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Herbal Interventions for Polycystic Ovary Syndrome: A Narrative Review of Clinical Evidence

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ABSTRACT

Polycystic ovary syndrome is a common and heterogeneous endocrine condition, and many women turn to herbal preparations alongside, or instead of, conventional care. This narrative review asks what clinical evidence exists for such preparations and how much weight it can bear. It draws on published guidelines, reviews and trials covering berberine, cinnamon, spearmint, chasteberry, licorice and fenugreek, together with work on product quality, safety and trial design, and it reports no new data. The clearest signals concern insulin-related measures with berberine and cinnamon, and anti-androgen effects with spearmint tea, but most trials are small, short and heterogeneous in their products, doses and outcomes. Evidence on ovulation, menstrual regularity and live birth is thinner still. Variable extract content, adulteration, interactions and rare serious harms, such as liver injury or licorice-related electrolyte disturbance, complicate any simple reading. The review concludes that some herbal agents merit properly powered, standardised and transparently reported trials, that current evidence does not justify replacing established care, and it sets out what such trials should contain.

Keywords: Polycystic ovary syndrome; Herbal medicine; Berberine; Cinnamon; Spearmint; Insulin resistance; Hyperandrogenism; Narrative review

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Article Class: Review Article

1. Introduction

Polycystic ovary syndrome (PCOS) is diagnosed when a woman shows a cluster of features, most often irregular or absent ovulation, clinical or biochemical signs of androgen excess, and a polycystic appearance of the ovaries on ultrasound.

The widely used Rotterdam criteria ask for two of the three, after other causes have been excluded (1). Because the criteria can be met in several different ways, the condition is a family of phenotypes rather than a single disease, and estimates of how common it is shift with the definition used



(2). International guidelines have tried to bring order to assessment and management, and they have been revised as evidence has accumulated (3, 4).

Conventional care leans on lifestyle change, hormonal contraception, insulin-sensitising drugs such as metformin, and ovulation induction when pregnancy is wanted (5, 6). Many women also look to herbal preparations. The reasons are easy to understand: plants are familiar, often cheaper, and seen as gentler than drugs, and a substantial share of modern pharmacology did begin with natural products (7). Whether a particular preparation helps in PCOS is a separate matter, and one that laboratory findings alone cannot settle (8).

This article reviews the clinical evidence for herbal interventions in PCOS. It is a narrative review of published work, so it contains no patient data and makes no claim that the authors enrolled or measured anyone. It asks which preparations have been tested in people, for which goals, and how securely the findings stand. The aim is a plain account of what has been tried and how far the findings can be trusted.

The sections that follow set out the background and the main herbal candidates, describe how the literature was gathered and read, summarise what the studies report, and then discuss what can and cannot be concluded.

2. Literature Review

2.1 The Condition and Why It Is Hard to Study

Insulin resistance sits close to the centre of PCOS for many, though not all, women with the syndrome. Raised insulin appears to push the ovary toward making more androgen and to lower the liver's output of the protein that binds sex hormones, which leaves more free androgen in the

circulation (9). Excess body weight worsens the picture and makes ovulation less likely, although lean women can be affected as well (10). Reviews of the field describe a tangle of ovarian, adrenal, metabolic and neuroendocrine contributions that differ from person to person (11, 12).

That heterogeneity matters for any intervention study. A trial that recruits women mainly troubled by acne and excess hair is asking a different question from one that recruits women who want to conceive, and the outcome that counts as success differs between them. Pooling such trials without care can hide a real effect in one group or invent a spurious one in another. This is one reason the same plant can look promising in one report and unremarkable in the next.

2.2 Herbal Preparations That Have Been Studied

A small group of plants accounts for most of the clinical literature. Berberine, an alkaloid found in several species, has been studied mainly for glucose and lipid handling, first in type 2 diabetes (13, 14) and then in PCOS, where one short study compared it with metformin on metabolic measures (15) and another looked at women undergoing in vitro fertilisation (16). Cinnamon has been tested for insulin resistance and for menstrual regularity (17, 18). Spearmint tea has been proposed as an anti-androgen (19), licorice has lowered testosterone in healthy women (20), and extracts of fenugreek and chasteberry have been tried for ovarian and cycle-related outcomes (21, 22). Table 1 lists these agents with the kind of evidence behind each.

