Functional Ingredient Mapping in PCOS Formulations: Insulin Sensitivity and Glycemic Control

M. Tulasi Lakshmi[1], Dhanshree Lakudkar[2], and Md Quamruz Zafar[3]
[1]*M. Tulasi Lakshmi, Hindu College of Pharmacy*
[2]*Dhanshree Lakudkar, Clinivance Labs*
[3]*Md. Quamruz Zafar, Clinivance Labs*

***Abstract*— Background: Polycystic Ovarian Syndrome (PCOS) is an endocrine gynaecology disorder affecting the reproductive aged women. It is observed in those who are having symptoms like hyperandrogenism, insulin resistance, polycystic ovaries, obesity, oxidative stress, menstrual irregularities and some were being investigated. A systematic review literature was done on many studies; we have observed that Hyperandrogenism and Insulin resistance are the major concerns. So, we are focusing on Insulin resistance in this article. Objectives: To map key functional ingredients to reasonable mechanisms and clinical outcomes related to insulin sensitivity and glycemic control in PCOS. Methods: Rapid systematic literature was done in which primary outcomes include insulin sensitivity and glycemic control in PCOS women**

***Index Terms*— polycystic ovarian syndrome (PCOS), Insulin resistance, Hyperandrogenism, Glycemic control, Functional ingredients, Insulin sensitivity, Endocrine disorder, Oxidative stress**

I. INTRODUCTION

Polycystic Ovarian Syndrome (PCOS) is an endocrine gynaecology disorder affecting the reproductive aged women. Insulin resistance affects majority of women with PCOS and leading to hyperinsulinemia, hyperandrogenism, irregular menstrual cycles and risk of developing type 2 diabetes. This review focuses on functional ingredients with human data for improving insulin sensitivity and glycemic control

II. DIAGNOSTIC CRITERIA

There are several widely used diagnostic criteria for PCOS which mainly used are

i) Clinical hyperandrogenism
ii) Menstrual cycle irregularity
iii) Polycystic ovaries by ultrasound

PCOS Phenotypes

PCOS Phenotypes are seen in individuals body types like lean/overweight/obese and along with the mechanisms in each woman with PCOS.

Insulin resistance

As we can see Insulin resistance is most commonly seen side - effect in woman with PCOS.

Glycemic control

We need to control the Glycemic levels in the blood in woman with PCOS

Current Treatment approaches

PCOS treatment includes both lifestyle modifications and pharmacological treatment in which lifestyle modifications are used to patients with mild symptoms and pharmacological treatment to patients with severe symptoms.

Treatment	Therapeutic intervention	Indication	Adverse effects
First line therapy	Lifestyle modifications	Improved body weight, fertility, hormonal profile and Insulin levels	Not effective against moderate to severe symptoms of PCOS
Second line therapy	Metformin (MTF)	Inhibits glucose production in liver, increase peripheral insulin sensitivity and glucose uptake	Nausea, headache, low vitB12, arrhythmia and Ovarian hyperstimulation syndrome (OHSS)
Third line therapy	Dipeptidyl peptides 4 inhibitors like vildagliptin, sitagliptin,linagliptin etc	Improves insulin sensitivity, hyperandrogenism and hyperglycemia	Breathing difficulty, headache, pharyngitis.

III. TREATMENT AND MANAGEMENT

It includes both lifestyle and pharmacological treatment for the woman having PCOS.

Lifestyle modifications

It includes diet and supplementation by managing weight with lifestyle changes which acts as a primary treatment i.e., First line therapy.

Pharmacological treatment

It includes various drugs like Metformin that acts as a second line therapy and third line therapy includes drugs like Sitagliptin, Linagliptin etc

IV. INGREDIENT MAPPING

Supplementations

It includes supplementations like Inositol, Berberine, Alpha-Lipoic acid, Probiotics, Vitamin D, N acetyl cysteine, Carnitine and Curcumin with various formulation approaches.

