

BRIDGING AYURVEDA, YOGA, AND MODERN ENDOCRINOLOGY IN PCOS: EXPLORING HORMONAL, METABOLIC, AND MOLECULAR MECHANISMS

Dr Garima¹, Dr Chanchal Sharma², Dr. R. Sathyaseela MD(s)³, Dr Ravneet Kaur⁴, Dr. K. Parameswaran Namboothiri⁵, Dr. Shalin Bhanawat⁶

¹Assistant Professor, Department of Prasuti Tantra Avum Stri Roga, Specialization in Prasuti Tantra Avum Stri Roga, SAMC & H, Mathura, garimaal234@gmail.com, orcid id: 0009-0004-4715-2471

²Director AASHA AYURVEDA, Specialization in AYURVEDA GYNAECOLOGY, chanchalsharma376@gmail.com, orcid id: 0009-0005-9291-5033

³Professor, Department of Sool Magalir Maruthuvam (O &G), Srisairam siddha medical college and research centre, West tambaram, Chennai, sathyaseela@sairamsiddha.edu.in

⁴Associate Professor, Department of Rasa Shastra Evum Bhaishajya Kalpana, University: Mahayogi Guru Gorakhnath AYUSH University, Pipari, Bhatat, Uttar Pradesh 273306, Specialization in MD Rasa Shastra, ravneet3177@gmail.com, Orchid id: <https://orcid.org/0000-0002-4653-9605>

⁵ Professor & Head, Department of Panchakarma, Amrita School of Ayurveda, Amrita Vishwa Vidyapeetham, Amritapuri, Kerala, India, 690525, nambu24@gmail.com, ORCID ID: 0000-0002-5348-6388

⁶Assistant Professor, Department of General Surgery, University name with full address (city, pin code): Pacific institute of medical sciences, Sai Tirupati university, Ambua Road, village Umarda, Girwa, Udaipur Rajasthan 313015
bhanawatshalin@gmail.com, ORCID ID: <https://orcid.org/0009-0007-1816-5515>

ABSTRACT:

Polycystic ovary syndrome (PCOS) is a heterogeneous endocrine-metabolic disorder characterized by hyperandrogenism, ovulatory dysfunction, insulin resistance, and metabolic abnormalities, with genetic, epigenetic, inflammatory, and environmental factors contributing to its pathogenesis. Increasing recognition of its multidimensional nature has encouraged interest in integrative approaches that complement contemporary endocrine management. This narrative review examines the interface between Ayurveda, Yoga, and modern endocrinology, emphasizing hormonal, metabolic, genetic, epigenetic, and molecular mechanisms relevant to PCOS. Current evidence indicates that genetic susceptibility, non-coding RNA regulation, impaired insulin signaling, oxidative stress, and ovarian cellular dysfunction form interconnected components of PCOS pathophysiology. Ayurvedic botanical interventions may influence metabolic, androgenic, inflammatory, and oxidative pathways, whereas Yoga may contribute through neuroendocrine regulation, metabolic improvement, stress modulation, and oxidative balance. However, mechanistic evidence remains heterogeneous, and traditional concepts should not be directly equated with specific molecular pathways without experimental validation. Integrating standardized interventions with molecular profiling, rigorous clinical evaluation, and personalized approaches may strengthen the translational relevance of Ayurveda and Yoga. Future interdisciplinary research incorporating genetics, multi-omics, and validated endocrine-metabolic outcomes could clarify their role within evidence-based, individualized PCOS management.

KEYWORDS: Polycystic ovary syndrome; Ayurveda; Yoga; Molecular mechanisms; Endocrinology

1. INTRODUCTION

Polycystic ovary syndrome (PCOS) is a polyvital and polyethnic (complex) endocrine-metabolic disease in women of reproductive age, characterized by different combinations of hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology (POM). Its clinical manifestation goes beyond reproductive abnormalities, but also includes insulin resistance, obesity, dyslipidemia and psychological disorders as well as a high risk of developing long term metabolic complications (Lakshmi et al., 2023). PCOS is now understood as a multisystem disorder, where there are complex interactions between genetic susceptibility, endocrine dysfunction, metabolic dysfunction and the environment. As such, the international guideline for PCOS stresses the need to attend to reproduction, metabolism, psychological and lifestyle aspects of the condition through the course of management (Teede et al., 2023). Its multi-dimensionality has sparked interest in therapeutic approaches that could target interrelated mechanisms in addition to isolated symptoms of the syndrome.

Endocrine abnormalities such as excessive ovarian androgen production and altered hypothalamic–pituitary–ovarian signaling are tightly linked to metabolic abnormalities. Insulin resistance and compensatory hyperinsulinemia are especially relevant since insulin abnormalities can worsen ovarian androgen production and may also play a role in systemic metabolic abnormalities. In-depth molecular studies have shown that insulin secretion, signalling, and clearance are involved in the metabolic heterogeneity of PCOS (Herman et al., 2023). These processes are part of a larger pathophysiological network that includes abnormalities in adipose-tissue and inflammatory processes, oxidative stress, and altered follicle development (Stener-Victorin et al., 2024). Thus, reproductive and metabolic consequences of PCOS should not be viewed as independent entities, but rather as interrelated aspects of dysregulated endocrine and cellular homeostasis.