Figure 1 shows the chain of steps that any of these preparations must complete to matter clinically, and the places where it can break. The plant material has to be what the label says; the active constituents



have to reach the tissue in useful amounts; the biological effect has to be large enough to move a measurable outcome; and the outcome has to matter to the woman. Evidence from one link does not carry over to the next. These points apply with equal force to any botanical preparation, not only the ones discussed here.

Table 1. Herbal agents most often studied in polycystic ovary syndrome.

Agent	Proposed target	Kind of evidence
Berberine	Insulin sensitivity, lipids	Small trials, pooled analyses (15, 23)
Cinnamon	Insulin resistance, cycles	Pilot and small trials (17, 18)
Spearmint tea	Circulating androgens	One short trial (19)
Chasteberry	Cycle regulation	Mixed female-health trials (22)
Licorice	Testosterone lowering	Healthy women only (20)
Fenugreek	Ovarian morphology	Single product trial (21)

Note: Qualitative summary of the literature discussed in the text; it is not a ranking and gives no effect sizes.

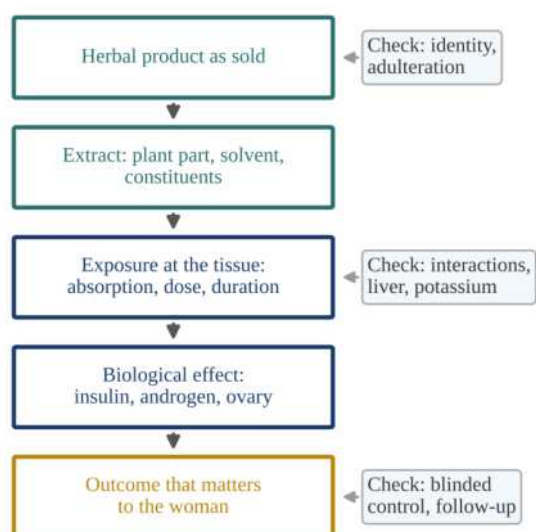


Figure 1. How a herbal preparation might reach a clinical outcome in PCOS, and the checks along the way (schematic, not data).

2.3 Quality and Safety of Herbal Products

Herbal products are not regulated like drugs in most jurisdictions, and in some they reach the market without any proof of benefit (24). The consequence for research is concrete. Two bottles carrying the same plant name can hold different parts of the plant, different extraction solvents and different amounts of the compounds of interest, which is why guidance now asks authors to characterise extracts chemically before publishing pharmacological results (25). Surveys using DNA methods have also found substitution and contamination in commercial herbal products (26).

Safety is a separate concern, and a natural origin is no guarantee of it (27). A network that tracks drug-induced liver injury in the United States has reported cases linked to herbal and dietary supplements (28). Cassia cinnamon contains coumarin, which in sensitive people can affect the liver at high intake (29). Habitual heavy use of licorice can cause low potassium and raised blood pressure through its action on mineral-corticoid handling (30). None of this makes these plants unusable, but it shows that dose, duration and product identity are safety questions as much as efficacy questions.

Standardisation is possible but not yet routine. A manufacturer can state the species, the part used, the extraction solvent and the content of a marker compound, and an independent laboratory can check it. Most herbal trials in PCOS describe the product in a sentence or less, which leaves readers unable to tell whether a later trial tested the same thing (25).

2.4 What a Convincing Trial Looks Like

A convincing trial in PCOS would define the syndrome by accepted criteria, randomise participants, conceal allocation, blind both sides where possible, and report



according to a recognised standard such as CONSORT (31). Blinding deserves emphasis, because placebo responses are larger for subjective outcomes such as symptoms than for objective ones (32). A large, sham-controlled trial of acupuncture and clomiphene in Chinese women with PCOS showed that blinded, adequately sized trials are feasible in this field, whatever one thinks of the treatment tested (33).

