NUTRITIONAL STRATEGIES IN POLYCYSTIC OVARY SYNDROME: A SYSTEMATIC REVIEW

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ABSTRACT:
Polycystic Ovary Syndrome (PCOS) is a prevalent endocrine disorder affecting women of reproductive age, characterized by a spectrum of clinical manifestations including hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology. The review aimed to evaluate the current evidence on dietary interventions, lifestyle modifications, and their effects on metabolic outcomes in women diagnosed with PCOS. Further the study reviews the current literature on PCOS, focusing on dietary approaches, nutritional supplementation, lifestyle modification and its metabolic implications which have shown promise in improving metabolic profiles and reducing symptoms of PCOS. The systemic concluded that the management of PCOS with lifestyle changes, including food and activity adjustments, is increasingly substantiated by evidence. However, there remains a need for more comprehensive data to confirm the long-term efficacy, safety, and health benefits of these diets. Further research is essential to evaluate and validate the effects of long-term dietary management for PCOS.

Introduction

Polycystic Ovary Syndrome (PCOS) is a prevalent endocrine disorder affecting a significant proportion of women of reproductive age, characterized by a complex interplay of reproductive and metabolic abnormalities. The syndrome is often associated with insulin resistance, hyperandrogenism, and various metabolic disturbances, which necessitate a comprehensive approach to management, particularly through nutritional strategies. Current evidence suggests that dietary modifications and lifestyle interventions play a crucial role in managing PCOS symptoms and improving overall health outcomes for affected women.

The International Evidence-Based Guidelines for the Assessment and Management of PCOS emphasize the importance of lifestyle modifications, including dietary changes and physical activity, as first-line treatments for women with PCOS, regardless of their weight status (Teede, 2023; Herbert, 2023). These guidelines advocate for a holistic approach that not only targets weight loss but also focuses on improving metabolic health and reproductive function. Aversa et al. highlight the heterogeneity of PCOS, indicating that tailored interventions based on individual phenotypes can enhance treatment efficacy (Aversa et al., 2020). This personalized approach is vital, as the clinical presentation of PCOS can vary widely among individuals, necessitating specific dietary strategies that address unique metabolic and hormonal profiles.

Research has consistently shown that women with PCOS often exhibit insulin resistance, which is a significant contributor to the metabolic complications associated with the syndrome (Ishrat et al.,

2021; Kuntal et al., 2021). Insulin resistance can lead to increased triglyceride levels and decreased HDL cholesterol, heightening the risk of cardiovascular diseases (Ishrat et al., 2021; Zhong et al., 2022). Therefore, dietary strategies aimed at improving insulin sensitivity are particularly beneficial. Diets low in glycemic index (GI) and glycemic load (GL) have been associated with improved metabolic outcomes in women with PCOS (Manta, 2023). Manta's study underscores the relevance of these dietary approaches, suggesting that they can effectively manage glycemic control and reduce the risk of developing type 2 diabetes (Manta, 2023).

Moreover, the role of specific nutrients, such as vitamin D, has garnered attention in the context of PCOS management. Vitamin D deficiency is prevalent among women with PCOS and is linked to insulin resistance and other metabolic disturbances (Williams et al., 2020; Karadağ et al., 2017). Supplementation with vitamin D has been shown to improve insulin sensitivity and hormonal profiles in some studies, indicating its potential as an adjunctive treatment in PCOS (Karadağ et al., 2017; Sadeghi et al., 2022). Additionally, the interplay between vitamin D receptor polymorphisms and PCOS phenotypes suggests that genetic factors may influence the effectiveness of dietary interventions (Song et al., 2019; Reis et al., 2017).

In terms of dietary composition, a focus on whole foods, including fruits, vegetables, whole grains, lean proteins, and healthy fats, is recommended. Such diets not only support weight management but also provide essential nutrients that can mitigate inflammation and oxidative stress, both of which are implicated in the pathophysiology of PCOS (Zhong et al., 2022; Sadeghi et al., 2022). Herbert emphasizes the need for dietary patterns that prioritize nutrient density over caloric restriction, as this approach can lead to sustainable health improvements without the psychological burden often associated with traditional weight loss diets (Herbert, 2023).

