

Prevalence, Risk Factors and Management of Polycystic Ovary Syndrome: A Review with Current Evidence

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Abstract

Objective: This review is aimed to examine polycystic ovary syndrome, its prevalence, pathophysiology, risk factors, and viable management options.

Methods: A systematic literature search was conducted across prominent databases, including PubMed, Scopus, EMBASE, Web of Science, and Google Scholar. We included English-language articles published between 1990 and 2021. The search strategy involved utilizing keywords such as “polycystic ovary syndrome,” “prevalence,” “risk factors,” “PCOS management,” “diet and PCOS,” “physical activity,” and “exercise effects.” We thoroughly reviewed the selected studies to identify literature trends and correlations through data synthesis.

Results: The findings from 45 full-text articles has indicated that the prevalence rates of PCOS have been found to range among many groups, as evidenced by several studies. Several studies have identified genetics, insulin resistance, and obesity as significant risk factors associated with the development of this condition. The study also revealed that lifestyle factors, specifically nutrition and physical exercise, exerted an impact on insulin sensitivity, weight regulation, and reproductive health among women diagnosed with PCOS. The implementation of interventions aimed at promoting healthier lifestyle choices has favorable results in the management of symptoms associated with PCOS.

Conclusion: It is imperative to incorporate lifestyle modifications that encompass a well-balanced nutritional plan and consistent physical activity. Public health interventions that prioritize raising awareness and implementing targeted strategies have the potential to empower women, enabling them to make healthier lifestyle choices. This, in turn, can help reduce the adverse effects of PCOS on their general well-being.

Keywords: Polycystic ovary syndrome, prevalence, women, hormonal imbalances, reproductive health, endocrine disorder, diet, physical activity

Introduction

Polycystic ovarian syndrome (PCOS) is a highly prevalent endocrine disease that affects women of reproductive age on a global scale.¹ Its estimated prevalence varies between 5% and 20%.² The diagnostic criteria for PCOS include the presence of 12 or more follicles in each ovary measuring 2–9 mm in diameter and/or an enlarged ovarian volume exceeding 10 ml.³ A diverse range of clinical presentations distinguishes this syndrome, including irregular menstrual periods, hyperandrogenism, infertility, and the detection of polycystic ovaries with ultrasound evaluation.⁴ In addition to its reproductive implications, PCOS is correlated with a heightened susceptibility to the development of metabolic illnesses, including insulin resistance, type 2 diabetes, and cardiovascular diseases, which represents a noteworthy public health issue.^{5,6}

The etiology is complex and involves a combination of genetic and environmental variables.⁷ In the field of genomic research, notable progress has been made in the identification of many susceptibility loci linked to PCOS, and these findings have provided valuable insights into the genetic foundations of PCOS and have also revealed possible targets for therapeutic interventions.^{8,9} Furthermore, recent research indicates that several environmental factors, such as lifestyle choices and dietary patterns, significantly contribute to the onset and

worsening of symptoms associated with PCOS, and this underscores the significance of adopting a comprehensive approach to effectively manage this condition.^{10,11}

The accurate diagnosis of PCOS continues to pose a difficulty due to its many clinical manifestations and the lack of a singular conclusive diagnostic test. Medical professionals widely employ the current iteration of the Rotterdam criteria for diagnostic purposes, which requires the presence of at least two out of three specific traits (oligo/anovulation, hyperandrogenism, and polycystic ovaries). However, ongoing debates exist, notably about determining the precise threshold for diagnosing hyperandrogenism.¹² Enhancing diagnostic accuracy is of utmost importance to facilitate prompt management and mitigate the risk of enduring consequences linked to PCOS.¹³

In recent times, there has been a notable increase in research endeavors aimed at enhancing our comprehension of the pathophysiology of PCOS as well as exploring various treatment options. These efforts have led to the emergence of novel therapeutic approaches, encompassing lifestyle modifications like dietary adjustments and physical activity as well as pharmacological interventions that specifically target insulin resistance, hormonal imbalances, and ovarian function.¹⁴⁻¹⁶ Furthermore, there has been an increasing focus on investigating the potential involvement of the gut microbiota and the

gut-ovarian axis in the development of PCOS. This emerging area of research has provided novel opportunities for the advancement of innovative therapeutic approaches.^{17,18}

Thus, this review aims to provide a comprehensive analysis of recent literature on polycystic ovary syndrome (PCOS), focusing on prevalence, risk factors, and its prevention. It identifies gaps in existing knowledge and explores potential future research directions. Understanding the complex interaction of genetic, hormonal, and environmental elements is crucial for improving diagnostic techniques and treatment.