Sample size is the other recurring weakness. Underpowered studies give unstable estimates, and those that happen to cross a significance threshold tend to overstate the effect (34). Combined with flexible analysis and selective reporting, this is one route by which published findings turn out false more often than readers assume (35). A single p-value was never meant to carry the weight that headlines put on it (36). The point is not that a trial is poor, only that its result travels less far than its abstract suggests.

2.5 Conventional Care as the Backdrop

Any herbal preparation enters a setting where established care already exists. Lifestyle change, with attention to diet, activity and weight, is the first line of current guidance (4), and a Cochrane review of lifestyle programmes in women with PCOS had to combine programmes that differed considerably in content and intensity (6). Metformin has been examined alone and alongside lifestyle measures, and its role is chiefly in metabolic features rather than as a cure for the syndrome (5).

Because body weight shapes both ovulation and insulin handling (10), a herbal trial that does not track weight can credit the plant with a change that diet or activity produced. That is the backdrop against which every herbal claim in this review has to be read.

3. Materials and Methods

3.1 Scope and Question

The review addresses one question in two parts: which herbal preparations have been tested in women with PCOS, and how reliable are the reported effects on metabolic, androgenic and reproductive outcomes. It deals with oral herbal preparations used on their own or as an addition to usual care. Acupuncture, dietary patterns and single vitamins fall outside its scope, apart from passing mentions used to illustrate trial design.

3.2 Literature Assembly

The review draws on peer-reviewed guidelines, clinical trials, systematic reviews and methodological papers, selected because they bear directly on the question. The authors did not run a formal systematic search and do not claim one. The synthesis is narrative: sources were chosen by familiarity with the field and by following citations from key papers, which means that relevant studies may have been missed and that more prominent work is likely over-represented. A narrative approach has real strengths for a question that spans pharmacology, trial methods and clinical practice (37), but it cannot offer the reproducibility of a protocol-driven review of the kind described in the PRISMA statement (38).

No effect sizes are pooled and none are reproduced here. Where individual studies are described, they are described qualitatively, and readers who need numbers are directed to the original reports.

3.3 Appraisal Framework

To judge how far each report can be trusted, the review used six plain questions adapted from the risk-of-bias tools used in trial appraisal (39, 40). They cover the herbal product, the population, the design, the outcomes, the duration and the



handling of safety (Table 2). None of these steps is complicated, but each is easy to skip.

Table 2. Appraisal questions applied to each report.

Domain	Question asked	Why it matters
Product	Is the plant part, extract and dose stated?	Doses cannot be compared otherwise (25)
Population	Which PCOS criteria were used?	Phenotypes differ in response (1, 2)
Design	Was there a control and blinding?	Placebo effects are real (32)
Outcomes	Were outcomes chosen in advance?	Selective reporting flatters results (39)
Duration	Was follow-up long enough?	Cycles and fertility need time
Safety	Were harms looked for and reported?	Absence of mention is not safety (27)

Note: The framework is a reading aid adapted from standard reporting and risk-of-bias tools, not a scored instrument.

4. Results

4.1 Insulin-Related Outcomes: Berberine and Cinnamon

The most consistent signal in the literature concerns insulin-related measures. A short trial reported that berberine improved metabolic characteristics in women with PCOS, with a direction of change similar to that of metformin, and noted gastrointestinal side effects as a practical limit (15). A later pooled analysis of berberine in PCOS with insulin resistance reached favourable conclusions, though it combined few small studies of varying quality (23). The work in women undergoing fertility treatment examined a different outcome altogether, so it cannot simply be added to the metabolic evidence (16).

Cinnamon follows a similar pattern. A pilot study of a cinnamon extract found

changes in insulin resistance parameters, and a small randomised trial reported improved menstrual cyclicity, which its authors labelled preliminary (17, 18). A pooled analysis of cinnamon in PCOS suggested favourable changes in some metabolic markers (41), while the broader literature in type 2 diabetes shows modest, heterogeneous effects on glycaemic measures (42). Differences in species, preparation and dose across these reports make direct comparison difficult. Small differences of this kind matter little in one trial but accumulate when results are pooled.

