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A case-based evaluation of personalized nutraceutical therapy in PCOD management

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Abstract

Polycystic Ovary Disease (PCOD) is a complex endocrine disorder that significantly affects the reproductive and metabolic health of women. Conventional pharmacologic treatments often provide limited success in addressing underlying metabolic dysfunctions. This 12-week observational case study evaluated the effects of a personalized nutraceutical smoothie premix on three women clinically diagnosed with PCOD. The formulation integrated Ayurvedic botanicals, essential micronutrients, and functional food ingredients designed to support hormonal balance and enhance insulin sensitivity. Participants were monitored for clinical parameters, biochemical markers, and patient-reported outcomes at baseline and study completion. Notable improvements were observed in total testosterone levels ($p<0.05$), fasting insulin, and the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR). Additionally, participants reported enhanced overall well-being, improved energy levels, and better menstrual regularity. These preliminary findings suggest that personalized, integrative nutraceutical interventions may offer a promising adjunctive approach to managing PCOD by targeting its metabolic and hormonal dimensions.

Keywords: PCOD; Nutraceuticals; Personalized Nutrition; Functional Foods; Women's Health

1. Introduction

Polycystic Ovary Disease (PCOD), also referred to as Polycystic Ovary Syndrome (PCOS), is one of the most prevalent endocrine and metabolic disorders affecting 5–10% of women of reproductive age (*Goodarzi et al., 2011*). Characterized by ovulatory dysfunction, hyperandrogenism, and polycystic ovarian morphology, PCOD often presents with irregular menstruation, infertility, insulin resistance, obesity, acne, and hirsutism (*Azziz et al., 2016*). The pathogenesis of PCOD is complex, involving genetic, hormonal, and environmental factors.

While conventional therapies including oral contraceptives, anti-androgens, and insulin sensitizers such as metformin offer symptomatic control, they are associated with limitations like side effects, poor compliance, and failure to address underlying causes (*Legro et al., 2013; Lord et al., 2003*). This has led to interest in complementary and integrative treatment modalities including lifestyle changes, dietary interventions, and nutraceuticals.

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Nutraceuticals, defined as food-derived bioactive compounds with health benefits, are increasingly being recognized for their role in metabolic regulation. Inositols, Omega-3 fatty acids, spearmint, cinnamon, and adaptogenic herbs such as Ashwagandha and Shatavari extract have shown promise in improving insulin sensitivity and reducing androgen levels (*Unfer et al., 2017; Akilen et al., 2010; Tripathy et al., 2020*). This study evaluates the impact of a tailored nutraceutical formulation on clinical and biochemical parameters in three women with PCOD over a 12-week intervention period.

2. Materials and Methods

This was a single-arm, non-randomized, observational case series conducted over a 12-week period. The primary objective was to assess the effects of a personalized nutraceutical smoothie premix on clinical symptoms, biochemical markers, and quality of life in women diagnosed with PCOD.

2.1. Smoothie Premix Formulated for trial

The intervention involved a standardized smoothie premix formulated based on Ayurvedic principles and recent nutraceutical evidence. Each daily serving (30g) of the premix was reconstituted in 250 ml of A2 Cow milk. It contained:

- Ayurvedic herbal extracts of Shatavari (*Asparagus racemosus*), Ashwagandha (*Withania somnifera*), Cinnamon (*Cinnamomum verum*), Spearmint (*Mentha spicata*) & Fenugreek (*Trigonella foenum-graecum*)
- Vitamins and Minerals: Vitamin B12 (1 mcg), Magnesium (200 mg), Zinc (15 mg), Omega-3 fatty acids (1.2 g from flaxseed and chia seed blend)
- Functional Foods: Organic flaxseeds, chia seeds, plant-based protein blend (pea protein & brown rice protein), Soya Protein Hydrolysate, Fructose Oligo Saccharides, Mannan Oligo Saccharides, Inulin, Lactic acid bacillus, *Lactobacillus acidophilus, Lactobacillus rhamnosus, Bifidobacterium longum, Bifidobacterium bifidum, Streptococcus thermophilus,* Alpha amylase, Protease, Lipase, Cellulase, Bromelain & Alpha galactosidase and Psyllium Husk.

The women in the case study also adhered to a gluten-free, lactose-free, and completely *satvik* diet throughout the intervention period.

2.2. Study Plan

Three female participants aged between 24 and 30 years, previously diagnosed with PCOD per Rotterdam Criteria (2003), were included. Inclusion: oligomenorrhea/amenorrhea, hyperandrogenism (clinical/biochemical), insulin resistance, and no recent hormonal or fertility treatments.

- Exclusion: pregnancy, lactation, other endocrine disorders, or known allergies to formulation components.

Assessments were done at baseline and week 12 including:

- Clinical: menstrual cycle, acne, hirsutism (Ferriman-Gallwey scale)
- Biochemical: serum testosterone, fasting insulin, LDL, HDL, HOMA-IR
- Patient-reported: energy, mood, quality of life

Data were analyzed using paired t-tests. Significance was set at $p<0.05$.

3. Results

All three participants exhibited marked improvements in both biochemical and clinical outcomes over the 12-week intervention period.

Notably, there was a consistent reduction in serum total testosterone levels, fasting insulin concentrations, and HOMA-IR scores, indicating a positive effect on hyperandrogenism and insulin resistance. Additionally, a decline in LDL cholesterol were observed, reflecting improved lipid metabolism (Table 1).