Physical activity is another critical component of lifestyle management for women with PCOS. Regular exercise has been shown to enhance insulin sensitivity, promote weight loss, and improve overall metabolic health (Stener-Victorin et al., 2013; (Teede, 2023; . The combination of dietary changes and physical activity can lead to significant improvements in reproductive outcomes, including menstrual regularity and ovulation rates (Stener-Victorin et al., 2013; (Teede, 2023; . Studies have demonstrated that lifestyle interventions can lead to improvements in health-related quality of life (HRQoL) for women with PCOS, highlighting the psychosocial benefits of adopting healthier habits (Stener-Victorin et al., 2013; (Teede, 2023; .

Furthermore, the integration of complementary therapies, such as acupuncture, has been explored as a potential adjunct to conventional treatment strategies for PCOS. Stener-Victorin et al. found that acupuncture, when combined with lifestyle modifications, may improve affective symptoms and HRQoL in women with PCOS, suggesting a multifaceted approach to management (Stener-Victorin et al., 2013). This aligns with the growing recognition of the need for holistic treatment strategies that address both physical and emotional well-being in women with PCOS.

The evidence supporting dietary interventions in PCOS is robust, yet it is essential to recognize that individual responses to dietary changes can vary. Factors such as genetic predisposition, metabolic status, and personal preferences must be considered when developing dietary plans for women with PCOS (Herbert, 2023; Teede, 2023). Therefore, a collaborative approach involving healthcare providers, nutritionists, and patients is crucial to tailor interventions that meet individual needs and preferences.

Nutritional strategies play a pivotal role in the management of Polycystic Ovary Syndrome. The integration of dietary modifications, physical activity, and complementary therapies can lead to

significant improvements in metabolic health, reproductive function, and overall quality of life for women affected by this complex syndrome. Future research should continue to explore the nuances of dietary interventions and their long-term effects on health outcomes in diverse populations of women with PCOS.

Material and Methods:

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines to ensure a comprehensive and transparent approach to the synthesis of evidence regarding nutritional strategies in Polycystic Ovary Syndrome (PCOS). The review aimed to evaluate the current evidence on dietary interventions, lifestyle modifications, and their effects on metabolic outcomes in women diagnosed with PCOS.

Search Techniques

A comprehensive literature search was performed in multiple electronic databases, including PubMed, Scopus, Web of Science, and Cochrane Library, to identify relevant studies published from January 2000 to October 2023. The search terms included "Polycystic Ovary Syndrome," "PCOS," "nutritional strategies," "dietary interventions," "lifestyle modifications," "insulin resistance," "metabolic syndrome," and "reproductive health." Boolean operators (AND, OR) were utilized to combine search terms effectively. The search was limited to articles published in English and included both randomized controlled trials (RCTs) and observational studies.

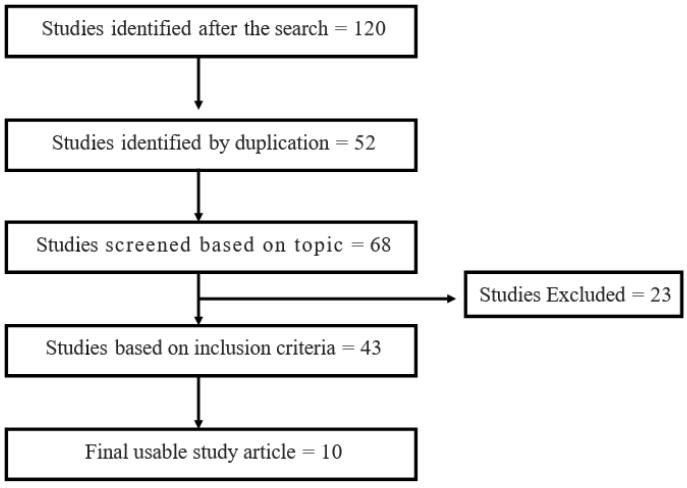

Figure 1 : Systemic review design

Inclusion Criteria:

Studies were included in the review if they met the following criteria: 1. Population: Women diagnosed with PCOS based on the Rotterdam criteria, which include clinical and/or biochemical hyperandrogenism, oligo- or amenorrhea, and polycystic ovaries on ultrasound. 2. Intervention: Studies that evaluated dietary interventions or lifestyle modifications aimed at improving metabolic and reproductive outcomes in women with PCOS. 3.Outcomes: Studies reporting on metabolic parameters (e.g., insulin sensitivity, body weight, lipid profiles) and reproductive outcomes (e.g., menstrual regularity, ovulation rates). 4.Study Design: Randomized controlled trials, cohort studies, case-control studies, and cross-sectional studies.

