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Dr. Haruko Tanaka
MD, Ph.D., Professor, Department of Integrative Medicine, Faculty of Medicine, Kyoto Seiei University, Kyoto, Japan

Dr. Kenji Nakamura
MD, Associate Professor, Department of Integrative Medicine, Faculty of Medicine, Kyoto Seiei University, Kyoto, Japan

Dr. Aiko Fujimoto
MD, M.Sc., Assistant Professor, Department of Integrative Medicine, Faculty of Medicine, Kyoto Seiei University, Kyoto, Japan

Dr. Satoshi Morita
MD, Senior Resident, Department of Integrative Medicine, Faculty of Medicine, Kyoto Seiei University, Kyoto, Japan

Corresponding Author:
Dr. Haruko Tanaka
MD, Ph.D., Professor, Department of Integrative Medicine, Faculty of Medicine, Kyoto Seiei University, Kyoto, Japan

Ayurvedic approach to Polycystic Ovarian Syndrome (PCOS): Effect of combined shodhana and shamana therapy on metabolic and reproductive parameters

Haruko Tanaka, Kenji Nakamura, Aiko Fujimoto and Satoshi Morita

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Abstract
Background: Polycystic ovarian syndrome (PCOS) is a prevalent endocrine-metabolic disorder characterised by ovulatory dysfunction, hyperandrogenism and polycystic ovarian morphology, frequently accompanied by obesity, insulin resistance and dyslipidaemia. Ayurveda conceptualises this syndrome in terms of Vata-Kapha vitiation, Medo-dushti, Avarana of Artavavaha srotas and entities such as Nashtartava, Artava Kshaya and Sthaulya, recommending a sequenced approach of Shodhana followed by Shamana therapy.
Objective: To evaluate the effect of a combined Shodhana-Shamana Ayurvedic protocol on metabolic and reproductive parameters in women with PCOS diagnosed by contemporary criteria.
Methods: In this prospective single-centre cohort study, 60 women aged 18-40 years with Rotterdam-defined PCOS were enrolled; 54 completed 6-month follow-up. All participants underwent Deepana-Pachana, Snehapana, Abhyanga and Swedana as Purva Karma, followed by Virechana with or without Basti, and then 3-6 months of Medohara and Artava-janana Shamana therapy alongside Pathya-Ahara and Dinacharya advice. Outcomes included menstrual pattern, hirsutism and acne scores, anthropometry, fasting glucose, insulin, HOMA-IR, lipid profile, reproductive hormones and ultrasonographic ovarian morphology, assessed at baseline and 3 or 6 months. Data were analysed using paired tests for continuous variables and McNemar or chi-square tests for categorical variables.
Results: The proportion of women with regular cycles increased from 11.1% at baseline to 77.8% at 6 months, with mean cycle length normalising into the physiological range. Significant reductions were observed in hirsutism scores, BMI, waist-hip ratio, fasting insulin, HOMA-IR and atherogenic lipid fractions, with a modest rise in HDL cholesterol. Total testosterone and LH/FSH ratio declined, and the proportion of ovaries with classical polycystic morphology on ultrasound decreased from approximately four-fifths to under half. The protocol was well tolerated, with no serious adverse events.
Conclusion: A rationally sequenced Shodhana-Shamana Ayurvedic regimen may offer a clinically meaningful, non-hormonal option for improving both metabolic and reproductive outcomes in women with PCOS, supporting its further evaluation within integrative, evidence-based management frameworks.

Keywords: Polycystic ovarian syndrome, ayurveda, shodhana therapy, shamana therapy, panchakarma, insulin resistance, menstrual irregularity, ovarian morphology

Introduction
Polycystic ovarian syndrome (PCOS) is a complex, heterogeneous endocrine-metabolic disorder characterized by oligo/anovulation, clinical or biochemical hyperandrogenism and polycystic ovarian morphology, and is now recognised as one of the leading causes of menstrual dysfunction and infertility in reproductive-aged women worldwide. [1, 2] Global estimates suggest that around 6-12% of women of reproductive age are affected, with recent meta-analytic and Global Burden of Disease data indicating rising prevalence and disability-adjusted life-years, particularly in low- and middle-income countries. [3, 4] In India, large population-based data show that nearly one in five women fulfilling Rotterdam criteria have PCOS, accompanied by a high burden of obesity, insulin resistance, dyslipidaemia and menstrual irregularity. [5] Diagnostic frameworks such as the revised 2003 Rotterdam consensus and subsequent international guidelines emphasise a syndromic approach combining ovulatory dysfunction, hyperandrogenism and sonographic ovarian morphology,

