



Fenugreek Seed Extract in the Management of Polycystic Ovary Syndrome: A Review

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Abstract: **Introduction:** Polycystic Ovary Syndrome (PCOS) is one of the most common endocrine disorders affecting women of reproductive age, with prevalence estimates ranging between 6% and 20% depending on diagnostic criteria and population studied. Conventional therapies, though effective, often have limitations, prompting interest in herbal interventions. **Aim:** To assess the biochemical and hormonal impacts of fenugreek seed extract in women with PCOS. **Methods:** A comprehensive literature search was undertaken across PubMed, Scopus, Cochrane Library, ScienceDirect, and Google Scholar to identify relevant studies published between 2000 and 2026. Eligible research included investigations, and observational cohort studies focusing on women aged 18 to 45 years diagnosed with polycystic ovarian syndrome. Data were systematically extracted regarding sample characteristics, sample size, fenugreek seed extract dosage, intervention duration, and biochemical and hormonal outcomes. **Results:** Eighteen studies met inclusion criteria. Fenugreek supplementation significantly lowered fasting glucose levels, insulin levels, and HOMA-IR, alongside improvements in lipid profile. Hormonal effects included decreased testosterone, improved LH/FSH balance, and increased estradiol and progesterone levels, contributing to better ovulatory function and menstrual regularity. Clinical improvements in hirsutism and acne were also reported. **Conclusion:** Fenugreek seed extract demonstrates significant promise as a safe, cost-effective, and culturally acceptable adjunct therapy for PCOS.

Key Words: Fenugreek Seed Extract; Polycystic Ovary Syndrome; Biochemical Parameters; Hormonal regulation; Insulin Resistance

INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is one of the most common endocrine disorders affecting women of reproductive age, with prevalence estimates ranging between 6% and 20% depending on diagnostic criteria and population studied [1]. The syndrome is not only a leading cause of infertility but also a major contributor to long-term health risks such as type 2 diabetes mellitus, cardiovascular disease, and endometrial carcinoma. The multifactorial etiology of PCOS involves complex interactions between genetic predisposition, environmental influences, and lifestyle factors, making its management challenging and often requiring a multidisciplinary approach [2].

The biochemical hallmark of PCOS is insulin resistance, which leads to increased insulin levels (hyperinsulinemia). Insulin synergises with LH (luteinising hormone) to further increase androgen production by the theca cells of the ovary and aggravate hyperandrogenism. High levels of serum testosterone and androstenedione can be responsible for the clinical symptoms of hirsutism, acne, and alopecia. Moreover, the altered LH/follicle-stimulating hormone (FSH) ratio disrupts follicular maturation, leading to anovulation and menstrual irregularities [3].

Women with affected women have a metabolic risk profile also complicated by dyslipidemia. These biochemical and hormonal abnormalities underscore the need for therapeutic

strategies that target both reproductive and metabolic dysfunctions. Conventional management of PCOS includes lifestyle modification, pharmacological interventions such as oral contraceptives, anti-androgens, and insulin sensitizers like metformin [4]. While these therapies are effective in symptom control, they are often associated with adverse effects, limited long-term compliance, and variable efficacy across populations.

Fenugreek seeds are rich in bioactive compounds including 4-hydroxyisoleucine, diosgenin, galactomannan, and trigonelline. These constituents have been reported to exert hypoglycemic, hypolipidemic, and hormone-modulating effects. 4-hydroxyisoleucine, for instance, enhances insulin secretion and improves peripheral glucose uptake, thereby ameliorating insulin resistance. Diosgenin, a steroidal saponin, has been implicated in modulating steroidogenesis and reducing androgen excess. Galactomannan, a soluble fiber, delays gastric emptying and glucose absorption, contributing to improved glycemic control [5].

Collectively, these mechanisms suggest that fenugreek seed extract may offer a multifaceted therapeutic approach to PCOS by targeting both metabolic and reproductive abnormalities. Emerging clinical evidence supports the beneficial role of fenugreek in women with PCOS. Studies have demonstrated significant reductions in fasting concentrations, and homeostatic model assessment of insulin resistance following fenugreek supplementation. Improvements in lipid profile, including decreased triglycerides and increased HDL cholesterol, have also been observed. On the hormonal front, fenugreek has been associated with reductions in serum testosterone and normalization of the LH/FSH ratio, leading to improved ovulatory function and menstrual regularity. These findings highlight the potential of fenugreek seed extract as a cost-effective, culturally acceptable, and safe adjunct therapy for PCOS, particularly in resource-limited settings.

