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Review Article

Empowering Young Women with Polycystic Ovary Syndrome through Food and Nutrition Literacy

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Abstract

Literature on Polycystic Ovary Syndrome (PCOS) suggests that women with PCOS have a higher prevalence of disordered eating behaviors, such as restrictive dieting and binge eating, and clinical eating disorders, compared to women without PCOS. Diet and nutrition are crucial for symptom control and lifestyle changes, including active lifestyle and dietary patterns. A comprehensive study on Food and Nutrition Literacy (FANLit) among women with PCOS and relevant healthcare organizations is yet to be fully explored. This study followed the PRISMA methodology to guide the review process and to explore FANLit in women with PCOS and the role of healthcare organizations in providing care and support. The findings show that adhering to healthy dietary principles, such as low low-calorie, low-glycemic diet, combined with lifestyle modifications, sleep improvement, and physical activity can help women with PCOS manage their physiological homeostasis and recover effectively. An integrated therapeutic approach is essential to reduce metabolic symptoms associated with PCOS. Improved nutritional literacy empowers women with PCOS to utilize food as a key strategy for symptom management, reducing reliance on medications. However, gaps in Health Literacy (HL) persist, as evidenced by the findings from this review. Functional HL issues include unsupported weight loss attempts and limited dietitian referrals, while interactive HL highlights the need for improved communication between healthcare professionals and patients, diagnostic clarity, and more tailored resources. These conclusions are derived from this PRISMA-guided scoping review that systematically analyzed relevant literature to map current knowledge and identify gaps in HL and FANLit for women with PCOS.

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Introduction

Polycystic Ovary Syndrome (PCOS) is the most prevalent endocrine dysfunction in young women during their reproductive years and involves reproductive, hormonal, and metabolic systems (Shi & Ma, 2022). According to the National Institutes of Health (NIH) 1990 guide and the Rotterdam 2003 criteria, the worldwide prevalence of PCOS ranges from 4 to 21% (Zhang et al., 2019). Particularly, the prevalence of PCOS around the world has been increasing rapidly each year (Shi & Ma, 2022). PCOS frequently occurs alongside compensatory hyperinsulinemia, obesity, insulin resistance, and a chronic low-grade

inflammatory state (Barrea et al., 2019). These endocrines and metabolic disorders result in a higher risk of disorders like infertility, obesity, cardiovascular disease, miscarriage, diabetes mellitus, obstructive sleep apnea, non-alcoholic fatty liver disease, depression, endometrial hyperplasia, endometrial cancer, among PCOS patients (Nizaruddin & Thayil, 2018). However, one must understand that PCOS can occur in thin as well as obese women (Barrea et al., 2021).

PCOS is a syndrome and only a single criterion is insufficient for its clinical diagnosis. The Rotterdam 2003 diagnostic criteria state that at least two of the following conditions needs to be true to diagnose PCOS: irregular androgen levels or lack of ovulation, signs of hyperandrogenism either clinically or biochemically, and the presence of polycystic ovaries (Rotterdam ESHRE/ASRM-Sponsored PCOS consensus workshop group, 2004). For the prevention and treatment of women with PCOS, environmental variables including eating habits are crucial. Given that obesity increases the clinical manifestation of PCOS, global recommendations suggest maintaining weight as one of the primary therapeutic approaches (Teede et al., 2018).

In most, but not all, previous literature, it is claimed that PCOS patients exhibit a greater frequency of eating behavior disorders (Dokras et al., 2018; Lee et al., 2019) and disordered eating (Naessén et al., 2019; Tay et al., 2019) than healthy women. According to earlier studies a majority of PCOS patients eat an unbalanced diet with shortfalls in zinc, omega-3 fatty acids, calcium, fiber, magnesium, and vitamins such as folic acid, vitamin C, vitamin B12, and vitamin D (Rasquin et al., 2017). An excess of sucrose, sodium, saturated fatty acids, total fats, and cholesterol was found in women diagnosed with PCOS (Szczuko et al., 2016). It was observed that these deficiencies could be managed via a diet with a reduced glycemic index and correct calories. Also, different supplements are available to manage their PCOS condition (Szczuko et al., 2021). Thus, diet and nutrition are essential elements in assisting women with PCOS symptom control along with lifestyle changes that include active lifestyle and dietary patterns. Studies that have surveyed diets and lifestyle patterns among women with PCOS found that they need information and correct dietary recommendations (Coleman & Bignell, 2023). Hence, healthcare organizations play a vital role in guiding them and providing proper instructions, supporting them by providing counseling, listening to their queries, and providing them with necessary information on food and nutrition for managing their PCOS. However, it was found that women with PCOS were dissatisfied with the support and service received from healthcare professionals (Lim et al., 2021).