Inositols

The main role is to improve the insulin sensitivity and glucose control in the woman with PCOS leading to improved ovulation. Dosing: 1-5 g/day.

Alpha- lipoic acid

Antioxidant and improved insulin sensitivity, particularly combined with Myo-Inositol. Improved regular ovulation is observed. Dosing:600-1200 mg/day.

N-Acetylcysteine (NAC)

Compared with Metformin and shows similar improvements in insulin sensitivity with fewer side effects. Dosing: 600 mg BD/TID.

Probiotics

It shows improved insulin resistance and fasting insulin. Dosing:10^9 CFU/day often 8-12 weeks.

Vitamin D

It benefits most apparent in deficit women for insulin and cardiometabolic markers. Dosing: 2000-4000 IU/day.

Cinnamon

The main role is that they decrease in fasting insulin and slight favourable to glycemic effects. Dosing: 1-1.5g/day extract or 1-2g/day powder.

Berberine

It shows similar efficacy to Metformin fir insulin resistance and the main role is to improve blood lipid regulation and shows antibacterial activity. Dosing: 500 mg BD/TID.

Curcumin

It shows signals for improved insulin sensitivity and androgens and improve glycemic control and lipid markers. Its formulations are used to treat the women with PCOS. Dosing: 500-1500 mg/day.

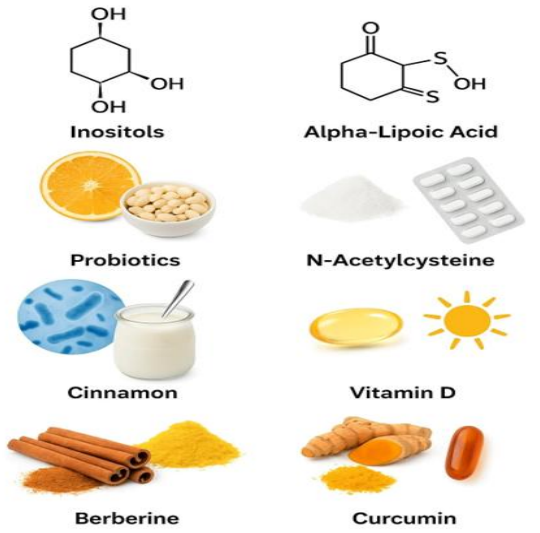

Fig 1. Raw materials which are used as supplementation in the treatment

V. INTERACTIONS

Most ingredients are well tolerated but some includes potential side effects.

- Berberine – drug interactions with CYP3A4/P-gp
- Cinnamon – hepatotoxicity
- Alpha- lipoic acid – lower blood glucose
- N-Acetylcysteine – GI upset
- Curcumin - Antiplatelet effects and GI intolerance may possible.
- Vitamin D – If taken over dose leads to hypercalcemia.
- Avoid all the medications in pregnancy and lactation.

VI. DISCUSSION

The mapping of functional ingredients for PCOS formulations targeting the insulin resistance and glycemic control reveals a spectrum of evidence. After reviewing many articles, I found that Myo- Inositol especially combined with D chiro Inositol emerged as most effective one during the trial. Moderate evidence-

based ingredients include: Cinnamon, Alpha-lipoic acid, N acetyl cysteine, Probiotics. Low moderate evidence-based ingredients include: Curcumin, Berberine. Certain agents like Berberine are mainly contraindicated in pregnancy and interact with prescription drugs.

VII. CONCLUSION

Functional Ingredient mapping offers a structured framework to align PCOS supplement formulation. The most consistent evidence supports Inositols with additional supportive signals for Cinnamon, alpha lipoic acid, prebiotic and Vitamin D. Berberine shows potential but require careful consideration of drug interactions. Myo-Inositol remains the cornerstone for improving insulin sensitivity with several moderate evidence agents offering potential synergistic effects. Future research studies should include more well designed and adequately done trials to formulate more safer and quality drugs to reduce insulin resistance and glycemic control in women with PCOS.

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