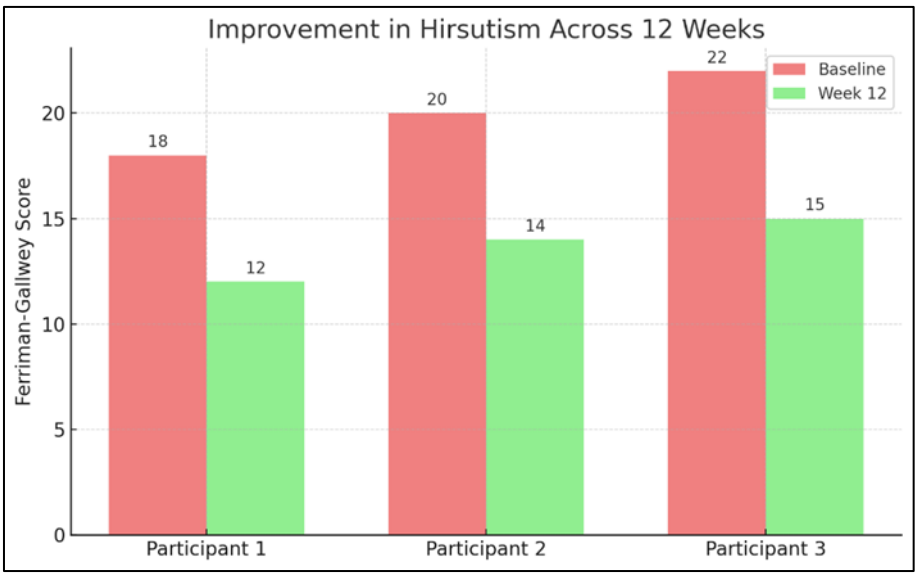
Clinically, all participants reported improved menstrual regularity, with two achieving ovulatory cycles by week 12. Acne severity reduced significantly, and hirsutism scores, assessed via the Ferriman-Gallwey scale, showed a downward trend (Figure 1). These outcomes suggest modulation of androgenic activity and improved hormonal balance.

Subjective evaluations also supported these findings. Participants reported enhanced mood, sustained energy levels, and improved quality of life based on self-assessment questionnaires administered at each interval (Table 2). The integration of functional foods, adaptogenic herbs, and micronutrients appears to have played a synergistic role in addressing the underlying metabolic and hormonal dysregulation associated with PCOD.

These results align with existing literature on the therapeutic potential of inositols, adaptogens such as Ashwagandha, and dietary Omega-3s in managing PCOD symptoms through improvement in insulin sensitivity and reduction in androgen levels. This study supports the feasibility of personalized nutraceutical interventions as a complementary therapy in PCOD management.

Table 1 Changes in Biochemical Parameters at Baseline and Week 12

Parameter	Participant 1 (Baseline)	Participant 1 (Week 12)	Participant 2 (Baseline)	Participant 2 (Week 12)	Participant 3 (Baseline)	Participant 3 (Week 12)	Mean Change ± SD	p-value
Serum Testosterone (ng/dL)	78	48	72	50	80	54	↓ 25.3 ± 2.5 ng/dL	<0.05
Fasting Insulin (µIU/mL)	22	14	19	12	24	15	↓ 7.3 ± 0.9 µIU/mL	<0.05
HOMA-IR	5.1	2.9	4.6	2.6	5.4	3	↓ 2.2 ± 0.2	<0.05
LDL Cholesterol (mg/dL)	142	118	136	110	148	120	↓ 24.6 ± 2.0 mg/dL	<0.05
HDL Cholesterol (mg/dL)	38	42	40	44	35	40	↑ 4.6 ± 0.9 mg/dL	>0.05



Bar Chart Description: X-axis: Participant Number (1, 2, 3); Y-axis: Ferriman-Gallwey Score; Bars: Two per participant – Baseline and Week 12

Figure 1 Improvement in Ferriman-Gallwey Scores for Hirsutism Across 12 Weeks

Table 2 Patient-Reported Outcomes at Baseline and Week 12

Outcome	Participant 1 (Baseline)	Participant 1 (Week 12)	Participant 2 (Baseline)	Participant 2 (Week 12)	Participant 3 (Baseline)	Participant 3 (Week 12)	Trend
Energy Levels (0–10)	4	8	5	9	3	7	↑ Improved
Mood Stability (0–10)	5	8	6	9	4	8	↑ Improved
Quality of Life (0–10)	4	8	5	9	3	8	↑ Improved
Menstrual Regularity	Irregular	Regular	Irregular	Regular	Irregular	Partial Regularity	↑ Improved
Acne Severity (0–5 scale)	4	1	5	2	4	2	↓ Reduced

4. Discussions

The findings of this observational study support the therapeutic potential of a personalized nutraceutical intervention in managing the complex hormonal and metabolic dysregulation associated with PCOD. The observed improvements in serum testosterone levels, insulin resistance (HOMA-IR), and lipid profile (notably LDL cholesterol) are indicative of the formulation's role in modulating endocrine and metabolic pathways. Clinically, enhanced menstrual regularity, reduced acne severity, and lowered hirsutism scores suggest a positive influence on androgen excess, one of the key pathophysiological features of PCOD. Subjective reports of improved mood and energy further highlight the formulation's potential in addressing quality-of-life aspects often overlooked in conventional management. These results are consistent with existing literature on the role of inositols, cinnamon, Omega-3 fatty acids, and adaptogenic botanicals in improving insulin sensitivity and androgen balance.

5. Conclusion

The 12-week intervention with a personalized nutraceutical smoothie premix showed encouraging improvements in clinical, hormonal, and metabolic parameters among women with PCOD. These preliminary findings underscore the potential of integrative nutraceutical strategies in managing complex endocrine disorders. Further large-scale studies are warranted to validate these outcomes and establish broader clinical applicability.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

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