4.2 Androgen-Related Outcomes

For androgen excess, the best-known clinical report is a short randomised trial of spearmint tea, in which circulating androgens fell over a brief treatment period (19). The study was small, lasted days to weeks rather than months, and did not follow clinical features such as hair growth over a meaningful span, so it points toward an effect rather than establishing one.

Even the spearmint result is hard to translate. Tea strength depends on the leaf, the infusion time and the number of cups, none of which is standardised, and the outcome was a laboratory measure rather than something women notice from day to day (19).

Licorice is sometimes proposed on the strength of a study in healthy women, in whom testosterone fell (20). Healthy volunteers are not women with PCOS, and the same plant carries the safety concerns noted above (30). This is a case where a plausible mechanism and a safety signal sit side by side, and the evidence for benefit is not yet strong enough to weigh against the harm. A benefit that vanishes under a better-measured outcome is not much of a benefit.



4.3 Cycle Regularity, Ovulation and Fertility

Evidence on ovulation and pregnancy is the thinnest. A trial of a proprietary fenugreek seed extract reported effects on ovarian features in PCOS, but it concerned a single branded product and cannot be generalised to fenugreek as a plant (21). A systematic review of chasteberry trials covered a range of female reproductive disorders, with most of the work on conditions other than PCOS and wide variation in design (22). A laboratory-led review of herbal medicine for PCOS likewise concluded that clinical corroboration for the experimental findings was patchy (8).

Cycle regularity is itself a slippery outcome. Cycles in women with PCOS vary widely from month to month, so a trial has to record them over enough months to show a pattern, and one that counts a single improved cycle risks mistaking chance for treatment (18).

Figure 2 sets these readings side by side as a qualitative matrix. It is a map of where studies exist, not a measure of how well any agent works, and an empty cell means no trial cited here rather than an absence of effect. Read this way, a null result from a small trial is not evidence of absence.

	Insulin	Androgen	Cycles	Fertility
Berberine	small trials	none cited	none cited	indirect
Cinnamon	small trials	none cited	small trials	none cited
Spearmint	none cited	small trials	none cited	none cited
Chasteberry	none cited	none cited	indirect	indirect
Licorice	none cited	indirect	none cited	none cited
Fenugreek	none cited	none cited	indirect	none cited

Schematic reading of the text, not data

Figure 2. Qualitative evidence matrix: agent by treatment goal (schematic reading of the text, not data).

4.4 Overall Reading and Safety Reporting

Across agents the same weaknesses recur: small samples, short follow-up, unclear products and outcomes that were not fixed in advance. Table 3 summarises the reading for each treatment goal. Trials rarely describe how harms were sought, so the absence of reported adverse events is weak reassurance, particularly for rare outcomes such as liver injury that small trials are not built to detect (28).

Table 3. Where the herbal evidence stands for common treatment goals.

Treatment goal	Reading of the evidence	Main caveat
Insulin sensitivity	Most consistent signal, mainly berberine (23)	Short trials, varied products
Androgen levels	Suggestive for spearmint (19)	Very short follow-up
Cycle regularity	Preliminary for cinnamon (18)	Small numbers
Ovulation, pregnancy	Sparse and indirect (16)	Few fertility trials
Long-term safety	Largely unstudied (28)	Rare events missed

Note: Qualitative reading of the studies discussed in the text. Weak means few small trials; it does not mean the agent is ineffective.

The comparator matters as well. A herbal preparation that looks useful against placebo may add little for a woman already following a structured lifestyle programme, and one that appears equal to metformin in a short trial may simply have too few participants to show a difference (5, 34). Few of the herbal trials discussed here were designed to answer the question a clinician would actually ask, which is whether adding the plant improves on usual care.

Figure 3 pictures the layers of evidence needed before a herbal claim is secure. Most of what exists for PCOS sits in the



lower layers, which are plant identity, laboratory mechanism and small clinical signals. The upper layers, large blinded trials with clinical endpoints and long-term safety follow-up, are largely empty. Short follow-up can capture a passing change rather than a lasting one.