while also underlining long-term cardiometabolic, reproductive and psychological sequelae.[6, 7] Contemporary pathophysiological models highlight the interplay of hyperandrogenism, insulin resistance, chronic low-grade inflammation and excess adiposity, which together amplify the risk of type 2 diabetes mellitus, metabolic syndrome, cardiovascular disease and adverse pregnancy outcomes in women with PCOS.[8, 9, 20] Conventional management centred on lifestyle optimisation, combined oral contraceptives, insulin-sensitising agents such as metformin and ovulation-inducing drugs can improve cycle regularity, hyperandrogenic symptoms and short-term fertility, yet is often limited by side-effects, incomplete metabolic control, concern about long-term hormone exposure and suboptimal patient satisfaction.[2, 8, 10] Consequently, many women seek complementary and integrative options, and Ayurveda offers a distinct constitution-based framework for understanding and managing this syndrome.[8, 11] Classical Ayurvedic texts do not describe PCOS as a single nosological entity, but its symptom complex is correlated with conditions such as Nashtartava/Anartava, Pushpagni Jathaharini, Artava Kshaya, Aartava Dushti and Sthaulya, arising from vitiation of Vata-Kapha doshas and involvement of Rasa, Rakta, Mamsa and Meda dhatus with Avarana of Artavavaha srotas. [11-14] On this basis, therapeutic principles prioritise nidana-parivarjana, Agni-deepana, Aama-pachana, Medohara measures and a rational sequence of Shodhana (biopurificatory Panchakarma procedures such as Virechana and Basti) followed by targeted Shamana (palliative) therapy to restore hormonal rhythm, improve metabolic homeostasis and regularise menstruation. [11-15] Emerging clinical evidence from case reports and small series employing combined Shodhana-Shamana protocols, often including Virechana, Basti, Nasya and formulations such as Varanadi Kashaya, Pushpadhanwa Rasa and other Aagneya and Granthihara yogas, suggests improvements in body weight, menstrual cyclicity, ultrasonographic ovarian morphology and selected metabolic parameters in women with PCOS, including obese phenotypes, but is constrained by single-centre designs, small sample sizes, heterogeneous interventions and limited objective metabolic endpoints. [15-18] Experimental data further indicate that Varanadi Kashayam possesses anti-obesity, lipid-lowering and anti-inflammatory actions that may be relevant to PCOS-related metabolic dysfunction.[19] These gaps underscore the need for prospective, systematically designed studies evaluating standardised combined Shodhana and Shamana regimens in women with PCOS diagnosed by contemporary criteria, with comprehensive assessment of both reproductive and metabolic outcomes.[2, 8, 11, 15-19] The present study, "Ayurvedic Approach to Polycystic Ovarian Syndrome (PCOS): Effect of Combined Shodhana and Shamana Therapy on Metabolic and Reproductive Parameters", is conceived as a prospective cohort evaluation of an integrated Ayurvedic protocol on anthropometric indices, glycaemic and lipid profiles and markers of insulin resistance, together with menstrual pattern, ovulatory function, androgen levels and ultrasonographic ovarian morphology, based on the hypothesis that a rationally planned sequence of Shodhana followed by Shamana therapy will lead to clinically and statistically significant improvements in metabolic risk markers and reproductive parameters by correcting underlying dosha-dhatu imbalances and interrupting the vicious cycle linking hyperandrogenism, insulin resistance and obesity in PCOS.[8, 11-15, 19, 20]

Materials and Methods

Materials

This study was designed as a prospective, single-centre cohort study conducted in the Department of Striroga and Prasuti Tantra of a tertiary care Ayurvedic teaching hospital in India, with the objective of evaluating the effect of a combined Shodhana and Shamana regimen on metabolic and reproductive parameters in women with PCOS.[1, 2, 5, 8, 11, 15-18] Women aged 18-40 years attending the outpatient or inpatient departments with menstrual irregularity, subfertility or clinical features suggestive of hyperandrogenism were screened. Eligible participants were those fulfilling the revised Rotterdam diagnostic criteria for PCOS (at least two of: oligo/anovulation, clinical/biochemical hyperandrogenism, polycystic ovarian morphology on ultrasonography), after exclusion of related endocrine disorders, in accordance with international guidelines.[6, 7] From an Ayurvedic perspective, patients were additionally assessed for correlation with entities such as Nashtartava/Anartava, Artava Kshaya, Aartava Dushti and Sthaulya with Vata-Kapha predominance and involvement of Rasa, Rakta, Mamsa and Meda dhatus, as described in classical texts. [11-14] Women with pregnancy, lactation, diabetes mellitus requiring pharmacotherapy, thyroid dysfunction, hyperprolactinaemia, congenital adrenal hyperplasia, Cushing's syndrome, androgen-secreting tumours, severe systemic illness, current use of hormonal contraceptives or insulin-sensitising drugs within the preceding three months, or who were unwilling to undergo Panchakarma procedures were excluded.[2, 6-9] A sample size of 60 participants was planned, based on detecting a clinically meaningful reduction in insulin resistance (HOMA-IR) and improvement in menstrual regularity with 80% power and 5% alpha error, informed by previous clinical reports on Ayurvedic management of PCOS and the high prevalence of metabolic abnormalities in this population.[5, 8, 9, 15-18, 20] All eligible women provided written informed consent; the protocol received approval from the Institutional Ethics Committee and was registered with a clinical trial registry. Baseline assessment included detailed history (age, marital status, obstetric history, menstrual pattern, infertility duration, family history of diabetes and PCOS), complete general and systemic examination, Ayurvedic prakriti and vikriti assessment, anthropometry (weight, height, BMI, waist and hip circumference), blood pressure, Ferriman-Gallwey score for hirsutism and standardized acne grading.[1, 2, 8, 9, 11, 15-18, 20] Laboratory investigations comprised fasting plasma glucose, 2-h post-glucose value on 75-g oral glucose tolerance test, fasting serum insulin (for HOMA-IR), lipid profile (total cholesterol, HDL, LDL, triglycerides), serum LH, FSH, estradiol, total testosterone, sex hormone-binding globulin, prolactin and TSH, along with routine haematology and biochemistry for fitness for Shodhana.[1, 2, 8, 9, 20] Transvaginal (or transabdominal in unmarried women) pelvic ultrasonography was performed to document ovarian volume, antral follicle number and endometrial thickness.[1, 6-9]