Further adding to the biological complexity of PCOS are advances in molecular genetics and epigenetics. Genetic susceptibility is a combination of several loci and pathways related to gonadotropin action, steroidogenesis, metabolic regulation and ovarian function. Importantly, genetic predisposition interacts with epigenetic modifications and

environmental exposures, which may lead to large interindividual variation in phenotypes of PCOS (Chen et al., 2024). The understanding of such mechanisms has led research into a more comprehensive molecular knowledge with regards to disease pathogenesis and therapeutic response. Meanwhile, lifestyle changes are essential to the management of PCOS, and there is growing evidence that the complementary strategies used can affect metabolic, inflammatory, neuroendocrine, and reproductive functions via several mechanisms (Nandagopal et al., 2026).

In this context, Ayurveda and Yoga have found attention as complementary therapies which can help in tackling lifestyle, metabolic, endocrine and psychosocial aspects of PCOS. Ayurvedic management involves dietary and behavioral changes along with the use of botanicals some of which have known insulin-sensitizing, antioxidant, anti-inflammatory and endocrine modulating properties (Singh et al., 2025). Likewise, Yoga is a synergistic blend of physical postures, breathing exercises, relaxation, and mind–body regulation and has been explored as an adjunctive tool in the management of PCOS (Singh et al., 2022). Yoga-based studies provide evidence that may indicate an impact beyond the psychological dimension to endocrine and metabolic parameters. Recent evidence synthesis has specifically focused on evaluating the alterations in anti-Müllerian hormone, androgen levels and metabolic parameters after Yoga intervention in women with PCOS (Chauhan et al., 2026). In general, integrative approaches that integrate naturopathy and Yoga highlight the importance of taking into account biological, behavioural, and psychosocial aspects when addressing the diverse manifestations of PCOS (Silwal et al., 2024).

Although there has been an increasing interest in this type of approach, one of the most important scientific problems is to discriminate between the traditional therapeutic reasoning and the observed clinical effectiveness, and the molecular mechanisms that have been experimentally proven. It is not possible to assume that the traditional concepts are directly equivalent to specific genes, signaling pathways or endocrine processes. Thus, a mechanistically based synthesis is required to discern the true point of contact between modern endocrinology and molecular biology, and the evidence related to ayurveda and yoga. To this end, this narrative review provides insights into the hormonal, metabolic, genetic, epigenetic, cellular and molecular mechanisms of PCOS and critically reviews the potential impact of Ayurveda and Yoga on modifiable aspects of this web-like pathophysiological process.

2. Contemporary Understanding of PCOS Pathophysiology

2.1 Endocrine and Hormonal Dysregulation

PCOS is a result of a combination of endocrine, reproductive and metabolic imbalances. Hyperandrogenism, impaired follicular maturation and anovulation are mediated by the interplay of dys-regulation of the hypothalamic-pituitary-ovarian axis, gonadotropin secretion and excessive ovarian androgen production. Developmental and evolutionary models also indicate that inherited susceptibility can be affected by environmental and metabolic factors, contributing to the heterogeneity of PCOS phenotype (Dumesic et al., 2023). This endocrine imbalance is exacerbated by hyperinsulinemia, which increases the activity of ovarian androgen production and lowers the production of hepatic sex hormone binding globulin, increasing the number of available androgens. On the other hand, excessive androgen can aggravate adipose and metabolic dysfunction. Thus, it is believed that tissue-specific insulin abnormalities affecting the skeletal muscle, adipose tissue, liver, and ovary establish an important mechanistic connection between the reproductive and metabolic manifestations (Zhao et al., 2023).

2.2 Metabolic Dysfunction and Insulin Resistance

Insulin resistance is a primary metabolic characteristic of PCOS and can happen even without obesity, but obesity often worsens insulin resistance. This insulin resistance leads to hyperinsulinemia and the imbalance of glucose and lipid metabolism. Of note, insulin-resistance is tissue specific, suggesting that PCOS is not simply the result of a single systemic signaling abnormality (Zhao et al., 2023). Metabolic dysfunction can then persist, leading to dyslipidemia, abnormalities of adipose tissue and increased cardiometabolic susceptibility. These insulin action and glucose regulation abnormalities lie at the heart of diabetes and are hallmarks of the broader metabolic abnormalities associated with chronic metabolic dysfunction (Rana et al., 2026). Lifestyle and complementary approaches have also been explored for metabolic disorders but need mechanistic and clinical validation for particular diseases, including PCOS (McBenedict et al., 2024).

Table 1. Major endocrine and metabolic mechanisms relevant to PCOS pathophysiology

Mechanism	Principal alteration	Pathophysiological consequence	Reference
Neuroendocrine dysfunction	Altered gonadotropin regulation	Hyperandrogenism, follicular dysfunction, and anovulation	(Dumesic et al., 2023)
Insulin resistance	Reduced tissue insulin responsiveness	Hyperinsulinemia and amplification of androgen excess	(Zhao et al., 2023)
Metabolic dysfunction	Impaired glucose and lipid homeostasis	Increased systemic metabolic risk	(Rana et al., 2026)
Complementary metabolic approaches	Lifestyle and alternative interventions	Potential metabolic modulation requiring PCOS-specific validation	(McBenedict et al., 2024)

The mechanisms summarized in Table 1 demonstrate the reciprocal relationship between metabolic and reproductive dysfunction. In particular, insulin resistance can intensify androgen excess, while hyperandrogenism and adipose dysfunction may further impair metabolic homeostasis.