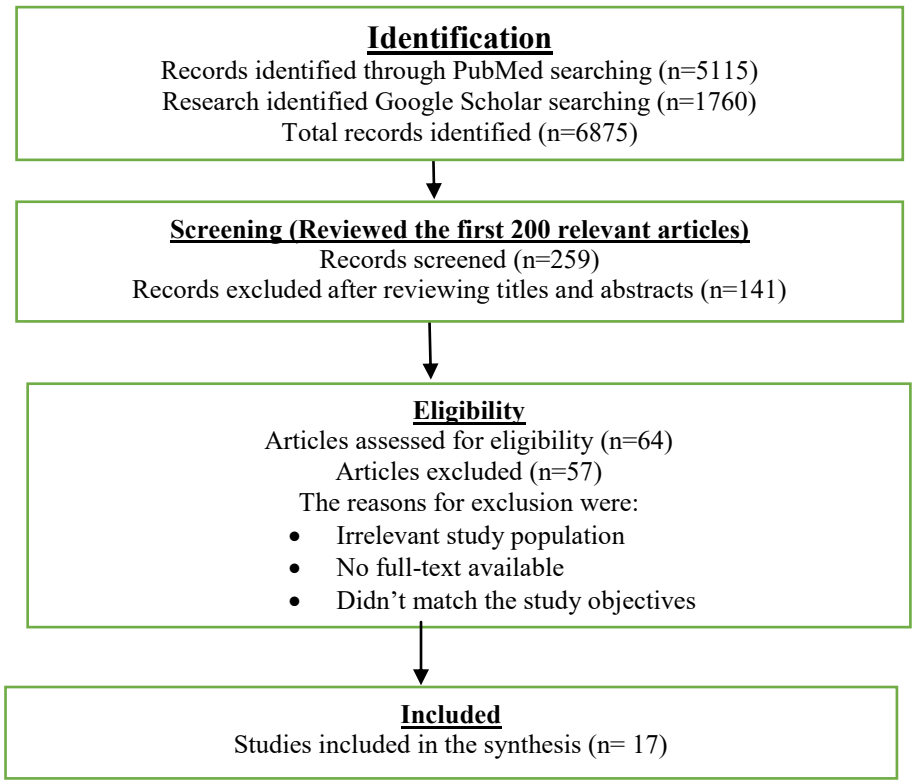
Comprehensive research on Food and Nutrition Literacy (FANLit) among women with PCOS and the relevant healthcare organizations is yet to uncover more. There is a need to explore FANLit among women with PCOS and the appropriate organizations to investigate the situation to strengthen the healthcare organizations and provide women with PCOS with all the care and support. Hence, ultimately empowering women to be in charge of managing their PCOS condition via acquiring correct knowledge and skills on food and nutrition. Therefore, this study aims to explore and establish the importance of FANLit in enhancing health outcomes for women with PCOS.

Methods

Articles were searched in PubMed and Google Scholar from August 2024 to October 2024. A rigorous search was done to include the most up-to-date relevant articles. Keywords such as food literacy, nutrition literacy, health literacy, food and nutrition literacy, polycystic ovary syndrome and polycystic ovary syndrome in young women, functional health literacy, interactive health literacy, critical health literacy, and food and nutrition were used while searching for the articles. Articles that aligned with the mentioned keywords and matched our study objectives were reviewed and selected for analysis. Inclusion criteria focused on studies that specifically addressed the role of food literacy (FL) and nutrition literacy (NL in managing PCOS in young women, particularly those emphasizing empowerment through HL. Both qualitative and quantitative studies were considered to provide a comprehensive understanding of how FANLiT can help young women manage their condition more effectively. Researches were critically evaluated for their methodological rigor, relevance, and contribution to the empowerment framework.

