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HORMONAL IMBALANCE AND POLYCYSTIC OVARY SYNDROME (PCOS) IN YOUNG WOMEN: A COMPREHENSIVE REVIEW

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ABSTRACT
Polycystic Ovary Syndrome (PCOS) is one of the most common endocrine and metabolic disorders "affecting young women, characterized by" hormonal imbalance" involving the hypothalamic-pituitary-ovary (HPO) axis, hyperandrogenism, and insulin resistance. "Findings reveal that "PCOS is not only a reproductive disorder but also a systemic condition with long-term risks," including "type 2 diabetes mellitus, cardiovascular disease, infertility, and psychological" disorders. Management strategies encompass lifestyle modifications, pharmacological interventions such as oral contraceptives and insulin sensitizers, and complementary therapies including yoga and nutraceuticals. Despite extensive research, uncertainties remain regarding adolescent diagnosis, long-term outcomes, and personalized therapeutic approaches. Addressing these gaps is crucial to enhance early detection, comprehensive management, "and quality of life among affected young women. **Objectives:** The purpose of this review is to provide "a comprehensive analysis" of Polycystic Ovary Syndrome" as a disorder of "hormonalimbalance" in young women. It aims to describe the prevalence, causes, and pathophysiology of PCOS, examine its clinical manifestations and diagnostic frameworks, evaluate management strategies, and assess its long-term complications. The paper also highlights research gaps and proposes future directions for improving diagnosis and treatment in adolescent girls, who represent a particularly vulnerable group. **Methods:** This review adopts a narrative approach to synthesizing evidence from secondary sources. Databases including PubMed, Scopus, Web of Science, and Google Scholar were searched for articles" using keywords such as PCOS, hormonal imbalance, adolescent PCOS, diagnosis of PCOS, and management of PCOS. Inclusion criteria required that studies be peer-reviewed, published between 2015 and 2025, written in English, and specifically address PCOS in young women. Exclusion criteria were non-peer-reviewed sources, studies unrelated to PCOS, and articles not available in English. Approximately sixty relevant studies, including original research, systematic reviews, and clinical guidelines, were selected and analyzed for this review. **Results:** My study shows that "Polycystic ovary syndrome (PCOS) is "highly prevalent, affecting between 5 and 20 percent of women worldwide, with particularly high rates in South Asia. The pathophysiology of PCOS is rooted in hormonal imbalance involving HPO axis dysfunction, insulin resistance, and hyperandrogenism. "Clinical manifestations include menstrual irregularities," infertility, dermatological problems such as acne and hirsutism, obesity, and significant psychological distress. The criteria used in diagnosis varies, the most commonly used being the Rotterdam criteria which is criticized as over-diagnosing in adolescents. The approaches to management focus on lifestyle change, which is reinforced by pharmacological interventions, including" oral contraceptives, anti-androgens, and insulin" sensitizers, and complementary methods. The effects of this condition in the long term include infertility, "diabetes, cardiovascular disease, endometrial cancer and mental health" complications, which underlines" the importance of early intervention. **Conclusion:** PCOS is a heterogenous multi-factorial endocrine dysfunction with multifactorial reproductive, metabolic, and psychological implications in young women. The pathophysiology of the condition is based on hormonal imbalance in the HPO axis, excess of androgens, and insulin resistance, and in clinical terms menstrual dysfunction, infertility, obesity, hirsutism, and mood disorders can be observed. Adolescent diagnosis is especially problematic because it is mixed with pubertal physiology. There is no universal cure, but lifestyle interventions are the first line with pharmacological and complementary therapy as the supportive approaches. Long-term complications, including diabetes, cardiovascular disease, endometrial carcinoma, explain why prompt diagnosis and prophylaxis are an emergency. Additional research is required, in respect of how to enhance the adolescent-specific diagnostic criteria, integrate genetic and epigenetic data, take the psychosocial factor into account, and how to elaborate personalized treatment schemes.

KEYWORDS: Polycystic Ovary Syndrome," hormonal imbalance," "insulin resistance," hyperandrogenism, reproductive health.