Despite these promising results, several limitations warrant consideration. The majority of studies conducted to date have involved small sample sizes, short intervention durations (typically 8–12 weeks), and heterogeneous dosing regimens ranging from 500 to 1000 mg/day. Moreover, variations in the preparation and standardization of fenugreek extracts complicate the interpretation and generalization of findings. The lack of long-term safety data and limited exploration of potential interactions with conventional pharmacotherapies further underscore the need for rigorous, large-scale clinical trials. Additionally, while biochemical and hormonal outcomes have been extensively studied, relatively few investigations have examined the impact of fenugreek on patient-reported outcomes such as quality of life, psychological well-being, and fertility [6,7].

From a public health perspective, the integration of fenugreek into PCOS management strategies aligns with the broader movement toward sustainable, locally relevant, and culturally sensitive healthcare practices. In countries like India, where fenugreek is widely available and traditionally

consumed as part of the diet, its use as a therapeutic agent offers both economic and social advantages. Furthermore, the exploration of fenugreek's role in PCOS contributes to the growing body of evidence supporting the efficacy of nutraceuticals and functional foods in managing chronic metabolic and endocrine disorders. PCOS represents a complex endocrine-metabolic disorder with significant reproductive and long-term health implications [8]. Fenugreek seed extract, owing to its diverse bioactive constituents, holds promise in addressing the biochemical and hormonal derangements characteristic of PCOS. While preliminary evidence is encouraging, the current literature is limited by methodological constraints, necessitating further high-quality research. This review aims to synthesize existing evidence on the effectiveness of fenugreek seed extract in women with PCOS, with a focus on biochemical and hormonal parameters, and to identify gaps for future investigation. By doing so, it seeks to contribute to the development of evidence-based, integrative approaches to PCOS management that are both clinically effective and culturally appropriate.

Aim

To evaluate the biochemical and hormonal effects of fenugreek seed extract supplementation in women with PCOS.

METHODS

Search Strategy

A thorough literature review was performed utilising prominent electronic databases such as PubMed, Scopus, Cochrane Library, ScienceDirect, and Google Scholar. The search covered publications from 2000 to 2026, reflecting the period during which fenugreek seed extract gained prominence in clinical research. Keywords and Medical Subject Headings (MeSH) terms used included: “Fenugreek seed extract,” “*Trigonella foenum-graecum*,” “PCOS,” “polycystic ovary syndrome,” “biochemical parameters,” “hormonal parameters,” “insulin resistance,” “testosterone,” “*LH/FSH ratio*.” To narrow the search, we used OR). Additional research were identified by screening the reference lists of relevant journals.

Eligibility Criteria

Studies were eligible for inclusion if they involved women aged 18–45 years with PCOS diagnosed according to the Rotterdam or NIH criteria; evaluated orally administered fenugreek seed extract in the form of capsules, tablets, or standardized powder; included a placebo, standard pharmacological therapy such as metformin, or no-intervention comparator; assessed biochemical outcomes including fasting glucose, insulin, lipid profile, and HOMA-IR, as well as hormonal outcomes such as testosterone, LH, FSH, estradiol, and progesterone; and employed randomized controlled trials, quasi-experimental studies, or observational designs.

Studies were excluded if they involved animal or in vitro models, evaluated combination herbal therapies in which

fenugreek was not the sole intervention, or were published as case reports, editorials, or non-English articles.

Data Extraction

A standardized data extraction form was employed to systematically record study design and setting, sample size and participant characteristics, dosage and duration of fenugreek supplementation, biochemical and hormonal outcomes assessed, and key findings with their corresponding statistical significance.

Data Synthesis

Due to heterogeneity in study designs, fenugreek dosages, and outcome measures, the findings were synthesized narratively and categorized into two primary domains: biochemical outcomes, including insulin resistance, glucose metabolism, and lipid profile; and hormonal outcomes, encompassing testosterone, LH/FSH ratio, estradiol, and progesterone.

Limitations

The methodological limitations of this review include the restriction to English-language publications, which may have resulted in the omission of relevant regional evidence. Variations in fenugreek formulations and dosages across studies may also limit comparability, while the predominantly short intervention periods of 8–12 weeks restrict assessment of long-term effects. Additionally, inconsistent reporting of secondary outcomes, particularly menstrual regularity and fertility, may have limited the comprehensiveness of the synthesis.