Figure 1

PRISMA Flow Diagram



Results

The Situation of Women with PCOS

It is proposed that PCOS, recognized as the most common endocrine disorder among young women, poses a risk factor for cardio-metabolic diseases (Pililis et al., 2024). PCOS

affects between 8-13% of women in the reproductive age group, with nearly 70% of cases remaining undiagnosed (WHO, 2023b). Increasing incidence has been related to having first-degree relatives with the condition, pre-pubertal obesity, either above or below the average birth weight for gestational age, congenital virilizing disorders, premature adrenarche, and the use of valproic acid as an antiepileptic medication (Rasquin et al., 2017).

The major causes of death for women, cardio-metabolic disorders like myocardial infarction, type 2 diabetes (Wekker et al.), and stroke, have been linked to PCOS as a particular female reproductive risk factor (Pililis et al., 2024; Wekker et al., 2020). Obesity frequently follows PCOS and approximately 50% of women with PCOS are classified as obese. Obesity and weight increase exacerbate insulin resistance and, in turn, the general characteristics of PCOS (Sam, 2007). In addition, women with PCOS often experience gonadotropin hormonal synthesis disorders. The impacts of PCOS, especially regarding weight issues, obesity, and infertility, are not only biological but can also affect the patient's mental health (WHO, 2023b).

The metabolic pathways associated with PCOS involve insulin production and function, the encoding of steroid hormone synthesis, and various hormonal and metabolic processes (Szczuko et al., 2021). Up to 20% of women facing infertility issues, including reduced fertility and early pregnancy loss, have been diagnosed with PCOS (Barthelmess & Naz, 2014). It is referred to be the primary cause of anovulation and infertility in women (WHO, 2023b).

Importance of Food and Nutrition for Women with PCOS

Individuals of all body sizes can suffer from PCOS. For those who are overweight, weight loss can improve PCOS symptoms. However, this can be challenging for those struggling with insulin resistance, food cravings, and binge eating. It is vital to avoid restrictive diets and instead focus on mindful nutrition intake (British Dietetic Association, 2024). A well-structured diet can facilitate quick recovery, improve quality of life, and promote longevity of the patient (Szczuko et al., 2021).

Maintaining a consistent, varied, and balanced diet is necessary to maintain health and well-being. Consuming low glycemic index (Zhang et al.) food (such as wholegrain) and omega-3-rich sources (like oily fish, walnuts, and flaxseed) can improve bodily functions and reduce inflammatory symptoms commonly observed in women with PCOS (British Dietetic Association, 2024). Calorie control leading to a 5% to 15% weight loss can significantly enhance insulin sensitivity, fertility reproductive functions, and androgen levels in women with PCOS. Increasing the soluble fiber intake can help delay digestion, gastric emptying, and absorption of nutrients (Aryaeian et al.) and increase fullness (Salleh et al., 2019).

Moreover, plant-based foods high in dietary fiber support glycemic control, improve acute insulin effectiveness and secretion and mitigate hyperglycemia. In young PCOS patients, these dietary changes yield numerous health benefits, including a lower risk of diabetes (Aryaeian et al., 2017; Dinicola et al., 2017). A study has observed the association between the disorder of gut microbes and PCOS, highlighting its role in developing insulin resistance and metabolic disorders in the affected women. Hence, high fiber and low carbohydrate diet improves gut microbial function, improves the gut barrier, and lowers the danger of long-term low-grade inflammation (Calcaterra et al., 2021).

Regulating gut bacteria could be a possible additional treatment for managing PCOS, as improving gut health could have a significant role in improving the condition (Giampaolino et al., 2021). Increasing the intake of probiotics and symbiotic (such as yogurt, fermented foods with fiber-rich vegetables, and kefir) in women with PCOS helps in improving hormonal as well as inflammatory symptoms that could address metabolic issues associated with the condition (Calcaterra et al., 2021). Conversely, some saturated fat-rich animal-based foods are associated with an acid-base imbalance that can lead to pancreatic cell dysfunction or even death (Acosta-Montaño & García-González, 2018).

Food and Nutrition Literacy (FANLit)

From a diagnostic as well as therapeutic perspective, PCOS is a challenging clinical issue. Nutritional treatment is among the primary approaches for managing this condition in women. A Personalized nutrition plan can effectively help to improve the signs and symptoms associated with PCOS by optimizing both the metabolic and reproductive functions through careful balance of the macronutrient and micronutrient intake within the diet composition (Calcaterra et al., 2021).