1. INTRODUCTION"

Polycystic Ovary Syndrome (PCOS)" "as" first described by Stein and Leventhal is one of the most" prevalent "endocrine disorders "in" "women of reproductive age.[1] "It is distinguished by hormonal disequilibrium "of the hypothalamic-pituitary-ovary axis, insulin resistance, and" hyperandrogenism.[2] The effects of such perturbations include poor ovulation, formation of numerous ovary follicles that are immature, and a broad spectrum of reproductive, metabolic, skin and psychological symptoms.[3] PCOS has become a key public health issue and the prevalence of the condition differs among different populations and is always higher among South Asian women than Caucasians.[4] It is a syndrome of reproductive and metabolic malfunction and is characterized by irregular menstrual cycles, infertility, obesity, acne, and hirsutism.[5] Besides the acute clinical presentation, PCOS belongs to the group of other risk factors that predetermine the development of long-term clinical health issues in women, including type 2 diabetes, cardiovascular disease, endometrial cancer, and mental disorders, like depression and anxiety.[6] All these conclusions are indications that the disorder is not a mere gynecological issue but a health disorder in general.[7] Since PCOS is a complex condition, it needs to be studied in depth in order to learn more about its etiology, manifestations, and treatment.[8] Although there is an increasing body of research, the diagnosis remains unclear, especially in adolescents where symptoms can resemble normal puberty.[9] The present review describes PCOS as one of the most common examples of hormonal imbalance in young women, summarizing the new evidence to analyze its prevalence, clinical presentation, diagnostics problems, treatment options, complications, and new research perspectives.[10]

1.1 Epidemiology and Prevalence: Prevalence of PCOS differs according to the criteria of diagnosis and population. It is estimated that PCOS affects 5 to 20 percent of women globally, although research has shown that the rates in South Asia are much higher with one out of five women potentially having the syndrome[11] A survey in India had found a prevalence of between 9 and 13 percent in adolescent girls, alarming as the symptoms of PCOS are similar to those of normal puberty. Environmental factors such as diet, sedentary lifestyle, and stress are believed to contribute to this rising incidence.[12]

1.2 Pathophysiology of PCOS: The pathogenesis of PCOS involves a combination of neuroendocrine dysfunction, metabolic imbalance, and genetic predisposition.[13] At the neuroendocrine level,"increasedpulsatility of gonadotropin-releasing hormone "favors" luteinizing hormone over follicle-stimulating hormone, leading to increased androgen production"and impaired follicular maturation. This creates a cycle of anovulation and menstrual irregularities. Metabolically, insulin resistance is a central feature, present in more than half of women with PCOS.[14] Hyperinsulinemia enhances androgen production while lowering sex hormone-binding globulin levels, thereby increasing free androgens.[15] These processes together create the hallmark features of hyperandrogenism, obesity, and infertility.

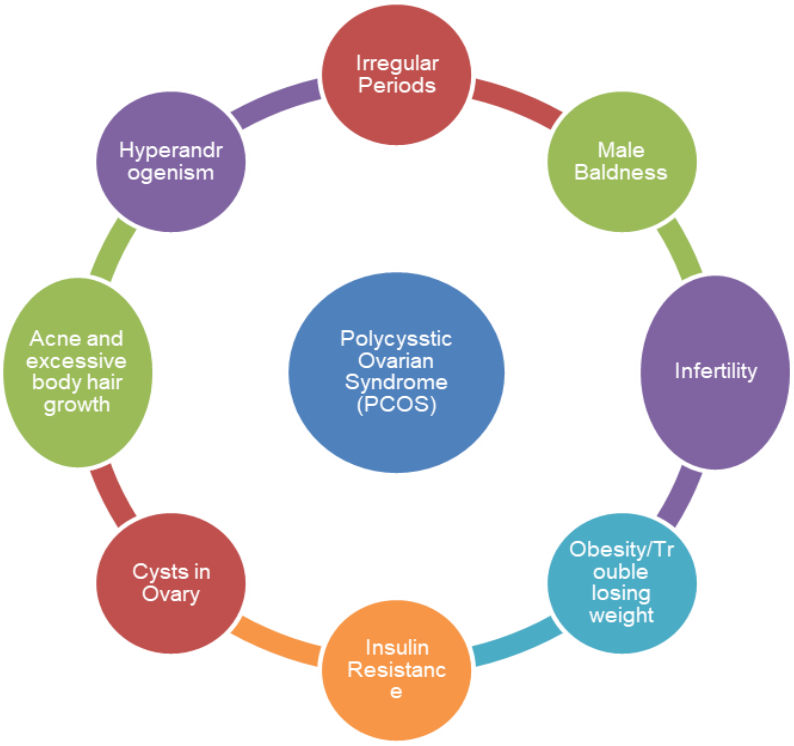

Figure: "Showing the various diagnostic symptoms of PCOS such as irregular menstrual cycle, hyperandrogenism, insulin resistance, cysts in ovaries, male baldness, infertility etc."