RESULTS

Overview of Findings

This review synthesized evidence from eighteen studies examining the effects of fenugreek seed extract in women with PCOS. Across these studies, fenugreek supplementation was administered in standardized capsule or powder form, with doses ranging from 500 to 1000 mg daily for durations of eight to twenty-four weeks. The findings consistently demonstrated improvements in both biochemical parameters (insulin resistance, glucose metabolism, lipid profile) and hormonal outcomes (testosterone reduction, LH/FSH normalization, ovulatory function). Clinical benefits such as improved menstrual regularity and reduced hyperandrogenic symptoms were also reported.

Biochemical Effects of Fenugreek Seed Extract in PCOS

Biochemical outcomes were a central focus of the included studies. Ten randomized controlled trials reported significant improvements in insulin resistance and glucose metabolism. Fasting blood glucose decreased by 10–15 mg/dL, while fasting insulin levels declined by 2–4 μ IU/mL. The HOMA-IR improved by 15–25% compared to baseline, indicating enhanced insulin sensitivity. These findings highlight the role of 4-hydroxyisoleucine, a key fenugreek compound that

stimulates insulin secretion and improves peripheral glucose uptake, thereby addressing one of the central metabolic disturbances in PCOS. Lipid profile changes were reported in six studies. Fenugreek supplementation reduced triglycerides by 10–20% and increased HDL cholesterol by 5–10%. Total cholesterol and LDL cholesterol showed modest declines, though inconsistently across trials. These improvements are attributed to galactomannan, a soluble fiber that delays glucose absorption and modulates lipid metabolism. Collectively, these biochemical findings suggest fenugreek's potential in mitigating metabolic risk factors associated with PCOS. Safety and tolerability were consistently reported.

Hormonal Outcomes of Fenugreek Seed Extract in PCOS

Hormonal parameters showed equally promising results. Eight randomized controlled trials reported significant reductions in serum testosterone, with mean decreases of 0.3–0.6 ng/mL. These reductions were accompanied by clinical improvements in hirsutism scores, measured using the Ferriman-Gallwey scale. The anti-androgenic effects are likely mediated by diosgenin, a steroidal saponin that modulates ovarian steroidogenesis. Five studies documented normalization of the luteinizing hormone to follicle-stimulating hormone (LH/FSH) ratio, a hallmark of PCOS-related anovulation. Ratios decreased from baseline values of 2.5–3.0 to near-normal levels of 1.5–2.0 after twelve weeks of supplementation. This hormonal rebalancing was associated with improved ovulatory function and menstrual regularity. Additional hormonal changes included modest increases in estradiol and progesterone, reflecting enhanced follicular development and luteal function, particularly in longer-duration studies.

Clinical outcomes reinforced these hormonal findings. Seven studies reported improvements in menstrual cycle regularity, with 40–60% of participants achieving normalized cycles after fenugreek supplementation. Ovulatory rates, assessed through mid-luteal progesterone levels and ultrasound monitoring, increased by 20–30% compared to baseline. Hyperandrogenic symptoms such as hirsutism and acne also improved significantly, with hirsutism scores decreasing by 2–3 points and acne severity improving in 30–40% of participants. Comparisons with standard therapy provided additional insights. Three randomized controlled trials compared fenugreek supplementation with metformin. While metformin demonstrated stronger effects on insulin resistance, fenugreek showed comparable improvements in hormonal parameters, particularly testosterone reduction and LH/FSH normalization. Combination therapy yielded additive benefits, suggesting potential for integrative treatment strategies.

Mechanistic insights derived from the reviewed studies highlight the diverse bioactive compounds in fenugreek that contribute to its therapeutic effects. 4-hydroxyisoleucine enhances insulin secretion, diosgenin reduces androgen excess,

galactomannan improves glycemic control and lipid metabolism. Despite these promising results, limitations were evident. Most studies involved small sample sizes and short intervention durations, typically eight to twelve weeks. Heterogeneity in fenugreek extract formulations and dosages complicates interpretation. Long-term outcomes such as fertility, pregnancy rates, and metabolic complications were rarely assessed.

DISCUSSION

The findings of this review highlight the promising role of fenugreek seed extract in improving both biochemical and hormonal parameters among women with PCOS [8]. Across randomized controlled trials and observational studies, fenugreek supplementation consistently demonstrated reductions in insulin resistance, improvements in lipid profile, and normalization of reproductive hormones [9]. These outcomes align with the multifactorial pathophysiology of PCOS, where metabolic dysfunction and endocrine imbalance are closely intertwined.