2.3 Inflammation, Oxidative Stress, and Mitochondrial Dysfunction

There is a close relationship between insulin resistance and metabolic stress and chronic low-grade inflammation and oxidative imbalance. This increased ROS and inflammatory signaling could result in decreased insulin sensitivity and decreased function of the ovarian cells, further contributing to endocrine-metabolic dysfunction. Thus, tissue-specific metabolic dysfunction can also impact ovarian function via systemic metabolic signaling (Zhao et al., 2023). Mitochondria might be a part of this network, given their involvement in energy metabolism and ROS production, but evidence for insulin resistance/metabolic dysfunction (references allocated to this section) is stronger than for detailed involvement in PCOS. Thus, the interpretation of mitochondrial function in the context of the overall metabolic and oxidative profile should be done with caution.

In conclusion, PCOS is a multifaceted condition characterized by a complex interplay of factors such as endocrine dysfunction, hyperandrogenism, insulin resistance, metabolic disturbances, inflammation, oxidative stress, and ovarian abnormalities. These interactions may be further modulated by developmental and environmental factors and are likely to result in phenotypic heterogeneity (Dumesic et al., 2023). The relationships are summarized mechanically as shown in Figure 1.

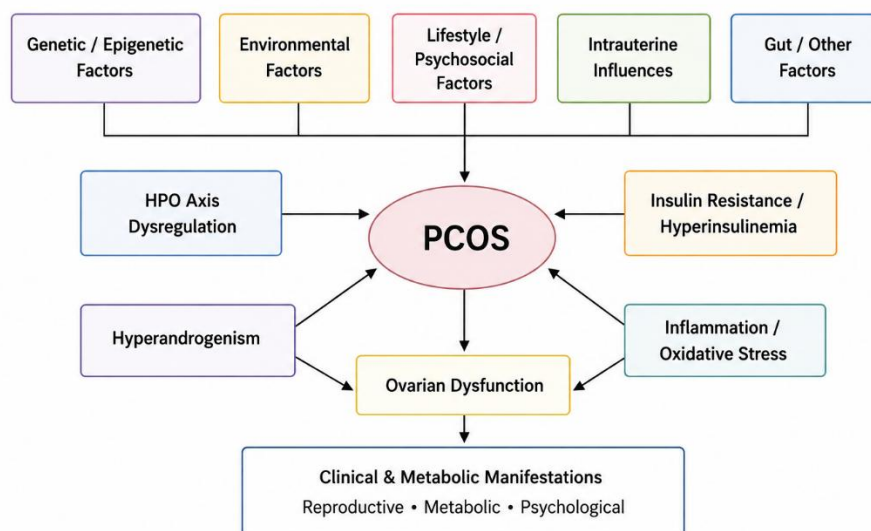


Figure 1. Integrated endocrine-metabolic pathophysiology of PCOS.

The figure should show the interconnections between each of these factors and how they interact with each other, with the arrows pointing in both directions to show the bidirectional pathways in PCOS pathophysiology.

3. Genetic, Epigenetic, and Molecular Basis of PCOS

3.1 Genetic Susceptibility and Gene Function

There is a significant genetic underpinning to PCOS, but this is complicated and no one single gene is responsible. Recent genetic findings suggest that there are several susceptibility loci that affect reproductive, endocrine and metabolic traits in a polygenetic manner. Genome-wide association studies (GWAS) have led to the identification of several loci involved in gonadotropin regulation, ovarian function, androgen biosynthesis and metabolic homeostasis that support the biological heterogeneity of the syndrome (Louwers et al., 2025). Thus, a genetic predisposition can create a molecular framework that is modulated by metabolic and environmental factors to give rise to the expression of the disease. This complexity also suggests that differences in clinical phenotypes, such as those in hyperandrogenism, ovulatory dysfunction and metabolic abnormalities, can be explained.

3.2 Epigenetic and Non-Coding RNA Regulation

Further, gene function in PCOS is influenced by other regulatory mechanisms outside of DNA sequence differences. Epigenetic processes may modify the transcriptional activity without changing the nucleotide sequence and thus may be a potential interface between genetic susceptibility and environmental or metabolic exposures. Non-coding RNAs are important regulators of gene expression, particularly within ovarian cells. Granulosa cell associated microRNAs, long non coding RNA and circular RNA are able to be involved with regulatory networks regulating proliferation, apoptosis, steroidogenesis, inflammation and follicular development (Liu & Fang, 2025). A dysregulation of these networks may thus play a role in the abnormalities in granulosa-cell function and ovarian dysfunction in PCOS.

3.3 Molecular Signaling Networks in PCOS

Eventually, all molecular anomalies associated with PCOS converge to common signaling pathways that regulate cell metabolism, cell growth, inflammation and ovarian activity. Genetic variations may affect pathways related to the action of the gonadotropins, steroidogenesis, and metabolic regulation (Louwers et al., 2025), and that changes in non-coding RNA activity can affect downstream gene expression and cellular responses (Liu & Fang, 2025). These regulatory mechanisms are not independent but form molecular networks that allow inherited susceptibility to interact with endocrine and metabolic disturbances. This implies that a more comprehensive, system-level perspective of the human physiology is

helpful when examining how molecular changes in one domain of regulation can have implications for interdependent reproductive and metabolic functions (Pacheco, 2025).