2. LITERATURE REVIEW

Polycystic OvarySyndrome (PCOS) is a common hormone disorder in women of childbearing age and a leading cause of infertility due to problems with ovulation.[16] The prevalence of PCOS ranges from 4% to 21% globally and in India, the prevalence varies from 2% to 35%.[17] PCOS is a complex condition caused by a mix of genetic, hormonal, and environmental factors.[18] PCOS symptoms can vary from person to person and may change over time without a clear cause. Some possible symptoms include: Irregular, heavy, long, or missed periods, trouble gettingpregnant, oilyskin or acne, excess facial or bodyhair, thinninghair or hair loss, similar to male baldness, weight gain especially aroundtheabdomen. People with PCOS are at a higher risk of developing other health problems, such as: Type 2 diabetes, high blood pressure, high cholesterol, heart disease, uterinecancer. Several hormones play a big part in hormonal imbalances and PCOS. Many women with PCOS don't respond well to insulin (insulin resistance), this causes high insulin levels, which make the ovaries produce more male hormones androgens.[19] In women with PCOS too much androgen leads to symptoms like obesity, excess body or facial hair, and trouble ovulating. Disruptions in hormones like LH, FSH, estrogen, and testosterone interfere with the normal menstrual cycle, causing irregularities such as infrequent periods (oligomenorrhea) or missed periods (amenorrhea).[20] PCOS can contribute to anxiety, depression, and low self-esteem. Symptoms like infertility, weight gain, and excessive hair growth may lead to social stigma, which can impact relationships, work, family life, and social participation. Some PCOS symptoms can be managed with lifestyle changes. Eating a healthy diet and exercising regularly can help with weight loss and lower the risk of type 2diabetes.Birth control pills can regulate the menstrualcycle and ease symptoms, while other medications can help reduce acne and unwanted hair growth. For infertility caused by PCOS, treatment options include lifestyle changes, medications, or surgery to encourage regular ovulation. In vitro fertilization might also be an option, but it comes with some risks.[21] This review synthesizes recent literature on the prevalence, pathophysiology, diagnostic challenges, clinical manifestations, and management of PCOS, with a particular focus on adolescents and young women.

2.1 Clinical Manifestations

The clinical presentation of PCOS is heterogeneous. Menstrual irregularities, ranging from oligomenorrhea to amenorrhea, are the most common symptoms. Infertility is a frequent concern due to chronic anovulation. Hyperandrogenism manifests as hirsutism, acne, and androgenic alopecia, often leading to psychological distress. Obesity, particularly abdominal obesity, is common and aggravates insulin resistance.[22] In addition, psychological disorders such as depression, anxiety, and poor self-image are increasingly recognized as part of the PCOS spectrum.[23]

Table: Clinical Manifestations of PCOS in Young Women.

Category	Manifestations
Reproductive	Oligomenorrhea, amenorrhea, infertility
Dermatological	Hirsutism, acne, seborrhea, alopecia
Metabolic	Obesity, insulin resistence, dyslipidemia
Psychological	Depression, anxiety, low self-esteem

2.2 Diagnosis and Classification

Diagnosis of PCOS has historically been inconsistent due to variations in criteria. The criteria of NIH (1990) targeted hyperandrogenism and recurrent anovulation.[24] The Rotterdam criteria (2003) were expanded to include two out of three characteristics: oligo-anovulation, hyperandrogenism, or polycystic ovaries on ultrasound.[25] Hyperandrogenism was introduced as a mandatory requirement in the AE-PCOS Society criteria (2006) "along with either ovulatory dysfunction or ovary morphology.[26]"

The most commonly used criteria are the Rotterdam criteria, which have been criticised as over-diagnosing PCOS in girls, whose irregular cycles and acne can be due to normal puberty. Instead, the NIH criterion would be too restrictive to underdiagnose PCOS.[27] This continuing controversies highlight the importance of adolescent-specific diagnostic guidelines.