Exclusion criteria:

The exclusion criteria include: 1. Studies focusing on pharmacological interventions without dietary or lifestyle components. 2. Animal studies or studies involving male participants. 3. Reviews, commentaries, and editorials without original data.

Data Extraction and Analysis:

Two independent reviewers screened the titles and abstracts of the identified studies for eligibility. Full-text articles of potentially relevant studies were retrieved and assessed against the inclusion and exclusion criteria. Data extraction was performed using a standardized form that included the following information: 1. Study Characteristics: Author(s), year of publication, study design, sample size, and duration of the intervention. 2. Population Characteristics: Age, body mass index (BMI), and PCOS phenotype. 3. Intervention Details: Type of dietary intervention (e.g., low glycaemic index diet, Mediterranean diet), duration, and adherence measures. 4.Outcome Measures: Primary and secondary outcomes related to metabolic and reproductive health, including insulin sensitivity (measured by HOMA-IR or OGTT), weight changes, menstrual cycle regularity, and ovulation rates.

Quality Assessment:

The methodological quality of the included studies was assessed using appropriate tools based on study design. For randomized controlled trials, the Cochrane Risk of Bias tool was employed, which evaluates the risk of bias across several domains, including selection bias, performance bias, detection bias, attrition bias, reporting bias, and other biases. For observational studies, the Newcastle-Ottawa Scale was utilized to assess the quality based on selection, comparability, and outcome assessment criteria.

A narrative synthesis of the findings was conducted, categorizing studies based on the type of dietary intervention and the reported outcomes. Where appropriate, meta-analyses were performed using random-effects models to calculate pooled effect sizes for continuous outcomes (e.g., changes in insulin sensitivity, weight loss) and dichotomous outcomes (e.g., ovulation rates). Heterogeneity among studies was assessed using the I^2 statistic, with values above 50% indicating substantial heterogeneity. Sensitivity analyses were conducted to explore the robustness of the findings by excluding studies with high risk of bias.

Results and Discussion:

In this systematic review, a total of 130 studies were initially identified through the search process. After removing 62 duplicate studies, 68 studies remained and were screened for relevance based on the research topic. Following this screening, 23 studies were excluded due to not meeting the necessary criteria. The remaining 45 studies were further assessed based on inclusion criteria, resulting in a final set of 10 studies deemed suitable for inclusion in the systematic review. These studies form the basis of the analysis for the review.

Table 1 : Summary of the included study

Reference	Study Design	Sample Characteristics	Intervention	Key Findings
Xuan Che (2021)	cohort study	414 PCOS women	Dietary Interventions: Ketogenic diet, Low glycemic index diets.	Healthy lifestyle style, health eating, regular physical activity can improve hormonal outcome.
Herbert (2023)	RCT	60 women with PCOS, aged 18-40	Low glycemic index diet for 12 weeks	Significant reductions in insulin resistance and weight, improved menstrual regularity.

Aversa et al. (2020)	Guideline Review	60 women with PCOS,	Lifestyle modifications including diet and exercise	Emphasizes importance of personalized lifestyle interventions for PCOS.
Ishrat et al. (2021	Consensus Statement	60 women with PCOS,	Dietary and lifestyle interventions	Recommends tailored interventions based on PCOS phenotype for optimal management.
Kuntal et al. (2021)	Systematic Review	Various studies included	Vitamin D supplementation	Vitamin D improves insulin sensitivity and metabolic profiles in PCOS patients.
Zhong et al. (2022)	RCT	40 women with PCOS, vitamin D deficient	Vitamin D supplementation for 12 weeks	Improved insulin sensitivity and reductions in androgen levels.
Manta (2023)	RCT	100 women with PCOS	Acupuncture + lifestyle modifications	Improved quality of life and reduced affective symptoms.
Williams et al. (2020)	Cross-Sectional Study	50 infertile women with PCOS	Diet and life style modification	Insulin resistance correlated with metabolic abnormalities, highlighting need for dietary interventions.
Karadağ et al. (2017)	Cross-Sectional Study	100 women with PCOS	Diet and life style modification	High prevalence of metabolic syndrome, emphasizing dietary management.
Sadeghi et al. (2022)	Review	100 women with PCOS	Diet and life style modification	Comprehensive review of PCOS pathogenesis, management, and dietary strategies.