Table 2. Major genetic and molecular regulatory mechanisms relevant to PCOS

Mechanism	Principal alteration	Potential consequence in PCOS	Reference
Genetic susceptibility	Polygenic variation and PCOS-associated susceptibility loci	Altered reproductive, endocrine, and metabolic regulation	(Louwers et al., 2025)
Gene regulation	Altered regulatory control of cellular functions	Variation in ovarian and metabolic phenotypes	(Louwers et al., 2025)
Non-coding RNAs	Dysregulated miRNA, lncRNA, and circRNA networks	Altered granulosa-cell function, steroidogenesis, proliferation, and apoptosis	(Liu & Fang, 2025)
Systems-level molecular interactions	Interdependence of physiological and cellular regulatory processes	Integration of molecular abnormalities with broader physiological dysfunction	(Pacheco, 2025)

3.4 Cellular Dysfunction and Abnormal Folliculogenesis

Granulosa cells play a role in follicular maturation, steroid metabolism and interaction with the ovarian microenvironment. Dysregulated ncRNA networks could disrupt granulosa-cell proliferation, apoptosis, steroidogenesis and other functions essential for the proper development of follicles (Liu & Fang, 2025). Normal selection and maturation of follicles can be impaired if these abnormalities in the cells are accompanied by other endocrine and metabolic changes that are genetically determined. PCOS can thus be considered as the result of a complex interplay of events from susceptibility through gene regulation to cellular dysfunction and the resulting abnormal ovarian phenotype. Genetic variation, regulatory RNAs, molecular networks, and ovarian cellular dysfunction all offer a mechanistic continuum of pathways linking susceptibility to disease expression. This relationship is summarised in Figure 2 and shows that genetic and regulatory changes can ultimately lead to ovarian dysfunction.

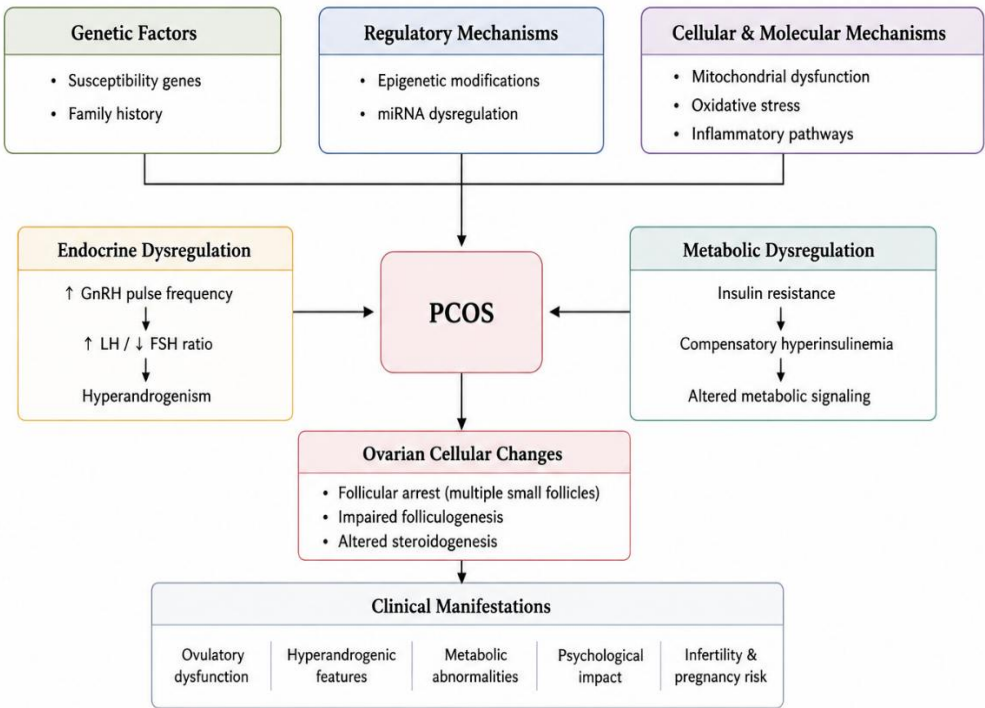


Figure 2. Genetic, regulatory, and cellular mechanisms contributing to PCOS.

The figure should illustrate that genetic susceptibility is an upstream factor that is responsible for genetic regulation and molecular signaling, which leads to altered non-coding RNA networks and granulosa-cell dysfunction. These mechanisms should converge to dysregulated steroidogenesis, abnormal follicular development and dysfunction of the ovary, representing the transition from genetic susceptibility to the cellular PCOS phenotype.

4. Ayurvedic Perspective on PCOS

4.1 Ayurvedic Conceptualization of PCOS

Ayurveda is an individualized science which deals with reproductive health as a part of the totality of the diet, lifestyle, metabolism and reproductive function. While there is no classical equivalent to PCOS in Ayurveda, modern interpretations align its menstrual, metabolic and hormonal symptoms with the traditional concepts of reproductive health (Goyal, 2026). Investigations can now be used in conjunction with this, and objectively assess the hormonal abnormalities and fertility-related parameters (Sharma, 2025). The concepts should therefore be based upon traditional thinking and give context to, rather than be synonymous with, molecular mechanisms.