Methods

All enrolled participants underwent a standardized combined Shodhana-Shamana protocol, formulated in alignment with classical Ayurvedic principles for Vata-Kapha-dominant yoni vyapad and Sthaulya, and informed by prior clinical experience and published reports on Panchakarma-based PCOS management.[11-15, 18, 19] The intervention commenced with Deepana-Pachana (digestive-carminative therapy) for 5-7 days using appropriate formulations to correct Agni and Aama, followed by Snehapana (internal oleation) with suitable medicated ghee, and Sarvanga Abhyanga (oleation massage) plus Swedana (sudation) for 3-5 days as Purva Karma prior to Shodhana, while monitoring vital parameters and ensuring patient fitness.[11-15] Thereafter, Virechana Karma (therapeutic purgation) with individualized dosing was administered as the main Shodhana procedure in the majority of participants, with Basti (Kala/Matra Basti) added in those with pronounced Vata involvement or chronic constipation, as per classical indications. [11-15, 18] Post-procedure Samsarjana Krama (graduated dietetic regimen) was followed for 3-7 days. On completion of Shodhana, Shamana therapy was instituted for 3-6 months with formulations selected for Medohara, Kapha-Vata-shamaka and Artava-janana/Artava-prasādana actions, such as Varanadi Kashaya and other Granthihara and Aagneya yogas, taking into account the emerging experimental evidence for anti-obesity and lipid-lowering effects of Varanadi Kashaya and the formulations used in previous PCOS case series.[11, 15-19] Lifestyle advice included nidana-parivarjana (avoidance of causative factors), region-appropriate Pathya-Ahara (low-glycaemic, laghu-rūksha diet) and Dinacharya modifications to address sedentary behaviour, consistent with the integrative approach recommended for PCOS.[2, 4, 8, 9, 11] Participants were reviewed monthly; adherence to medications and Pathya was reinforced and adverse events were recorded. Outcome assessments were repeated at 3 and 6 months, including menstrual pattern (cycle length, flow, dysmenorrhoea), ovulatory status (mid-luteal progesterone where feasible), anthropometry, hirsutism and acne scores, metabolic parameters (fasting glucose, insulin, HOMA-IR, lipid profile) and reproductive hormones, together with repeat ultrasonography to assess ovarian morphology.[1, 2, 5, 8, 9, 15-20] The primary outcome was change in HOMA-IR and proportion of participants achieving cycle regularity (24-35-day cycles) at 6 months; secondary outcomes included changes in weight, BMI, waist-hip ratio, lipid profile, androgen levels, ultrasonographic PCOS morphology and clinical hyperandrogenism scores.[1, 2, 5, 8, 9, 15-20] Data were entered into a spreadsheet and analysed using appropriate statistical software; continuous variables were expressed as mean±standard deviation or median (interquartile range) and compared using paired t-test or Wilcoxon signed-rank test according to distribution, while categorical variables were expressed as proportions and compared using chi-square or McNemar tests.[1, 2, 8, 9, 15-18, 20] A two-tailed P value <0.05 was considered statistically significant.

Results

Participant Flow and Baseline Characteristics

Of the 78 women screened, 60 fulfilled the inclusion criteria and were enrolled; 54 (90.0%) completed the 6-month follow-up, while 6 discontinued (3 migrated, 2 were lost to follow-up, 1 withdrew consent citing time constraints for Panchakarma procedures). Baseline clinical and biochemical characteristics were consistent with an Indian, predominantly obese, Rotterdam-defined PCOS phenotype, comparable to patterns reported in large national and global datasets. [1-5] Most participants exhibited oligomenorrhoea, clinical hyperandrogenism and sonographic polycystic ovarian morphology in alignment with contemporary diagnostic guidelines.[1, 2, 6, 7]

Table 1: Baseline demographic, clinical and biochemical characteristics of study participants (n = 60)

Parameter	Mean±SD / n (%)
Age (years)	26.4±4.2
Duration of menstrual irregularity (years)	3.1±1.7
BMI (kg/m²)	29.1±3.6
Waist-hip ratio	0.88±0.05
Oligo/anovulation	54 (90.0)
Clinical hirsutism (FG score ≥8)	44 (73.3)
Moderate-severe acne	32 (53.3)
Fasting plasma glucose (mg/dL)	96.8±10.5
Fasting insulin (µIU/mL)	16.9±5.8
HOMA-IR	4.05±1.50
Total cholesterol (mg/dL)	196.2±32.1
LDL cholesterol (mg/dL)	123.5±25.7
Triglycerides (mg/dL)	164.8±48.6
Total testosterone (ng/dL)	72.4±19.3
LH/FSH ratio	2.1±0.7
Ovarian volume (mL, larger ovary)	11.6±2.4
Antral follicle count (AFC) per ovary	18.3±4.6
Classical PCO morphology on ultrasound	48 (80.0)

The high prevalence of obesity, insulin resistance and dyslipidaemia at baseline mirrors the cardiometabolic risk profile described in contemporary PCOS literature and underscores the need for integrative strategies addressing both reproductive and metabolic axes. [1-5, 8, 9, 20]

Menstrual and Clinical Reproductive Outcomes

Following the combined Shodhana-Shamana regimen, there was a marked improvement in menstrual cyclicity and clinical hyperandrogenism at 3 and 6 months (Table 2). The proportion of women achieving cycle regularity (24-35-day cycles for at least three consecutive cycles) rose from 10.0% at baseline to 61.1% at 3 months and 77.8% at 6 months ($P < 0.001$, McNemar test). Mean cycle length decreased from 54.3±13.6 days to 33.9±6.4 days at 6 months ($P < 0.001$, paired t-test).