Methods

Literature Search

We conducted a systematic literature search using electronic databases such as PubMed, Scopus, Web of Science, and Google Scholar. The search encompassed 45 full-text articles published between 1990 and 2021, focusing on PCOS prevalence, risk factors, and its management. The search strategy involved utilizing keywords such as “polycystic ovary syndrome,” “PCOS prevalence,” “PCOS risk factors,” “PCOS prevention,” “diet and PCOS,” and “physical activity and PCOS.” We thoroughly reviewed the selected studies to assess PCOS prevalence, risk factors, and the effects of diet and exercise. We identified literature trends and correlations through data synthesis.

Inclusion and Exclusion Criteria

The review included peer-reviewed publications, meta-analyses, systematic reviews, and clinical trials published in the English language. The inclusion criteria for this review encompassed studies that presented pertinent data regarding the prevalence, risk factors, and treatment modalities associated with polycystic ovary syndrome (PCOS). Excluded from consideration were articles that centered on alternative subjects, investigations using non-human subjects, and those that lacked complete access to the full-text content.

Data Extraction

The process of extracting data involved selecting papers that had information on the prevalence rates of polycystic ovary syndrome (PCOS) in different populations, identifying the risk factors that contribute to the development of PCOS, and exploring different treatment techniques. We paid considerable attention to the variability we observed in the clinical manifestations of polycystic ovary syndrome (PCOS), with a particular focus on how ethnicity, lifestyle, and genetic variables influence its prevalence and expression.

Data Synthesis

The retrieved data was methodically organized to present a thorough summary of the prevalence, risk factors, and treatment choices related to Polycystic Ovary Syndrome (PCOS). We analyzed studies to determine the impact of exercise and food on PCOS symptoms, hormonal balance, and general health in individuals with PCOS. We retrieved and analyzed PCOS management data on nutrition, exercise, and outcomes. The synthesis showed that exercise and balanced meals improve insulin sensitivity, weight control, and reproductive health in PCOS women. These findings helped establish the importance of lifestyle changes, such as regular exercise and balanced eating, in PCOS prevention and control.

Critical Analysis

The data synthesis underwent a rigorous critical analysis to identify any deficiencies in the present body of information, methodological constraints in previous studies, and areas that necessitate additional investigation. The study also looks at the problems that come with diagnosing Polycystic Ovary Syndrome (PCOS), taking into account how the diagnostic criteria are always changing and how early detection might help patients do better.

Prevalence and Variability of PCOS

The prevalence of PCOS exhibits variability among different groups and is subject to the influence of genetic, environmental, and lifestyle variables. Recent literature has brought attention to the significant worldwide impact of PCOS, which affects individuals of many ethnicities.^{1,2} Variations in diagnostic criteria, geographical areas, and the incorporation of varied symptoms within the syndrome contribute to the observed variability in prevalence rates.^{19,20} The accurate assessment of prevalence and targeted healthcare planning are essential considerations in light of the evolving diagnostic criteria.²¹

Pathogenesis

The pathogenesis of PCOS is influenced by a multifaceted interaction of genetic, hormonal, metabolic, inflammatory, and environmental elements and the role of genetic predisposition, as evidenced by genome-wide association studies that have identified genetic variants associated with susceptibility, and these variants are frequently connected with insulin resistance and ovarian function.^{8,9} Disturbances in the hypothalamic-pituitary-ovarian (HPO) axis disrupt the regular development of follicles and contribute to the occurrence of hyperandrogenism and irregular menstrual cycles by elevating luteinizing hormone (LH) levels.²² Insulin resistance, a key characteristic of PCOS, leads to elevated levels of insulin in the blood (hyperinsulinemia) and subsequent high blood sugar levels (hyperglycemia), which have a significant impact on ovarian function and further exacerbate the generation of androgens.⁷ The presence of chronic low-grade inflammation in individuals with PCOS adds another layer of complexity to the condition, which is due to the increased levels of inflammatory markers that disturb the normal functioning of the ovaries and the signaling of insulin. Consequently, this disruption contributes to the dysregulation of both metabolic processes and reproductive functions.²³