4.2 Ayurvedic Therapeutic Approaches Relevant to PCOS

In Ayurvedic oriented management, dietary modification, lifestyle control, medicinal plants and herbal formulations are included. Medicinal plants utilized in women health have various bioactive phytoconstituents that can exercise metabolic and physiological effects (Goyal et al., 2026). There is also more general literature on herbs and hormones, herbs and reproductive health, herbs and the physiology of women. Culinary herbs and spices can also influence obesity and weight management (Deekshith, 2024), while there is a growing trend in the literature on PCOS that focuses on nutritional and herbal interventions and reproductive and metabolic outcomes (Muhammed Saeed et al., 2025). However, traditional use should not be considered as evidence of efficacy in PCOS.

4.3 Connecting Ayurvedic Interventions with Modern Biological Mechanisms

The most solid connection between the science of Ayurvedic phytotherapy and modern endocrinology is the effects demonstrated on insulin resistance, androgen excess, lipid metabolism, inflammation, oxidative stress and ovarian function. The direct effects of curcumin on metabolic parameters and androgen levels have been tested in women with PCOS (Ghanbarzadeh-Ghashti et al., 2023). In the same way, Shatavari, (*Asparagus racemosus*) has been evaluated for its efficacy and safety in a randomized, placebo-controlled study in PCOS (Mhatre et al., 2026). These studies offer more of disease specific evidence than can be gained from traditional use alone. Overall, the thorough study of herbal therapeutics underscores the need for in-depth assessment of efficacy, safety, dosage, and biological impacts prior to clinical application (Allam et al., 2025).

Table 3. Ayurvedic and herbal approaches relevant to PCOS

Intervention/approach	Biological relevance	Potential implication	Reference
Integrative Ayurveda	Hormonal and reproductive balance	Multidimensional PCOS management	(Goyal, 2026)
Modern investigations	Reproductive assessment	Objective evaluation of abnormalities	(Sharma, 2025)
Medicinal plants	Bioactive phytoconstituents	Metabolic and physiological modulation	(Goyal et al., 2026)
Reproductive herbal approaches	Hormonal/menstrual health	Potential reproductive support	(White, 2022; Roni et al., 2024)
Herbal remedies	Physiological homeostasis	General phytotherapeutic rationale	(Bachynski, 2024)
Culinary herbs/spices	Obesity and metabolism	Potential weight-management relevance	(Deekshith, 2024)
Curcumin	Metabolism and androgen regulation	PCOS-specific metabolic/endocrine effects	(Ghanbarzadeh-Ghashti et al., 2023)
Herbal/nutritional interventions	PCOS metabolic-reproductive dysfunction	Multitarget therapeutic potential	(Muhammed Saeed et al., 2025)
Shatavari	PCOS management	Clinical efficacy and safety	(Mhatre et al., 2026)
Evidence-based herbal therapy	Clinical validation	Need for controlled evaluation	(Allam et al., 2025)

Overall, there is no direct equivalence between the traditional concepts and molecular pathways that makes Ayurvedic interventions most appropriately connect to modern PCOS biology through experimentally measurable outcomes. The possible endocrine-metabolic target to which botanical/lifestyle approaches are related is summarized in Figure 3.

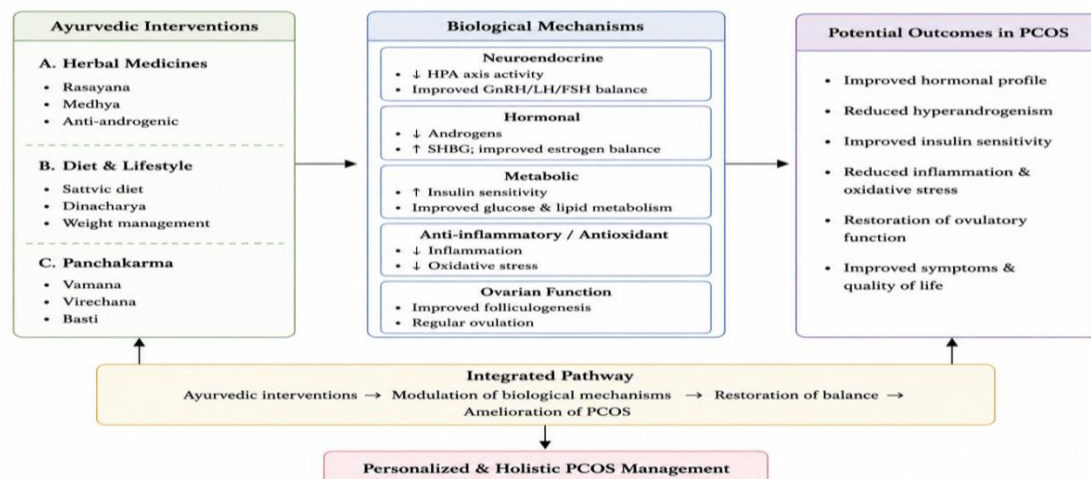


Figure 3. Proposed interface between Ayurvedic interventions and biological mechanisms relevant to PCOS.

There should be a connection between potential effects on insulin sensitivity, androgen regulation, lipid metabolism, inflammation, oxidative stress, ovarian function, and Ayurvedic dietary, lifestyle and botanical advice in PCOS, and the proposed mechanisms should be differentiated from the evidence in PCOS.