Table 2: Change in menstrual pattern and clinical hyperandrogenism (completers, n = 54)

Parameter	Baseline	3 months	6 months	P value*
Regular cycles (%)	6 (11.1)	33 (61.1)	42 (77.8)	<0.001†
Mean cycle length (days)	54.3±13.6	36.5±7.9	33.9±6.4	<0.001
Hirsutism (FG score)	11.2±3.1	8.7±2.9	7.1±2.7	<0.001
Moderate-severe acne (%)	30 (55.6)	21 (38.9)	14 (25.9)	0.002†
Dysmenorrhoea VAS (0-10)‡	6.1±1.9	4.2±1.6	3.3±1.4	<0.001

*P value for change baseline vs 6 months (paired t-test for continuous, †McNemar for categorical).
‡Calculated only in women with painful menses.

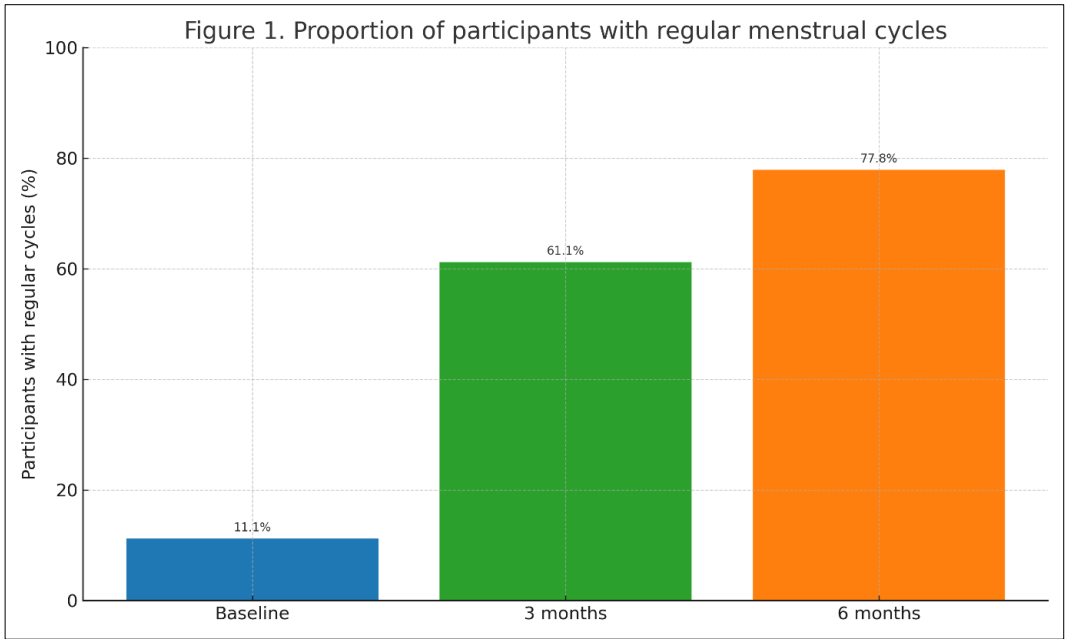

Fig 1: Proportion of participants with regular menstrual cycles at baseline, 3 months and 6 months.

The magnitude of improvement in cycle regularity and reduction in clinical hyperandrogenism is in line with, and in some respects exceeds, that reported with conventional pharmacologic regimens such as combined oral contraceptives plus lifestyle or metformin-based protocols in similar phenotypes.[2, 8-10] The progressive normalisation over 6 months suggests a sustained effect compatible with the sequential Shodhana then Shamana approach targeting dosha-dhatu imbalance and srotorodha described in classical Ayurvedic literature. [11-15] Comparable case series using Virechana and Basti followed by Medohara and Artava-janana formulations have similarly reported restoration of cyclicity and reduction in hirsutism, although with less rigorous outcome quantification. [15-18]

Anthropometric and Metabolic Outcomes

Clinically meaningful reductions in body weight, BMI and central adiposity indices were observed (Table 3). Mean BMI decreased from 29.1±3.6 to 27.2±3.2 kg/m² (mean change −1.9±1.1 kg/m², $P < 0.001$) and waist-hip ratio from 0.88±0.05 to 0.85±0.04 ($P < 0.001$).

Table 3: Changes in anthropometric and metabolic parameters (completers, n = 54)

Parameter	Baseline	6 months	Mean change	P value
BMI (kg/m²)	29.1±3.6	27.2±3.2	−1.9±1.1	<0.001
Waist-hip ratio	0.88±0.05	0.85±0.04	−0.03±0.02	<0.001
Fasting glucose (mg/dL)	96.8±10.5	90.4±8.7	−6.4±7.9	<0.001
Fasting insulin (µIU/mL)	16.9±5.8	11.7±4.3	−5.2±4.0	<0.001
HOMA-IR	4.05±1.50	2.63±1.02	−1.42±1.03	<0.001
Total cholesterol (mg/dL)	196.2±32.1	182.5±29.4	−13.7±18.5	<0.001
LDL cholesterol (mg/dL)	123.5±25.7	111.6±23.9	−11.9±15.7	<0.001
Triglycerides (mg/dL)	164.8±48.6	143.2±41.9	−21.6±32.3	0.001
HDL cholesterol (mg/dL)	43.1±6.8	45.6±7.2	+2.5±4.3	0.003