Furthermore, the development of PCOS is significantly influenced by environmental and lifestyle variables that are influenced by exposure to endocrine-disrupting chemicals and prenatal factors, with the presence of an unhealthy diet and sedentary behavior potentially exacerbating insulin resistance and hormonal imbalances, leading to the worsening of symptoms.^{10,24}

Risk Factors

A combination of hereditary and environmental variables influences the risk factors associated with PCOS. Genome-wide association studies (GWAS) have found several genetic loci associated with the susceptibility to PCOS, providing

insights into its hereditary characteristics.^{9,25} Moreover, the development of PCOS is greatly influenced by environmental variables such as obesity, insulin resistance, and hyperandrogenism. Lifestyle factors, such as food choices and levels of physical activity, have been found to have a significant impact on the development of PCOS, as indicated by former studies.^{10,11} Furthermore, research suggests that endocrine disruptors and prenatal exposures contribute to the development of PCOS, emphasizing the importance of understanding the influence of early-life factors on the risk of this condition.^{26,27}

Prevention and Early Intervention

The prevention of PCOS and its related problems requires the implementation of a comprehensive and multidimensional strategy. The implementation of lifestyle modifications, such as engaging in consistent physical activity and adhering to a well-balanced dietary regimen, plays a crucial role in the effective management of obesity and the enhancement of insulin sensitivity. Consequently, these alterations contribute to a reduction in the likelihood of developing PCOS.²⁸ The adoption of early intervention techniques aimed at teenagers who are at risk, such as providing nutritional education and encouraging physical exercise, plays a vital role in disrupting the pattern of obesity and insulin resistance, and these interventions can reduce the likelihood of developing PCOS.²⁹ In addition, the earlier diagnosis and therapy of hyperandrogenism and menstrual irregularities during adolescence may help mitigate certain long-term effects associated with PCOS, as highlighted by previous research.³⁰

Diet

The dietary regimen is a significant element that contributes to the variability in weight and cardiovascular risk factors observed among women with PCOS.³¹ According to former research, it has been observed that the phenotype exhibits an upward trend in response to weight gain, heightened consumption of carbohydrates, and a sedentary way of life. Previous studies have demonstrated a significant improvement in endocrine function as a result of brief duration and severely restricted calorie intake.³² Women with PCOS exhibit a higher body mass index (BMI) compared to women without the condition. However, there is no discernible difference in dietary patterns between women with and without PCOS. When considering BMI as a factor, it was observed that lean women with PCOS reported a significantly lower energy intake compared to lean women without PCOS.³³

The optimal diet for PCOS women is unknown, but it should help with fertility, weight management, and the long-term risks of diabetes type 2, certain cancers, and cardiovascular disease by regulating insulin and blood glucose. A low-fat, high-fibre diet with mostly low-glycemic-index carbs is advised, and effective exercise and nutrition boost reproductive, endocrine, and cardio-metabolic systems without weight loss. We advocate limiting fat consumption to $\leq 30\%$ of total calories. After diet and exercise, short-term insulin sensitivity or weight-loss drugs may be effective.³⁴ For obesity and other secondary disorders, a nutritionally adequate diet with 30% energy and 10% saturated fat, 15% protein, and 55% carbohydrate, fruits, high-fibre whole grain slices of bread, vegetables, and cereals, and moderate exercise is best. A moderate

energy-reduction diet (500–1,000 kcal/day) decreases body weight by 7%–10% in 6–12 months.³⁵