Table: Diagnostic Criteria for PCOS.

Criteria	Year	Features required	Strengths	Limitations
Nih	1990	Hyperandrogenism+ chronic anovulation	Simple and specific	Excludes ovary morphology
Rotterdam	2003	"Any two of: oligo-anovulation, hyperandrogenism, polycystic ovaries"	Widely adopted	Risk of overdiagnosis
Ae- pcos society 2006	2006	Hyperandrogenism+ (ovulatory dysfunction or polycystic ovaries)	Emphasizes addrogen excess	May overlook non-hyperandrogenic cases
International Guideline	2018/ 2023	Adults: 2 to 3 features; Adolescents: Both hyperandrogenism + menstrual irregularity; AMH can be used in adults, not adolescents	Improves diagnostic accuracy includes AMH	

2.3 Management Strategies

The basis of PCOS management is still Lifestyle modification. Even a modest 5 to 10 percent weight loss can be enough to re-initiate ovulation and to increase insulin sensitivity.[28] Low glycemic index food and balanced diet, as well as structured exercise programs, which involve aerobic and resistance training, are especially effective.[29] When the use of lifestyle interventions is insufficient, the use of pharmacological therapies is observed. Oral contraceptives are used to regulate menstrual cycles and androgen levels and to treat the hirsutism and acne with anti-androgens such as spironolactone.[30] Metformin enhances the insulin sensitivity and it also reestablishes the normalcy of the ovary.[31] Ovulation-stimulating medications such as clomiphene citrate or letrozole can be used by women who desire pregnancy. Yoga, acupuncture, and a host of supplements such as inositols and vitamin D are all the rave in alternative and complementary therapies and have proven to be effective.[32] Care also includes psychological counseling and takes into account the high anxiety, depression, and body image problems in patients with PCOS.[33]

Approach	Examples	Outcomes
Lifestyle	Diet, exercise, weight management	Restores ovulation, improves insulin sensitivity
Pharmacological	Oral contraceptives, metformin, anti- androgens	Cycle regulation, reduced hyperandrogenism
Fertility	Clomiphene, letrozole	Induction of ovulation
Complementary	Yoga, insitols, accupuncture	Improves symptoms, reduces stress
Psychological.	Counseling, cbt	Improves quality of life addresses depression

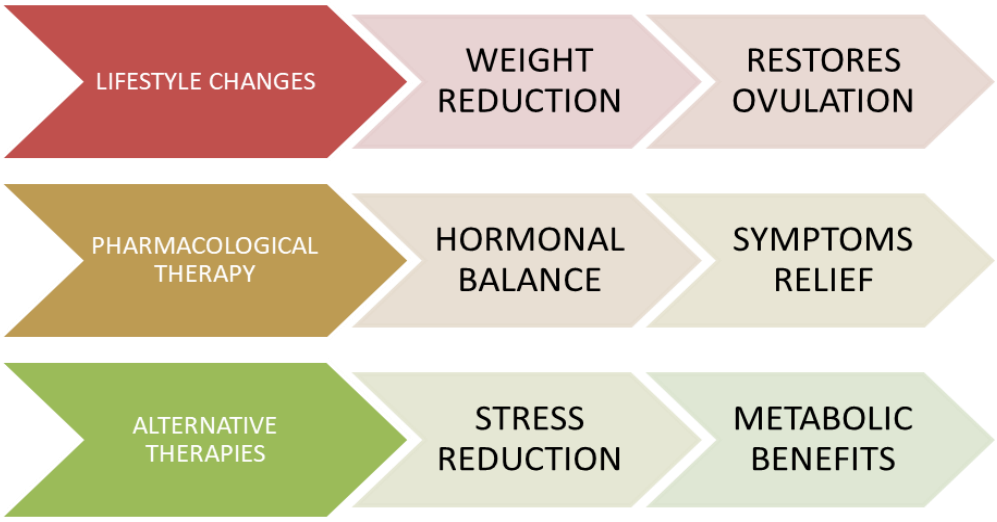

Figure: Integrated management strategies for PCOS, highlighting the role of lifestyle changes, pharmalogical therapy, and alternative approaches in improving ovulation, symptom relief and metabolismhealth.