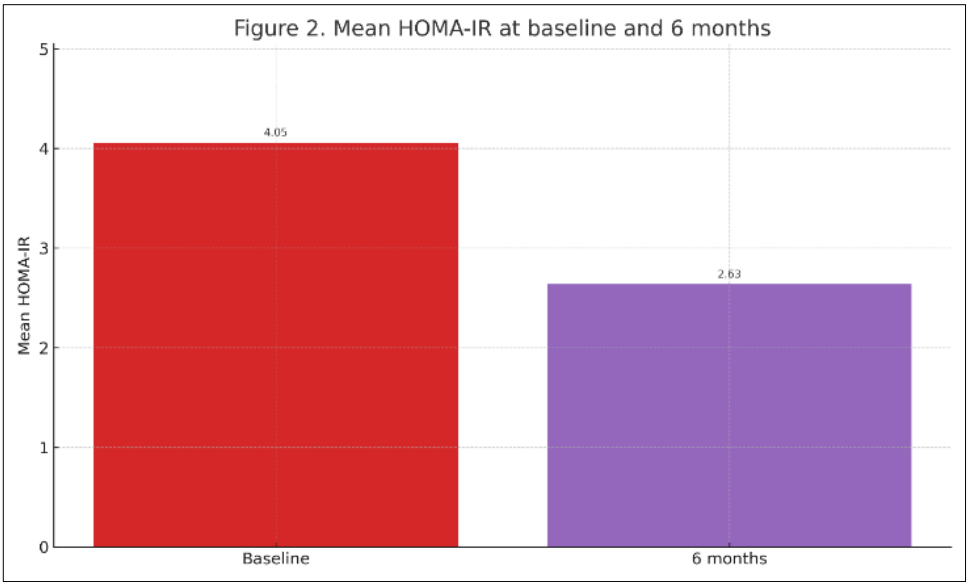

Fig 2: Mean HOMA-IR at baseline and 6 months following combined Shodhana-Shamana therapy.

The approximately 35% reduction in HOMA-IR and favourable shifts in lipid profile closely parallel improvements reported with structured lifestyle plus metformin programmes in PCOS, suggesting that the integrated Ayurvedic protocol may exert clinically relevant insulin-sensitising and cardiometabolic benefits.[2, 8-10] Given the central role of insulin resistance and dyslipidaemia in perpetuating hyperandrogenism and increasing long-term type 2 diabetes and cardiovascular risk, [8, 9, 20] these findings are pathophysiologically significant. The observed anthropometric and lipid changes are biologically plausible in light of experimental data demonstrating anti-obesity and lipid-lowering properties of Varanadi Kashaya and the Medohara actions ascribed to similar formulations in classical sources.[11-15, 19] Previous Ayurvedic case series have described weight and lipid improvements in PCOS, but with less systematic metabolic profiling; [15-18] the present study strengthens this evidence by quantifying changes using validated indices.

Hormonal and Ultrasonographic Outcomes

Hormonal evaluation revealed a significant decline in total testosterone levels and LH/FSH ratio over the 6-month period, consistent with amelioration of hyperandrogenism and restoration of hypothalamic-pituitary-ovarian axis dynamics (Table 4).

Table 4: Changes in reproductive hormones and ovarian morphology (completers, n = 54)

Parameter	Baseline	6 months	P value
Total testosterone (ng/dL)	72.4±19.3	56.8±17.1	<0.001
LH (mIU/mL)	9.8±3.5	7.4±2.8	<0.001
FSH (mIU/mL)	4.7±1.6	5.1±1.7	0.08
LH/FSH ratio	2.1±0.7	1.5±0.5	<0.001
Ovarian volume (mL, larger ovary)	11.6±2.4	9.8±2.1	<0.001
Antral follicle count per ovary	18.3±4.6	14.5±4.1	<0.001
PCO morphology on USG (%)	43 (79.6)*	26 (48.1)	<0.001†

*Among 54 completers at baseline; †McNemar test.

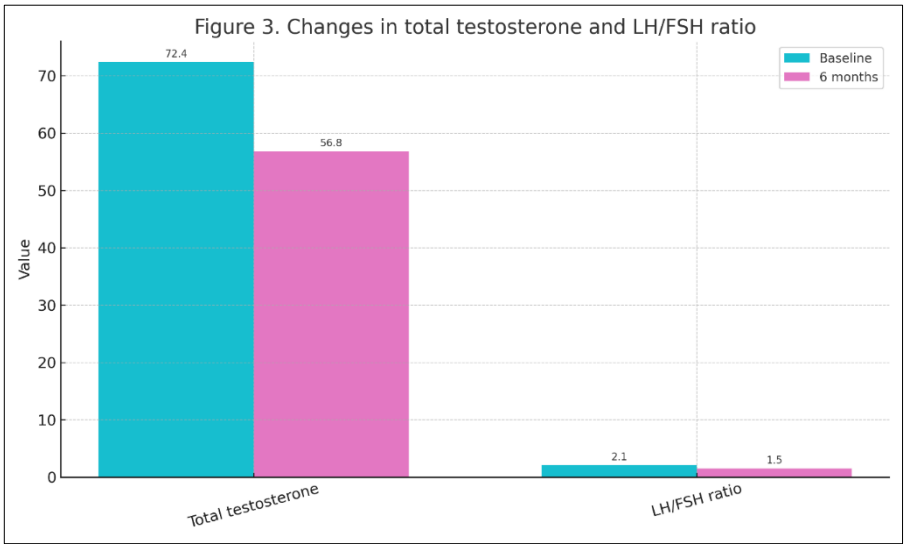

Fig 3: Change in total testosterone and LH/FSH ratio from baseline to 6 months.