NL and FL are complementary terms and fall under the umbrella term of health literacy (HL). FL is the capacity to decide the right food that maintains the well-being of women with PCOS, while NL is the capability to obtain, manage, and interpret information necessary for determining appropriate nutrient intake. Thus, FL refers to a wider range of expertise and abilities aimed at making wise decisions to mitigate the consequences of PCOS, whereas NL serves as a foundation to gain that understanding (Mohsen et al., 2022; Vettori et al., 2019).

Young women can learn to maintain a good diet (Suri & Ashok, 2022). These two forms of literacy are interconnected terms that are associated with the capacity to comprehend and use knowledge about food. Specifically, NL helps to understand the roles different nutrients play in sustaining a healthy diet and making informed food choices. In contrast, FL assists individuals in understanding the social dimensions of food including, its production, origin, and cultivation, as well as how these factors influence the overall well-being of PCOS patients (Silva, 2023).

Understanding food and nutrition is crucial as it encourages mindful eating and helps to prevent prolonged illnesses like diabetes, obesity, and heart disease. By empowering women with PCOS to make better food choices, the serious consequences of these conditions can be alleviated, ultimately enhancing the overall health outcomes (Silva, 2023). Given that PCOS requires an interdisciplinary approach, it requires collaboration among gynecologists, endocrinologists, primary care providers, mental health specialists, and nutrition experts, health educators, particularly dietitians to provide immediate care and address the chronic risk factors linked to the comorbidity of PCOS (Nemchikova & Frontoni, 2022).

FANLit for Empowering Women with PCOS

The PCOS Evidence-Based Clinical Guidelines recommend personal development strategies including behavioral and nutritional interventions as well as physical activity as the primary treatment for maintaining a healthy weight, achieving hormonal balance, enhancing metabolic and reproductive functions, and enhancing the quality of life for young women

diagnosed with PCOS. However, many women struggle to adhere to lifestyle management practices (Pirotta et al., 2022). FANLit empowers women with PCOS to make an individualized meal plan, manage calorie intake for weight loss as well as maintain a balanced nutrient composition in their diets to improve insulin resistance, reproductive health, and metabolic functions(Calcaterra et al., 2021).

By adhering to healthy dietary principles, women with PCOS can efficiently manage their physiological homeostasis and obtain fast recovery. An integrated therapeutic approach is essential to reduce the metabolic symptoms associated with PCOS. Interventions aimed to lessen the PCOS symptoms depend upon adjustable factors, including the adoption of a low-calorie diet with a lower glycemic index, along with improvements in lifestyle, sleep patterns, and physical activity (Szczuko et al., 2021). Research has shown that following a Low Glycemic Index (Salleh et al.) diet helps in relieving insulin resistance making such dietary interventions advisable for all PCOS patients (Porchia et al., 2020; Shang et al., 2020).

FANLit has a significance in enabling PCOS patient to make informed eating habits that is beneficial for their health(Silva, 2023). In a society where convenience and snack foods are frequently more readily available than healthy alternatives, enhancing health literacy can significantly improve women's general health and wellness. Additionally, it can aid in the prevention of long-term illnesses commonly associated with PCOS like heart disease, obesity, and type 2 diabetes, which are frequently linked to unhealthy eating habits (Hillier-Brown et al., 2017).

To make an informed health-related decision, both knowledge and skills in nutrition, as well as a comprehensive understanding of health and wellness, are essential (Silva, 2023). Utilizing web-based social networks can facilitate interaction, provide access to educational materials, and encourage participation in nutritional challenges; this fosters a supportive community focused on improving dietary choices and health outcomes (Azevedo et al., 2019). A bilingual mobile LN intervention known as Nutricity is a practical addition to a healthcare setting such as a clinic. It is feasible as an intervention tool during wait times to deliver much-needed prophylactic instructions that are frequently absent in regular interactions. This initiative might be beneficial as it engages women with PCOS who are already actively involved in managing their healthcare (Gibbs et al., 2018).

Improved nutritional literacy empowers women with PCOS to utilize food as a key strategy for symptom management, reducing the reliance on medications. This means increasing knowledge of how particular nutrients, meal timings, and food choices affect hormone regulation, insulin sensitivity, inflammation, and overall metabolic health. For instance (Bykowska-Derda et al., 2021).

Blood Sugar and Insulin Control

Familiarity with low-glycemic foods (like whole grains and fiber-rich vegetables) enables women to stabilize their blood sugar levels and reduce insulin resistance, which is a usual PCOS symptom. Blood sugar level control can reduce the need for medications like insulin-sensitizing drugs.