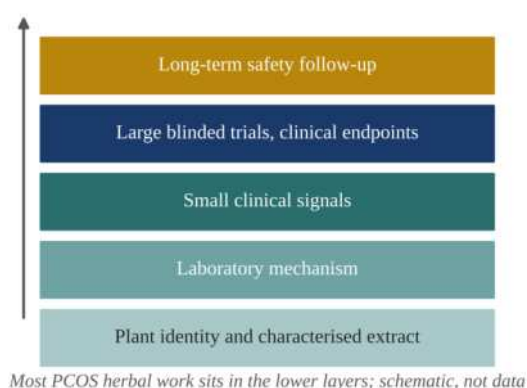


Figure 3. Layers of evidence needed before a herbal claim is secure (schematic; heights are not counts).

5. Discussion

5.1 Interpretation

The reading that emerges from this review is conditional. Berberine and cinnamon have the most consistent, though still limited, signals for insulin-related outcomes; spearmint has a suggestive signal for androgens; and the remaining agents rest on thin or indirect evidence. None of these findings is strong enough to displace lifestyle measures or established medical treatment, which are the foundation of current recommendations (4).

Placebo effects also deserve a fair hearing. Women with PCOS often report symptoms such as fatigue, mood change or cycle irregularity that vary naturally and respond to expectation, and an open-label herbal study can easily mistake that variation for benefit (32). Anyone reading a headline about a herbal cure would reasonably ask

whether the people studied resemble the people reading. The better trials of the future will have to separate the two.

Safety belongs in the same sentence as efficacy. A preparation that lowers an androgen level slightly but carries a risk of liver injury or electrolyte disturbance is not an attractive trade, and the data needed to judge that trade are mostly missing (28, 30). Women with PCOS are often also taking metformin, hormonal contraception or other supplements, so interactions are plausible even where none has been documented, and a product that is not what its label says makes the problem worse (26). Enthusiasm for any single plant should therefore be matched by caution about the product on the shelf.

5.2 Limitations

This is a narrative review and shares the weaknesses of the form. Study selection was not systematic, appraisal was informal, and no quantitative synthesis was attempted. Several of the cited trials are small and come from a handful of research groups, and the review could not examine unpublished or non-English studies thoroughly. Reviews are more useful when they say where the evidence stops than when they smooth it over. Findings from healthy volunteers, from type 2 diabetes and from laboratory work are used here for context only, and they should not be read as proof of benefit in PCOS.

5.3 Future Work

A decisive programme of work would begin with chemically characterised, reproducible products, as current guidance on extract characterisation recommends (25). Trials would use recognised diagnostic criteria, pre-registered outcomes, adequate sample size, credible placebos and follow-up long enough to capture cycles and pregnancy. They would report harms systematically and look



specifically for liver and electrolyte effects. It is a habit worth keeping even when the answer seems obvious.

Comparisons against and in combination with metformin and lifestyle programmes would be more informative than comparisons with nothing, since these are what women actually receive (5, 6). A formal systematic review with a registered protocol would give the field a sturdier base than any narrative summary can.

6. Conclusion

Herbal interventions for PCOS are an area of genuine interest and uneven evidence. Berberine and cinnamon show the most consistent signals for insulin-related outcomes, spearmint tea shows an early signal for androgens, and for ovulation and fertility the data are sparse. Product variability, small trials and limited safety reporting keep every conclusion tentative.

For readers, the message is practical rather than discouraging: herbal preparations deserve proper trials, not dismissal, and until those exist they are best regarded as unproven additions to, not replacements for, established care. That is a modest conclusion, and it is the one the evidence will currently bear.

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9. Conflict of Interest

The authors declare no conflict of interest.

10. Author Contributions

T.F. conceived the review and wrote the sections on herbal products and their safety. A.V. wrote the sections on

pharmacology and the metabolic evidence. C.C. wrote the sections on trial design and appraisal. All authors revised the manuscript and approved the final version.

11. Ethics Statement

This is a review of published literature. No human participants or animals were studied and no ethical approval was required.

12. Data Availability

No new data were generated. All sources are cited in the reference list.

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