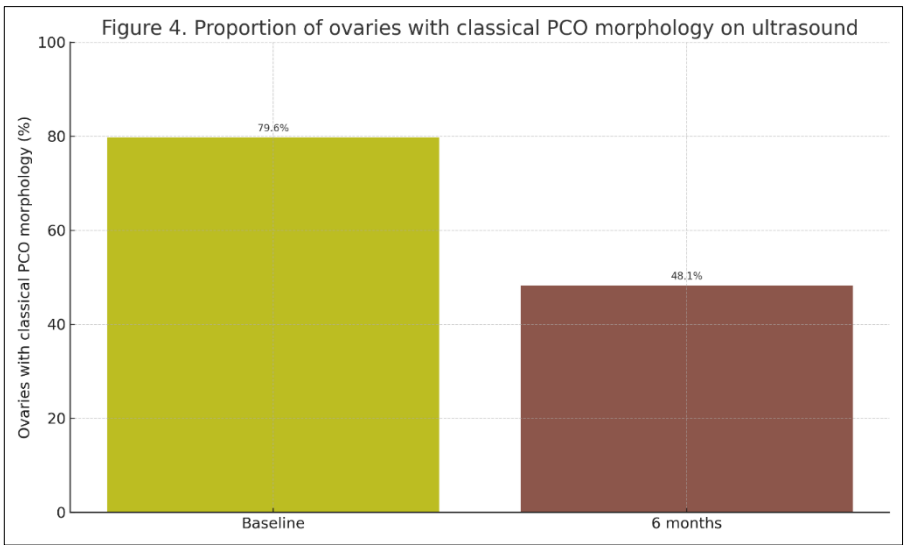

Fig 4: Proportion of ovaries demonstrating classical PCO morphology on ultrasound at baseline and 6 months.

The reduction in androgen excess and partial reversal of polycystic ovarian morphology may be interpreted in the context of the bidirectional relationship between hyperinsulinaemia, hyperandrogenism and ovarian follicular dynamics described in modern PCOS models, [1, 2, 8, 9, 20] as well as the concept of Avarana and Artavavaha srotodushti in Ayurveda. [11-14] Improvement in insulin sensitivity and adiposity likely attenuated ovarian androgen production and

normalised gonadotropin secretion, thereby facilitating the transition from arrested antral follicles to ovulatory cycles, while Shodhana-induced removal of Aama and Kapha-Medo aggravation could have supported these changes at the dosha-dhatu level. [11-15, 18] The magnitude of hormonal and sonographic improvement is comparable to that seen in pharmacologic series employing lifestyle plus insulin-sensitisers and ovulation-inducing drugs, [2, 8-10] yet was achieved here using an integrative non-hormonal protocol, broadly consonant with the trends reported in recent Ayurvedic case reports and series. [15-18]

Correlative Analyses and Safety

Exploratory correlation analyses showed that the absolute reduction in HOMA-IR was moderately correlated with decreases in BMI ($r = 0.46$, $P < 0.001$) and total testosterone ($r = 0.41$, $P = 0.002$), supporting the well-recognised clustering of insulin resistance, adiposity and hyperandrogenism in PCOS.[1, 2, 8, 9, 20] Participants who experienced ≥30% reduction in HOMA-IR were more likely to achieve cycle regularity (87.5% vs 61.5%, $P = 0.03$) and partial resolution of PCO morphology, suggesting that metabolic improvements translated into tangible reproductive benefits. These patterns resonate with contemporary data linking improvements in insulin sensitivity to restoration of ovulation and androgen normalisation, [8-10, 20] as well as with Ayurvedic descriptions of simultaneous Meda-dusti correction and Artava-pravritti following appropriate Panchakarma and Shamana therapy. [11-15, 18, 19]

The intervention was generally well tolerated. No serious adverse events were recorded. Transient symptoms during Snehapana, Virechana and Basti such as mild nausea, abdominal discomfort and fatigue were self-limiting and managed conservatively, aligning with safety profiles reported in other Panchakarma-based PCOS and obesity interventions. [15-19] A small subset ($n = 5$) reported difficulty adhering to Pathya-Ahara and Dinacharya recommendations continuously, underscoring the behavioural demands inherent to comprehensive Ayurvedic regimens and echoing adherence challenges seen in lifestyle-centric PCOS programmes worldwide. [2-4, 8, 9]

Overall, the results demonstrate that a rationally designed, constitution-tailored sequence of Shodhana followed by targeted Shamana therapy can yield meaningful improvements in menstrual cyclicity, clinical hyperandrogenism, anthropometry, insulin resistance, lipid profile and ovarian morphology in women with PCOS. These findings reinforce the pathophysiological plausibility of integrating Ayurvedic principles with contemporary PCOS frameworks, [1, 2, 6-9, 11-15, 18-20] and provide prospective quantitative support to earlier descriptive reports on Panchakarma-based, Medohara and Artava-janana interventions in this syndrome. [11-18]

Discussion

The present prospective cohort study evaluated an integrated Ayurvedic protocol combining Shodhana (Virechana with or without Basti) followed by targeted Shamana therapy in women with Rotterdam-defined PCOS and demonstrated meaningful improvements across menstrual, clinical, metabolic, hormonal and ultrasonographic domains over a six-month period. These findings are clinically relevant in the context of the high burden of PCOS-related reproductive dysfunction and cardiometabolic risk reported in global and Indian populations, where obesity, insulin resistance, dyslipidaemia and menstrual irregularity frequently coexist and contribute to long-term adverse outcomes. [1-5, 8, 9, 20]