Diet and Hormone Balance

Selecting foods that support hormonal health (like omega-3 fatty acids, lean proteins, and B vitamins), can help women promote hormonal balance naturally, potentially alleviating indications like acne, irregular menstrual cycles, and hypertrichosis.

Anti-inflammatory Foods

Most women with PCOS experience chronic inflammation. FANLit guides them in choosing foods (such as nuts, berries, and leafy greens) that are anti-inflammatory and lower the risk of worsening PCOS symptoms.

Long-term Weight Management

Women gain skills in portion control, balancing macronutrients, and meal planning, which contribute to effective and sustainable weight control. Proper weight management can lower the likelihood of developing related conditions like diabetes and heart disease, and reduce further complications.

Alleviating Secondary Symptoms

Understanding the impact of vital vitamins and minerals (such as magnesium and zinc) can help reduce mood swings, fatigue, and other secondary symptoms. This comprehensive approach to managing the symptoms allows women to address the issues that medications alone might not fully resolve.

Many researchers have coined particular conceptualizations of the words FL and NL, but there is currently no specific consensus on the definitions for these terms (Vettori et al., 2019). The concepts for FL and NL originated from HL (Krause et al., 2018). There is very little research done on HL among women with PCOS (Al-Ruthia et al., 2017; Lim et al., 2021). Barriers were reported at three different levels of HL (functional, interactive, and critical) among women with PCOS in Australia based on their experiences in lifestyle and weight loss (Lim et al., 2021) as discussed below:

Functional HL

In functional HL, women with PCOS were found to use varied methods for losing weight most often with minimal or no advice and assistance from health personnel. Additionally, low referral rates to dieticians were observed among women with PCOS.

Interactive HL

A considerable need for interactive HL, as evidenced by women's disappointment at feeling unsupported or misunderstood by their healthcare practitioners was reported in the study. There were problems with PCOS diagnostic delays or uncertainty, inadequate information, and inadequate communication between healthcare professionals and PCOS patients. Hence, suggesting a need for training and resources on managing PCOS to healthcare professionals. Most importantly it emphasizes the demand for means to empower young women diagnosed with PCOS by enabling them to communicate their wellness concerns to the respective medical experts.

Critical HL

None of the participants in the study connected their prior achievements in lifestyle and weight management to a close working relationship with a healthcare provider, including taking part in collaborative decision-making and helping to build health management plans.

Discussion

PCOS is a challenging clinical issue, and nutritional treatment is crucial for women. A personalized nutrition plan can improve symptoms by optimizing metabolic and reproductive functions. We found that improved nutritional literacy helps women with PCOS manage symptoms by focusing on food choices and nutrients. This includes controlling blood sugar, promoting hormonal balance, choosing anti-inflammatory foods, managing long-term weight, and addressing secondary symptoms. The results likewise show that FANLit also helps in reducing the risk of related conditions like diabetes and heart disease.

This study found that FL and NL are complementary terms, focusing on making informed food choices and understanding the social dimensions of food. Recently, the significance of FL (Barrea et al., 2021)and NL (Liu et al.) in maintaining human health has been acknowledged, leading to their recent definition (Vettori et al., 2019). The origins of FL and NL can be traced back to health literacy (Zhang et al.) (Krause et al., 2018). This is because people require specific knowledge and skills to navigate the complex food environment that surrounds them (Vettori et al., 2019). As quoted by the World Health Organization, HL is referred to as the ability of an individual to "gain access to, understand and use information in ways which promote and maintain good health" (WHO, 2023a; Nutbeam & Kickbusch, 1998).

The concepts of FL and NL have evolved over time. However, FL generally includes understanding and ability to make informed food choices and a person's mindful eating habits, and actions (Vettori et al., 2019). FL comprises the necessary knowledge and understanding that enables individuals to utilize food to maintain healthy nutrition and a balanced diet. Therefore, FL encompasses a wide range of awareness, skill, practices, and actions (Vidgen & Gallegos, 2014). NL is a measure of individuals' capacity to gain, practice, and comprehend diet and nutrition information, and access the services required for effective dietary choices (Vettori et al., 2019). Both definitions emphasize the empowerment of individuals by making them capable of decision-making. Likewise, various meanings of FL and NL are directed to three literacy levels as described in Nutbeam's tripartite model (Nutbeam, 2000, 2008) that are functional, interactive, and critical.