5. Yoga in PCOS: From Neuroendocrine Regulation to Molecular Effects

5.1 Neuroendocrine and Hormonal Regulation

Yoga is a mind–body practice that integrates the practice of yoga postures, breathing exercises, relaxation, and meditation, which could potentially affect the regulation of the physiological and psychological realms (Murugesan, 2025). In PCOS, it is also of relevance in the neuroendocrine and hormonal disturbances related to reproductive dysfunction. Some direct clinical evidence suggests that Integrated Naturopathy and Yoga interventions can impact testosterone levels as well as psychological parameters in women with PCOS (Shetty et al., 2024). These observations suggest that Yoga might be considered as an adjunctive intervention to endocrine regulation, but to do so, the components of multicomponent interventions must not be always mechanistically separable.

5.2 Metabolic Regulation and Insulin Sensitivity

Another area of potential treatment with Yoga-based interventions is metabolic dysfunction. The effect of yoga on dyslipidemia and cardiovascular-metabolic regulation have been studied and may influence lipid-related risk factors (Tyagi et al., 2022). More specifically, Yoga intervention in PCOS women has shown improvement in various metabolic parameters and quality of life, highlighting its relevance for the metabolic aspect of the syndrome (Patil et al., 2023). In particular, metabolic dysfunction and reproductive abnormalities often go hand-in-hand in PCOS, so such benefits might be significant.

5.3 Oxidative Stress and Mind–Body Mechanisms

Oxidative and psychological stress are other possible ways that yoga can impact PCOS. The effects of short-term integrated naturopathy and Yoga approach has been assessed in women with PCOS with regard to oxidative stress and testosterone and mental health outcomes (Shetty et al., 2024). In addition, mindful practices can also influence stress responses, as these practices can interact with responses in attention, emotional regulation, and physiology (Bablis et al., 2025). But data from non-PCOS populations are only mechanistic and not direct evidence of PCOS specific molecular effects.

Table 4. Potential physiological effects of Yoga relevant to PCOS

Yoga-related domain	Principal target	Potential relevance to PCOS	Reference
Yoga therapy	Mind–body regulation	Support of physical and psychological homeostasis	(Murugesan, 2025)
Yoga and dyslipidemia	Lipid/metabolic regulation	Potential improvement in cardiometabolic risk factors	(Tyagi et al., 2022)
Mindfulness	Stress and psychological regulation	Potential modulation of stress-related physiological responses	(Bablis et al., 2025)
Integrated naturopathy and Yoga	Testosterone, oxidative stress, mental health	Direct PCOS-specific endocrine and oxidative outcomes	(Shetty et al., 2024)
Yoga intervention	Metabolic parameters and quality of life	PCOS-specific metabolic and clinical benefits	(Patil et al., 2023)

5.4 Integrating Yoga with Molecular PCOS Pathways

There is some evidence that Yoga acts in several interrelated domains and not in any one molecular target. All these mechanisms—neuroendocrine regulation, metabolic improvement, reduction of oxidative stress, and psychological regulation—may interact to affect the endocrine-metabolic environment in PCOS. However, the evidence included in this section is stronger for clinical and physiological outcomes than for particular gene-expression or intracellular signaling mechanisms. Therefore, the direct molecular effects should be viewed with caution until evidence from PCOS-specific molecular studies is forthcoming. Figure 4 provides an overview of the proposed pathways.

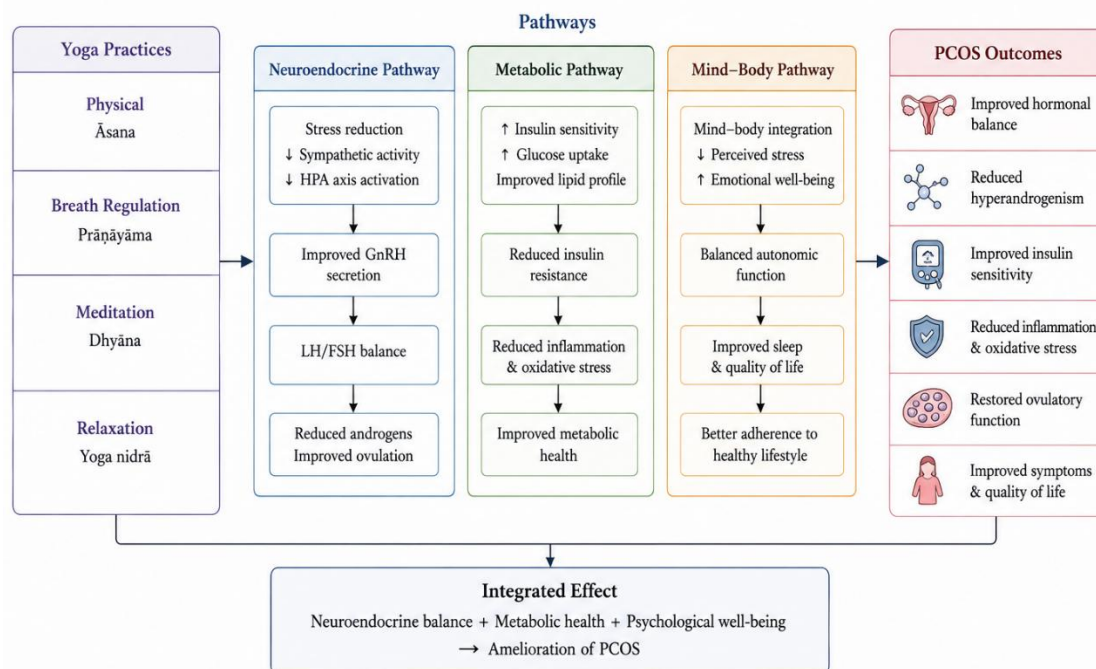


Figure 4. Proposed neuroendocrine, metabolic, and mind–body pathways linking Yoga with PCOS outcomes.