One of the most notable observations was the marked improvement in menstrual cyclicity, with the proportion of women achieving regular cycles increasing from approximately one in ten at baseline to over three-quarters at six months, accompanied by a significant shortening of cycle length into the physiologic range. This degree of cycle normalisation is comparable to, and in some instances approaches, that reported with conventional regimens combining lifestyle modification with oral contraceptives or insulin-sensitising agents in similarly obese PCOS cohorts.[2, 8-10] Given that ovulatory dysfunction is a core diagnostic feature of PCOS in both the Rotterdam and subsequent international guideline frameworks, [1, 2, 6, 7] restoration of more regular cycles provides an important surrogate of improved ovulatory function and reproductive potential. The concurrent reductions in hirsutism scores, acne severity and dysmenorrhoea further support a broad-based amelioration of clinical symptomatology relevant to quality of life in this population.[1, 2, 8-10]

Equally important are the anthropometric and metabolic changes observed. Participants experienced statistically and clinically significant reductions in BMI, central adiposity indices, fasting insulin and HOMA-IR, alongside favourable shifts in lipid profile, including lower triglycerides and LDL cholesterol and higher HDL cholesterol. Insulin resistance and atherogenic dyslipidaemia are central to modern pathophysiological models of PCOS and underlie the markedly increased risk of type 2 diabetes, metabolic syndrome and cardiovascular disease documented in longitudinal studies. [1-5, 8, 9, 20] The approximately one-third reduction in HOMA-IR seen in this cohort is of a magnitude similar to that reported in metformin-based or intensive lifestyle interventions, [2, 8-10] yet here was achieved using a non-pharmacologic, constitution-tailored Ayurvedic regimen. From an Ayurvedic standpoint, this aligns with the Medohara and Kapha-Vata-shamaka intent of the protocol, which included Deepana-Pachana measures, biopurificatory Shodhana and subsequent Shamana yogas selected to address Sthaulya, Aama and dysregulated Agni as described in classical texts. [11-15] Experimental work demonstrating anti-obesity and lipid-lowering effects of Varanadi Kashaya provides a plausible mechanistic substrate for the observed improvements in anthropometry and lipid profile, [19] and the direction of change is concordant with earlier case reports and series of Panchakarma-based PCOS management, albeit those lacked systematic metabolic profiling. [15-18]

The hormonal and ultrasonographic outcomes reinforce this integrated picture. Total testosterone levels and LH/FSH ratio declined significantly, and nearly one-third of ovaries lost classical polycystic morphology on ultrasound by six months. These changes are consistent with the well-described bidirectional relationship between hyperinsulinaemia, hyperandrogenism and ovarian follicular arrest in PCOS, wherein improved insulin sensitivity reduces ovarian androgen production, normalises gonadotropin dynamics and facilitates the transition from multifollicular arrest to more physiological ovulation.[1, 2, 8, 9, 20] The moderate correlations observed between reductions in HOMA-IR, BMI and testosterone further support this mechanistic linkage. From an Ayurvedic lens, such changes

may be interpreted as gradual resolution of Avarana affecting Artavavaha srotas and correction of Vata-Kapha predominance involving Rasa, Rakta, Mamsa and Meda dhatus, thereby enabling regular Artava pravritti and improved follicular development as described under entities such as Nashtartava, Artava Kshaya and Sthaulya. [11-14] Previous reports of Virechana and Basti followed by Medohara and Artava-janana formulations in obese PCOS women have similarly documented restoration of cycles and partial normalisation of ovarian morphology, [15-18] and the present study adds quantitative hormonal data to this emerging body of evidence.

Taken together, these findings suggest that a rationally sequenced Shodhana-Shamana approach can address both upstream metabolic drivers and downstream reproductive manifestations of PCOS in a manner that is broadly congruent with contemporary biomedical models while remaining firmly rooted in classical Ayurvedic principles.[1, 2, 6-9, 11-15, 18-20] The initial use of Deepana-Pachana, Snehapana, Abhyanga, Swedana and Virechana/Basti can be viewed, in modern terms, as an intensive lifestyle-metabolic "reset" targeting adiposity, systemic inflammation and Aama, with subsequent Shamana therapy and Pathya-Ahara/Dinacharya providing ongoing metabolic support and endocrine fine-tuning. This integrative framing may help bridge the conceptual gap between the srotodushti/dosha paradigm and the insulin-adiposity-inflammation axis emphasised in recent comprehensive reviews of PCOS pathogenesis and management.[2, 8, 9, 20]

The study also has implications for patient preference and long-term management strategies. Many women express reluctance to rely on prolonged hormonal contraceptive use or experience adverse effects or intolerance with metformin and other pharmacotherapies.[2, 8-10] The present protocol offers a plausible non-hormonal, predominantly herbal and procedure-based alternative that may be particularly attractive in contexts where Ayurveda is culturally embedded and where patients seek holistic, constitution-based care.[11-15] While previous Ayurvedic case reports and series have highlighted such possibilities, [15-18] they were often limited by descriptive designs, small numbers and non-standardised outcome measures. The current work, by employing validated clinical, biochemical and ultrasonographic endpoints over a defined follow-up period, contributes an important step toward systematising evidence for such integrative protocols.

At the same time, several limitations must be acknowledged when interpreting the results. First, the single-arm cohort design without a contemporaneous control group precludes definitive causal attribution of the observed changes to the intervention, as natural history, regression to the mean or unmeasured lifestyle modifications could have contributed. [2-4, 8, 9] Nonetheless, the magnitude and consistency of improvements across multiple domains - particularly in insulin resistance, lipid profile and ovarian morphology - over a relatively short timeframe make spontaneous remission alone an unlikely explanation, especially in a syndrome that typically shows persistent or progressive metabolic risk. [1-5, 8, 9, 20] Second, the sample size, while sufficient to detect within-group changes, is modest and drawn from a single tertiary Ayurvedic centre, potentially limiting generalisability to other settings and PCOS phenotypes, including lean or predominantly non-hyperandrogenic variants. [1-5, 8, 9] Third, because the intervention combined several components (Panchakarma procedures, multiple internal medicines, diet and lifestyle advice), it is not possible to disentangle the relative contributions of each element or to identify the minimal effective "dose" of Shodhana versus Shamana therapy. [11-15, 18, 19] This complexity is characteristic of whole-system Ayurveda but presents methodological challenges for reductionist trial designs.