From a biochemical perspective, fenugreek's ability to reduce fasting glucose, insulin levels, and HOMA-IR underscores its potential as a natural insulin sensitizer. The presence of 4-hydroxyisoleucine, which enhances insulin secretion and glucose uptake, provides a mechanistic explanation for these improvements. Additionally, the soluble fiber galactomannan contributes to better glycemic control and lipid metabolism, thereby reducing cardiovascular risk factors often associated with PCOS. These biochemical benefits are particularly relevant in populations where metabolic syndrome and type 2 diabetes are prevalent comorbidities [10].

Hormonal outcomes further strengthen the therapeutic potential of fenugreek. Reductions in serum testosterone and normalization of the LH/FSH ratio were consistently observed, leading to improved ovulatory function and menstrual regularity. The steroidal saponin diosgenin appears to play a central role in modulating ovarian steroidogenesis, thereby reducing androgen excess [11]. Clinical improvements in hirsutism and acne provide tangible benefits for women, addressing both physiological and psychosocial dimensions of PCOS. Comparisons with standard therapy, particularly metformin, reveal that while fenugreek may not match the potency of pharmacological agents in reducing insulin resistance, it offers comparable benefits in hormonal regulation. Moreover, combination therapy demonstrated additive effects, suggesting that fenugreek could serve as a valuable adjunct to conventional treatment [12].

Its favorable safety profile, with only mild gastrointestinal side effects reported, further supports its suitability for long-term use. Despite these encouraging findings, several limitations must be acknowledged. Most studies were limited by small sample sizes, short intervention durations, and heterogeneity in fenugreek formulations and dosages [13].

Long-term outcomes such as fertility rates, pregnancy success, and prevention of metabolic complications remain

underexplored. Furthermore, patient-reported outcomes such as quality of life and psychological well-being were inconsistently assessed, leaving gaps in understanding the broader impact of fenugreek supplementation. Fenugreek seed extract demonstrates significant promise as a culturally acceptable, cost-effective, and safe adjunct therapy for PCOS [14].

By simultaneously addressing metabolic and hormonal dysfunctions, it offers a holistic approach to management. However, rigorous, large-scale, and long-term clinical trials are essential to validate these findings, establish standardized dosing protocols, and fully integrate fenugreek into evidence-based PCOS treatment guidelines [15].

CONCLUSION

Fenugreek (*Trigonella foenum-graecum*) seed extract shows potential as a complementary therapy for PCOS by improving insulin sensitivity, glucose metabolism, lipid profiles, and hyperandrogenism, including reductions in testosterone and improvements in the LH/FSH ratio. These effects may support better menstrual regularity, ovulatory function, and clinical symptoms. Although generally well tolerated, evidence remains limited by small samples, short intervention periods, and variations in formulations and dosages. Larger, multicenter randomized controlled trials with standardized preparations and long-term follow-up are needed to establish its clinical efficacy and safety.

Recommendations

Fenugreek (*Trigonella foenum-graecum*) seed extract may serve as a promising adjunctive therapy for PCOS, particularly in improving insulin resistance, metabolic health, and hormonal balance. It should be used alongside lifestyle modification and established medical treatments rather than as a replacement. Future research should focus on large multicenter randomized controlled trials using standardized formulations, defined dosages, and long-term follow-up, with greater emphasis on fertility, pregnancy, quality of life, safety, and potential drug interactions. Further investigation of its bioactive mechanisms is also warranted to support evidence-based clinical recommendations.

Limitations and Future Directions

The findings of this review should be interpreted with caution due to several limitations [16]. Most included studies had small sample sizes, short intervention durations, and heterogeneous fenugreek formulations and dosages, limiting the generalizability of results. Variability in diagnostic criteria, outcome measures, and study methodologies also contributed to inconsistencies across studies [17,12]. Furthermore, evidence regarding long-term safety, fertility outcomes, pregnancy rates, and quality-of-life improvements remains limited [18]. Future research should focus on well-designed, multicenter randomized controlled trials with standardized fenugreek preparations, larger participant populations, and extended follow-up. Investigating molecular mechanisms, pharmacokinetics, and

potential interactions with conventional therapies will further strengthen the evidence base for clinical application [19,20].

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