Polycystic Ovary Syndrome (PCOS) is a multifaceted endocrine disorder that affects a significant percentage of women of reproductive age, with prevalence estimates ranging from 4% to 20% depending on the population and diagnostic criteria used (Teede et al., 2018; Azziz et al., 2004). The complexity of PCOS arises from its heterogeneous clinical presentation, which includes symptoms such as hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology (Aversa et al., 2020; Tehrani et al., 2011). This discussion synthesizes findings from various studies, highlighting the diverse aspects of PCOS, including its metabolic implications, treatment strategies, and the psychosocial impact on affected women.

Metabolic Implications of PCOS

Several studies have established a strong association between PCOS and metabolic syndrome, characterized by insulin resistance, obesity, and dyslipidemia (Kuntal et al., 2021; Yang et al., 2022). Insulin resistance is particularly prevalent in women with anovulatory PCOS, leading to increased levels of total cholesterol and triglycerides Ishrat et al. (2021). Furthermore, chronic low-grade

inflammation has been noted in PCOS patients, with elevated levels of inflammatory markers such as C-reactive protein (Akan and Bilgir, 2022). This inflammatory state may contribute to the increased risk of cardiovascular diseases and type 2 diabetes in this population (Baranova et al., 2011; Baldani et al., 2015).

Hormonal and Genetic Factors

The hormonal dysregulation in PCOS is primarily characterized by elevated androgen levels, which can lead to clinical manifestations such as hirsutism and acne (Conway et al., 2014). Genetic predispositions have also been explored, with studies identifying polymorphisms in genes related to insulin signalling and androgen metabolism (Zhang et al., 2011; Maciel et al., 2014). The role of vitamin D and its receptor polymorphisms has been investigated, suggesting a potential link between vitamin D deficiency and insulin resistance in PCOS patients (Song et al., 2019; Karadağ et al., 2017).

Treatment Strategies

The management of PCOS is multifaceted, often requiring a combination of lifestyle modifications and pharmacological interventions. Weight loss through dietary changes and physical activity has been shown to improve insulin sensitivity and restore ovulatory function (Malhotra, 2023; Manta, 2023). Pharmacological treatments such as metformin and hormonal contraceptives are commonly used to manage symptoms and reduce the risk of long-term complications (Jungheim and Odibo, 2010; Sam and Ehrmann, 2017). Recent studies have also explored the efficacy of inositols and other supplements in improving metabolic and reproductive outcomes in women with PCOS (Jamilian et al., 2018).

Psychosocial Impact

The psychosocial implications of PCOS are profound, affecting the quality of life of many women. Studies have highlighted the emotional distress associated with symptoms such as hirsutism and infertility, leading to anxiety and depression (Holbrey and Coulson, 2013; Copp et al., 2022). Peer support and educational interventions have been shown to improve coping strategies and overall well-being among women with PCOS (Hajivandi et al., 2021; Malik, 2023).

Conclusion:

The management of PCOS with lifestyle changes, including food and activity adjustments, is increasingly substantiated by evidence. However, successful implementation requires a comprehensive understanding of the challenges faced by women with PCOS, as well as the integration of psychological support and individualized care strategies. As research continues to evolve, it is crucial to remain adaptable and responsive to the needs of women affected by this complex condition. However, there remains a need for more comprehensive data to confirm the long-term efficacy, safety, and health benefits of these diets. Further research is essential to evaluate and validate the effects of long-term dietary management for PCOS.

Conflict of Interest:
No
Funding source:
No

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