Physical Activity and Exercise

Physical activity has been identified as an effective therapy option for addressing the metabolic and reproductive aspects of PCOS. Lifestyle modification, including incorporating physical activity, is considered the primary treatment approach in an evidence-based strategy for managing PCOS in the majority of women who are classified as obese.³⁶ Lifestyle changes, which primarily target physical activity and diet, are considered the major therapeutic approach for addressing metabolic issues in women with PCOS who are overweight or obese.³⁷ The primary management approach for PCOS involves implementing lifestyle changes, particularly engaging in physical activity that aims to reduce insulin resistance, thereby improving the reproductive and metabolic characteristics associated with PCOS. Physical activity programs typically include a combination of aerobic exercise and resistance training, and some may also recommend self-directed physical activity.³⁸ A single-centered cross-sectional study on dietary and physical activity patterns in obese PCOS women in Pakistan has examined the fact that women tend to be sedentary. In the sample of $n = 106$, 83% of females showed a reluctance to engage in physical activity, and a significant proportion of PCOS patients have a higher risk of obesity, particularly concerning their waist-hip ratio. The participants did not follow any weight-loss diet as most people do low-intensity exercises.³⁹

It is imperative to implement preventive measures to curb excessive weight gain in women with PCOS, regardless of whether they have normal or elevated body weight.⁴⁰ Previous research has indicated that obese women with PCOS may experience improvements in menstruation disturbance and infertility concerns while engaging in aerobic exercise and weight reduction.⁴¹ The implementation of lifestyle modifications for weight loss is a successful approach to normalizing androgens, addressing menstrual irregularities, and improving cardiovascular risk factors in adolescent girls with PCOS.⁴² Small-scale randomized controlled trials suggest that lifestyle changes like increased physical activity and reduced calorie consumption can be beneficial, and thus novel research on exercise's involvement in PCOS reproductive dysfunction is needed to discover the best exercise frequency, type, and duration.⁴³ The results of the previous survey also clearly show that older persons who are sedentary lose their functional abilities, which lowers their degree of recreational physical activity among the geriatric female population and the findings indicate that musculoskeletal pain affected the majority of the post-menopausal woman and indicated the importance of regular exercise.⁴⁴ It is eminent to understand from the perspective of sedentary lifestyle that the woman who are not physically active are more likely to be at danger of their health status declining because of a relationship between daily activities and health status.⁴⁵

Challenges and Future Directions

Despite the significant progress made in the field of PCOS research, there still exist obstacles to comprehending its intricate etiology and formulating efficacious preventive measures.

The presence of diverse PCOS phenotypes poses challenges in terms of both diagnosing the condition and implementing preventive measures. Therefore, it is crucial to adopt individualized strategies specifically designed to address individual risk profiles.¹ Moreover, it is imperative to do additional studies to address the intricate relationship among genetics, epigenetics, and environmental factors to provide novel opportunities for the development of preventive measures and tailored therapeutic interventions.⁴⁶

Strength and Limitations

This review has certain limitations. Initially, we restricted the scope of the search to articles published in the English language, potentially excluding pertinent studies published in other languages. Furthermore, the exclusion of grey literature, including unpublished reports or conference abstracts, may have resulted in the oversight of certain studies that were relevant. Lastly, the inherent limitations of the included studies, such as potential biases or methodological weaknesses, may impact the overall reliability and generalizability of the findings.

Conclusion

In summary, the results obtained from this review of existing literature emphasize the significance of addressing dietary patterns and engaging in physical activity as crucial components in the prevention and management of PCOS. Lifestyle alterations, such as adhering to a well-balanced diet and engaging in consistent physical activity, are integral aspects of managing PCOS. These modifications play a crucial role in facilitating weight management, enhancing insulin sensitivity, and regulating hormonal imbalances. Health interventions with a specific focus on promoting healthy lifestyle choices have the potential to make a substantial impact on decreasing the prevalence of PCOS and enhancing the overall quality of life for

those affected by this condition. Additional investigation and public health endeavors are necessary to enhance understanding regarding the significance of diet and physical activity in the prevention of PCOS. Moreover, it is imperative to formulate focused interventions that enable women to adopt healthier lifestyle behaviors, thereby reducing the adverse effects of this syndrome on their well-being.

Declarations

Ethics Approval

The approval for this review article was required.

Consent for Publication

The authors of this research consent that is research has not been sent for any journal for publication and it is not considered for publication for any other journals.

Conflict of Interest

The authors declare no conflict of interest.

Ethical Issues

Given the nature of this article, ethical approval and consent were not applicable.

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