2.4 Long-Term Complications

PCOS is a disease that can have dire health consequences on women who are not treated. Reproductive: infertility and pregnancy issues including gestational diabetes and preeclampsia. The metabolic outcomes are not promising as well and women are four to seven times more likely to be affected by type 2 diabetes.[34] There is also cardiovascular disease such as hypertension, dyslipidemia and atherosclerosis.[35] "Prolonged unopposed estrogen exposure increases the risk of endometrial hyperplasia and carcinoma.[36] "Psychological outcomes such as depression and anxiety persist throughout life, reducing quality of life.

Category	Complications
Reproductive	Infertility, miscarriage, gestational diabetes
Metabolic	Type 2 diabetes, obesity, dyslipidemia
Cardiovascular	Hypertension, atherosclerosis, heart disease
Oncological	Endometrical hyperplasia, endometrical carcinoma
Psychological	Depression, anxiety, eating disorder

2.5 Research Gaps: "Although PCOS is widely studied," key gaps remain. There is no consensus on diagnostic criteria for adolescents, leading to frequent misdiagnosis.[37] Genetic and epigenetic studies are limited, leaving much of the etiology unexplained. Longitudinal studies tracing PCOS progression from adolescence to adulthood are scarce, and research into psychological outcomes is underdeveloped. South Asian women, despite their higher prevalence, are underrepresented in global studies. Addressing these gaps is essential for developing personalized and culturally sensitive approaches to care.

3. ARTICLE IDENTIFICATION AND SEARCH STRATEGY

The literature for this review was identified through systematic searches of PubMed, Scopus, and Web of Science, using keywords related to PCOS, hormonal imbalance, and adolescent diagnosis and management. Studies were screened for relevance, and duplicates were excluded. Only peer-reviewed, English-language publications were included.. The analysis was kept up to date by restricting the search to publications published between 2018 and 2024, thereby collecting the most recent advancements and research on the topic.

3.1 Screening and Eligibility Criteria

Thestudyemployedinclusionandexclusioncriteriatoevaluatethepapers. Includedwerepeer- reviewed English-language studies on Hormonal imbalance and PCOS from 2015 to 2025. Duplicate publications or those with conference abstracts were omitted.

3.2 Data Synthesis and Review Process

Each manuscript wasevaluated separatelyto ensure it specifically addressed hormonal imbalanceand PCOS in young women, excluding those that did not focus on this topic or merely discussed general endocrine issues.

4. FINDINGS

The findings of this review demonstrate that PCOS is a heterogeneous condition rooted in hormonal imbalance, particularly involving the HPO axis, hyperandrogenism, and insulin resistance. It presents as a multisystem disorder, affecting reproductive, metabolic, dermatological, and psychological health. "Management requires a combination of lifestyle" changes, pharmacological interventions, and complementary therapies. However, diagnostic uncertainty persists, especially in adolescents. "The long-term health" burden of PCOS underscores "the importance of early diagnosis and "multidisciplinary care.

5. FUTURE DIRECTIONS

Development of diagnostic criteria of adolescents in specific should be considered in future research to minimise the possibility of false diagnosis. Advances in genomics and epigenetics could potentially contribute to understanding the heterogeneity of PCOS and possibly even treating the disease individually. Patient monitoring and communication can be improved with the help of digital technologies (i.e., mobile apps and wearables). They ought to be more concerned with the psychological burden of PCOS and undertake cross-cultural research studies, especially in South Asia where its burden is the greatest.

6. CONCLUSION

Polycystic Ovary Syndrome is a hormonal imbalance disorder with a vast impact on the reproductive, metabolic and psychological health of young females. One of the most important aspects in preventing long-term complications is early management and diagnosis of the disease. Lifestyle change supported by pharmacological and complementary support is the essence of care. One of the major gaps of the current practice is the absence of adolescent-specific diagnostic criteria. Medical professionals can help PCOS women live better lives by doing whatever they can to make the diagnosis and by motivating the women to participate in research and implementation of holistic care management.

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