The Yoga practices should be demonstrated to interact with stress regulation, neuroendocrine function, metabolism and oxidative balance, and to converge on androgen regulation, metabolic parameters, psychological well-being, and reproductive function. Solid connections could be clinically assessed outcomes of PCOS, while proposed mechanistic links should be considered as indirect or emerging evidence.

6. Bridging Ayurveda, Yoga, and Modern Endocrinology

6.1 Integrative Framework for PCOS Management

Given the heterogeneous nature of PCOS in relation to endocrine-metabolic processes, we suggest an integrative approach to the condition that incorporates biomedical evaluation, along with lifestyle and mind–body practices. Precision-oriented healthcare concepts (Kaushik, n.d.) could also be complemented by individualized models within the realm of alternative medicine, and transdisciplinary approaches showcase that biological, behavioral, and metabolic factors can all be taken into account. There might be a role for Ayurveda and Yoga in this framework in the form of lifestyle regulation and mind – body practices. Their use along with each other has been evaluated using traditional clinical outcomes in cardiometabolic disease (Balkrishna et al., 2025) and wider AYUSH and nature-cure perspectives focus on supporting mind–body and lifestyle interventions (Meenakumari, n.d; Tewani & Silwal, 2023). This evidence can present an integrative rationale but should not be understood as direct evidence for the efficacy in the context of PCOS.

6.2 Translating Traditional Interventions into Molecular Evidence

Traditional interventions need to be assessed using measurable biological mechanisms in order to be integrated with modern endocrinology. It has been suggested that zebrafish could be used for Ayurveda drug discovery and could help in the pharmacological and mechanistic studies of the bioactives from the traditional medicine (Gupta et al., 2025). Experimental assessment of integrative interventions can be further enhanced by scientific advances in methodology (Harit et al., 2024). However, don't equate traditional concepts with hormones, genes or signaling pathways without evidence. There is also a philosophical discussion on the need for critically reviewing concepts of disease, causation and therapeutic evidence for integrated medicine (Tresker, 2022).

Table 5. Framework for integrating Ayurveda and Yoga with modern biomedical approaches

Integrative domain	Biomedical interface	Potential relevance	Reference
Individualized medicine	Precision-oriented care	Personalized management	(Kaushik, n.d.)
Transdisciplinary care	Metabolic assessment	Biological–lifestyle integration	(Kouser et al., 2026)
Ayurveda and Yoga	Clinical outcomes	Combined intervention assessment	(Balkrishna et al., 2025)
AYUSH/mind–body care	Supportive health	Multidimensional management	(Meenakumari, n.d.)
Nature cure	Lifestyle regulation	Integrative health framework	(Tewani & Silwal, 2023)
Ayurveda drug discovery	Experimental models	Mechanistic validation	(Gupta et al., 2025)
Scientific advancement	Emerging methodologies	Improved intervention evaluation	(Harit et al., 2024)
Medical philosophy	Evidence and causation	Critical traditional–modern translation	(Tresker, 2022)
Interdisciplinary research	Integrative scholarship	Cross-disciplinary development	(Pratiwi, 2025)

Therapeutic integration	Multidisciplinary framework	Conceptual integrative context	(Malviya & Mishra, n.d.)
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6.3 Toward Evidence-Based Integrative Endocrinology

A scientifically well founded model should link Ayurveda and Yoga to observable endocrine, metabolic, cellular and molecular phenomena. Interdisciplinary scholarship can support the collaboration between conventional and complementary sciences (Pratiwi, 2025), and integrative scholarship can give concept support to the multidisciplinary therapeutic approaches (Malviya & Mishra, n.d.). The traditional rationale to standardized intervention to biological target to mechanistic validations to clinical outcome is thus a suitable translational pathway. This framework allows for the use of TK in the creation of testable hypotheses and still have up to date evidence standards.

7. Clinical and Translational Implications

7.1 Personalised and Multi-dimensional Management of PCOS

PCOS is a heterogeneous disorder and needs to be managed clinically for its reproductive, metabolic and lifestyle-related manifestations, and not with a single approach. The metabolic abnormalities linked to obesity can significantly impact long-term health outcomes, highlighting the need to integrate weight management into a comprehensive approach to health and well-being (Goyal, 2026a). Health of the heart and blood fat also needs to be considered as metabolic risk can have implications beyond reproductive symptoms (Goyal, 2026b). Integrative management should thus be tailored to the predominant clinical phenotype, metabolic status, reproductive priorities and patient's needs.

7.2 Reproductive Health and Clinical Translation

Of special significance is the reproductive aspect, as menstrual irregularities, fertility problems, and pregnancy complications can have significant impacts on women with PCOS. A larger scope of reproductive health that includes fertility, pregnancy and wellbeing also emphasizes reproductive health outcomes and general physiological health (Vaamonde et al., 2022). There is thus a need for a more translational approach in the management of PCOS focusing on outcome measures that are clinically relevant, such as menstrual regularity, metabolic improvement, fertility, and quality of life.