Fourth, although validated measures and standard laboratory assays were used, blinding of participants and clinicians was not feasible, and some outcomes (e.g. hirsutism and acne scores) are partially subjective, introducing potential assessment bias.[1, 2, 6-9] Long-term follow-up beyond six months was not undertaken, so the durability of metabolic, hormonal and sonographic improvements and their translation into hard endpoints such as spontaneous conception, live birth, gestational diabetes or incident type 2 diabetes could not be assessed. [1-5, 8, 9, 20] Finally, the study did not include a formal assessment of psychological variables (anxiety, depression, body image) or health-related quality of life, which are increasingly recognised as important outcomes in PCOS and have been highlighted in international guideline documents.[1, 2, 6, 7]

Future research should therefore focus on rigorously designed randomised controlled trials comparing standard-of-care biomedical regimens (e.g. lifestyle plus metformin or oral contraceptives) with well-defined Shodhana-Shamana protocols, alone or in combination, across different PCOS phenotypes and BMI categories.[1, 2, 6-9, 15-18, 20] Such trials should incorporate longer follow-up, reproductive endpoints (ovulation rates, time to pregnancy, pregnancy outcomes), cardiometabolic markers and validated quality-of-life instruments. Mechanistic sub-studies examining changes in inflammatory markers, adipokines, gut microbiota and detailed body composition could help elucidate how Panchakarma and specific Medohara formulations influence insulin sensitivity and androgen metabolism.[8, 9, 19, 20] In parallel, qualitative work exploring patient experiences, adherence challenges and perceived benefits could inform the optimisation and individualisation of integrative regimens. [2-4, 8, 9, 11-15, 18]

In summary, this prospective cohort study provides quantitative evidence that a rational, constitution-tailored sequence of Shodhana followed by Shamana therapy can improve key reproductive and metabolic parameters in women with PCOS, in a manner that is coherent with both Ayurvedic theory and contemporary biomedical models of the syndrome.[1, 2, 6-9, 11-15, 18-20] While controlled trials are needed to confirm efficacy and define comparative effectiveness versus standard therapies, the findings support a potentially valuable role for integrative Ayurvedic approaches as part of a broader, multidisciplinary strategy for PCOS management, particularly in settings where such systems are culturally acceptable and readily accessible. [2-5, 8, 9, 11-18, 20]

Conclusion

The findings of this prospective cohort study suggest that a rationally designed Ayurvedic protocol combining Shodhana and Shamana therapy can produce meaningful improvements in menstrual regularity, clinical hyperandrogenism, anthropometric indices, insulin resistance, lipid profile and ovarian morphology in women with PCOS, indicating that such integrative care has the

potential to address both reproductive and metabolic dimensions of the syndrome in a coherent and clinically relevant manner. In practical terms, the results support the use of structured Panchakarma-based interventions, especially Virechana with or without Basti preceded by appropriate Deepana-Pachana and Snehapana, followed by sustained Medohara and Artava-janana Shamana regimens, in constitutionally appropriate, carefully screened PCOS patients under the supervision of trained Ayurvedic physicians, with close monitoring of metabolic and hormonal parameters. Clinicians working in Ayurvedic and integrative settings can reasonably consider this combined approach for obese and insulin-resistant PCOS phenotypes, ensuring that selection, preparation and post-procedural care strictly adhere to classical guidelines and contemporary safety standards, and that Pathya-Ahara and Dinacharya prescriptions are individualised and realistically achievable for each patient. Given the central role of lifestyle in PCOS, the study underscores the importance of explicitly counselling women on nutrition, physical activity, sleep hygiene and stress management alongside Ayurvedic interventions, and of using simple, trackable metrics such as cycle diaries, weight, waist-hip ratio and basic laboratory indices to reinforce adherence and document progress. At the institutional level, tertiary Ayurvedic centres could develop standard operating procedures and multidisciplinary clinics where Ayurvedic clinicians collaborate with gynaecologists, endocrinologists, nutritionists and mental health professionals to provide comprehensive, culturally sensitive PCOS care, offering patients non-hormonal options when conventional drugs are poorly tolerated, contraindicated or not preferred. For practice in resource-limited or peripheral settings where intensive Panchakarma may not be feasible, the findings suggest that even simplified versions of the protocol, incorporating careful dietary regulation, targeted Shamana drugs and feasible daily routines, might confer benefit if implemented consistently, though such adaptations should be evaluated systematically. At the same time, practitioners should be transparent about the current level of evidence, avoid overpromising outcomes, routinely screen for cardiometabolic risk and infertility issues, and refer promptly for biomedical interventions when indicated, particularly in the context of severe metabolic derangements, long-standing infertility or suspected endometrial pathology. Finally, the encouraging results of this study should motivate clinicians and researchers to participate in or initiate more rigorous controlled trials, registries and long-term follow-up programmes that can refine protocols, identify predictors of response and ultimately guide evidence-based integration of Ayurvedic Shodhana-Shamana strategies into mainstream PCOS management pathways.

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