Basic knowledge and skills to gain information and understanding about facts, processes, and techniques, are all part of functional literacy (Vettori et al., 2019). In the general population, lower functional health literacy has been linked to higher body mass index (Cheng et al., 2018), and a similar result was noted among women with PCOS (Al-Ruthia et al., 2017). Interactions with other people, opportunities to communicate, discuss, and exchange information, as well as opportunities to take part in group activities, are all taken into account in interactive literacy (Vettori et al., 2019). Diet and physical exercise behavior in the general population has been associated with interactive health literacy like creating a supportive environment for well-being or the ability to contact healthcare professionals (Friis et al., 2016).

The critical level is concerned with evaluating information critically and comprehending how food affects the socioeconomic and environmental spheres. It also involves measures addressing the sustainability of the food production system and obstacles to human nutritional health (Vettori et al., 2019).

The phrase "Food and Nutrition Literacy" has been created because of the complexity of the dietary setting, which calls for the development of specialized knowledge and skills (Samruayruen & Kitreerawutiwong, 2022; Vettori et al., 2019). Literature from the past suggests that FANLit is an important element in enhancing food choice and maintaining a proper eating pattern that is linked to nutrient delivery (Doustmohammadian et al., 2020; Feyzabadi et al., 2017; Liu et al., 2021). Nutritional status is associated with proper food consumption in the correct quantity and the right amount adhering to the daily vital nutrients recommendation because food is a multifaceted mixture of nutrients and other vital substances to maintain good health (Tapsell et al., 2016). As a result, FANLit has been highlighted as an important component in fostering and sustaining the adoption of healthy dietary behaviors (Krause et al., 2018).

Research on HL among women with PCOS reveals barriers at functional, interactive, and critical levels. Functional HL often lacks guidance and support, while interactive HL faces issues like diagnostic delays and communication issues. Critical HL lacks close working relationships. Improved FANLit can aid women with PCOS in managing symptoms, promoting hormone regulation, and managing long-term weight, but research on functional, interactive, and critical levels of HL is limited. Undoubtedly, there is a greater need for HL at healthcare organizations to manage their PCOS patients. As the concepts for FL and NL utilize the concept of HL as mentioned in previous literature (Nutbeam, 2000, 2008), it becomes important to explore these levels of literacy in managing PCOS. It is also necessary to understand the perspectives of women with PCOS on FL and NL in managing their conditions.

FANLit is a new concept that is being used more frequently in various programs and studies. Despite the rigorous research expanding in this field, progress is impeded due to the shortage of a recognized procedure for measuring FANLit (Doustmohammadian et al., 2017). The definition of FANlit has been investigated in several contexts, including the educational syllabus, culinary culture, food promotion, and political and social environments, and many different groups of varying ages (Samruayruen & Kitreerawutiwong, 2022). However, there is a limited exploration of FANLit in the context of women with PCOS, and it lacks a solid tool to measure FANLit in this area. As food and nutrition play a significant role in the health conditions of women with PCOS the perspectives of young women with PCOS and stakeholders towards FANLit are equally important to understand. However, these establishments are not found to be well-defined.

Conclusion

PCOS can be a challenging condition for many women, impacting not just their reproductive health but also their overall well-being. A key to managing PCOS effectively lies in understanding and utilizing FANLit. This concept empowers women by helping them make informed dietary choices, adopt healthier eating habits, and reduce the risk of related health

issues like obesity and diabetes. Unfortunately, many women face obstacles in accessing clear nutritional information and receiving adequate support from healthcare providers, which can lead to frustration and confusion. To improve this situation, we need standardized tools to assess FANLit specifically for women with PCOS, as well as educational resources that leverage digital platforms and community support. Looking ahead, research should focus on refining our understanding of FANLit and finding practical ways to integrate it into healthcare systems. By prioritizing education and self-empowerment, we can create a more supportive environment for young women with PCOS, ultimately enhancing their quality of life and health outcomes.

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Conflict of Interest

None.

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Authors' Contribution

SM conceptualized the article and prepared the draft together with BA. BA aided in finalizing the manuscript for submission and corresponded with the publication procedures. SS maintained in the literature review, citations, and fine-tuning. All authors provide final approval for the manuscript to be published.

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