7.3 Safety, Standardization and Evidence-based Integration

There are challenges to consider, including safety, dosage, formulation, bioavailability, and regulatory standards, when making herbal or phytochemical interventions a reality in the clinic. Plant material, extraction methods, active ingredients and dosage can affect efficacy and/or adverse reactions. Thus, the standardization and safety evaluation of phytochemicals are crucial prior to their confident inclusion in evidence-based therapeutic approaches (Karthikeyan et al., 2025). Complexity-based views on clinical reasoning also suggest that integrative healthcare is a process of interactions between biological, behavioral, therapeutic and patient-specific factors (Graham, 2023). This level of complexity helps to provide patient-specific care and also makes it even more critical to repeatable interventions and quantifiable clinical endpoints.

Table 6. Major considerations for clinical translation of integrative PCOS management

Translational domain	Clinical consideration	Implication	Reference
Weight management	Obesity and metabolic health	Individualized lifestyle management	(Goyal, 2026a)
Cardiometabolic health	Lipid and cardiovascular risk	Broader long-term risk management	(Goyal, 2026b)
Reproductive health	Fertility, pregnancy, wellness	Reproductive outcome-oriented care	(Vaamonde et al., 2022)
Phytochemical therapy	Safety, dosage, standardization	Reliable and regulated clinical application	(Karthikeyan et al., 2025)
Integrative clinical reasoning	Complex patient-therapy interactions	Personalized, multidimensional decision-making	(Graham, 2023)

8. Current Challenges, Research Gaps, and Future Perspectives

While there is growing interest in using Ayurveda and Yoga in conjunction with the management of PCOS, there are still significant methodological and translational challenges. While evidence for nutritional and herbal interventions is growing, there are challenges in directly comparing results across studies due to the heterogeneity of botanical preparations, dosage, duration of interventions, participant characteristics, reference standards for diagnosis, and outcome measures (Muhammed Saeed et al., 2025). The same is true with traditional notions of therapy that are simply interpreted into the molecular lexicon but not directly validated in the lab. Standardized interventions, well-defined bioactive ingredients, sufficient sample size and randomized trials, and reproducible endocrine and metabolic measures should therefore be considered for future investigations.

Another significant research gap is understanding the biological systems by which integrative interventions could influence PCOS. Future studies should expand symptom-based endpoints to include molecular endpoints such as gene expression, epigenetic regulation, non-coding RNAs, inflammatory mediators, oxidative-stress markers, insulin-signaling pathways, and ovarian cellular responses. New scientific technologies can be leveraged to integrate molecular profiling, experimental models, multi-omics, and computational analysis to explore complex biological responses to traditional and mind-body interventions (Harit et al., 2024). These strategies could serve to separate true associations from plausible mechanisms, and determine molecular signatures of therapeutic response.

Clinical heterogeneity is another challenge which is due to the fact that PCOS is comprised of various reproductive, metabolic and psychological phenotypes. Thus, future integrative research should focus on phenotype-specific and personalized approaches, and not on a one-size-fits-all therapeutic response. There is also a need for more attention to be paid to reproductive outcomes, including the function of menstruation, ovulation, fertility, pregnancy, and long-term women's health outcomes (Vaamonde et al., 2022). Finally, interdisciplinary efforts of endocrinologists, molecular biologists, geneticists, reproductive specialists, Ayurveda researchers and Yoga scientists will be the key for progress. The combination of thorough molecular investigation and standardized clinical research could help to define the role of traditional and mind-body medicine in the future management of PCOS, within an evidence-based precision framework.

9. CONCLUSION

PCOS is a complex and heterogeneous disorder with reproductive dysfunction, hyperandrogenism, insulin resistance and metabolic disturbances, inflammation, oxidative stress and genetic and epigenetic factors interacting through interconnected biological pathways. These relationships are now better understood, due to the advances of molecular endocrinology, and a transition is now underway from symptom management to the development of mechanistically guided and personalized therapies. In this context, Ayurvedic and Yoga therapy can be complementary therapies that can target lifestyle, metabolic, reproductive and mind-body aspects of PCOS. However, it is important to integrate these traditional approaches with modern endocrinology, but not necessarily to make a direct equivalence between the traditional concept and the molecular mechanism. With regard to the effects on metabolic homeostasis, androgen regulation, oxidative balance, psychological well-being and reproductive function, there is some evidence that ayurvedic botanicals and Yoga-based interventions may play a role. However, there is a range of evidence to support the idea that ayurvedic botanicals and Yoga-based interventions may impact metabolic homeostasis, androgen regulation, oxidative balance, psychological well-being and reproductive function. Therefore, standardization, safety assessment, mechanistic investigation and rigorous clinical evaluation are still vital for meaningful translation. Intersection of Ayurveda, Yoga, genetics, molecular biology and endocrinology will give an opportunity to create a multidimensional approach in managing PCOS. Incorporating molecular profiling, standardized interventions, solid clinical outcomes and personalized approaches will be central to future advances. This interdisciplinary research could help determine the effectiveness of integrative strategies for biological, for whom, and how they could be used in conjunction with evidence-based PCOS care.

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