i>Asanas</i>: <ul style="list-style-type: none"> <li>• Triangle Pose (<i>Trikonasana</i>)</li> <li>• Twisted Angle Pose (<i>Parshava Konasana</i>)</li> <li>• Spread leg intense stretch (<i>Prasarit Padottanasana</i>)</li> </ul> </li> <li>6. Supine <i>Asanas</i>: <ul style="list-style-type: none"> <li>• Shoulder Stand (<i>Sarvangasana</i>)</li> <li>• Plough Pose (<i>Halasana</i>)</li> </ul> </li> <li>7. Sitting <i>Asanas</i> : <ul style="list-style-type: none"> <li>• Sitting Forward Stretch (<i>Paschimottanasana</i>)</li> <li>• Fixed angle pose (<i>Badhha konasana</i>)</li> <li>• Garland Pose (<i>Malasana</i>)</li> </ul> </li> <li>8. Guided Relaxation (<i>Shavasana</i>)</li> <li>9. Breathing techniques (<i>Pranayama</i>) <ul style="list-style-type: none"> <li>• Sectional breathing (<i>Vibhagiya Pranayam</i>)</li> <li>• Forceful exhalation (<i>Kapalbhati</i>)</li> <li>• Right Nostril breathing (<i>Suryanulom vilom</i>)</li> <li>• Alternate Nostril breathing (<i>Nadi Shuddhi</i>)</li> </ul> </li> <li>10. OM Meditation (<i>OM Dhyana</i>).</li> </ol> <p>➤ A matching set of physical exercises for Control group.</p>

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