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FORMULATION AND EVALUATION OF POLYHERBAL SYRUP IN THE MANAGEMENT OF PCOS

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ABSTRACT

Polycystic Ovary Syndrome (PCOS) is a complex endocrine disorder associated with hormonal imbalance, irregular menstruation, and insulin resistance. The present study was aimed at developing a polyherbal syrup as a natural and supportive approach for PCOS management. The formulation was prepared using selected medicinal plants including fenugreek, turmeric, aloevera, cinnamon, spirulina, and stevia as a natural sweetening agent. The syrup was formulated by decoction method and evaluated for organoleptic and physicochemical parameters such as color, odor, taste, pH, viscosity, and density. The formulation showed acceptable stability, palatability, and uniform consistency. Phytochemical screening confirmed the presence of bioactive constituents like flavonoids and tannins, indicating potential therapeutic activity. The use of stevia instead of sugar enhances suitability for individuals with insulin resistance. Overall, the developed polyherbal syrup demonstrates promising potential as a safe and effective supportive formulation for PCOS management, warranting further clinical investigation.

KEYWORDS: *Polycystic Ovarian Syndrome (PCOS), Polyherbal syrup, Insulin resistance, Endocrine disorder, Stevia rebaudiana, Phytochemical screening, Evaluation.*

1. INTRODUCTION

Polycystic ovary (ovarian) syndrome (PCOS) is a common hormonal disorder affecting increasing number of women between puberty and menopause. It is called a 'syndrome' because it refers to a number of symptoms experienced at the same time. It is also known as 'polycystic ovary disease', 'Stein-Leventhal syndrome' or 'hyperandrogen anovulation syndrome.

The condition is usually diagnosed based on the following factors

1. Increased androgens (male hormones, such as testosterone) as shown by excess hair growth, acne or raised blood testosterone levels
2. Lack of regular ovulation (irregular menstrual periods or failure to release an egg from the ovary)
3. A characteristic appearance of the ovaries on ultrasound (polycystic ovaries – PCO)

The majority of women who have PCOS also have what is known as insulin resistance which occurs when the body struggles to carry out the normal actions of insulin such as regulating the blood glucose levels. High levels of insulin can also increase the production of the male hormones including testosterone from the ovary, which contributes to such symptoms as excessive hair and acne. Insulin resistance can be caused by either genetic factors or lifestyle factors (such as being overweight) or it can be due to a combination of both.[1]

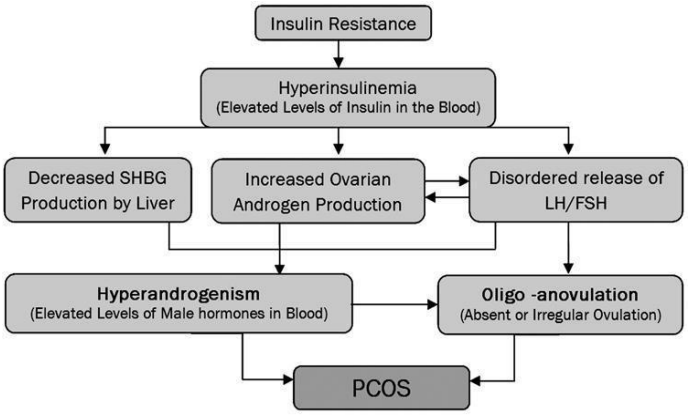

Figure 1: intricate pathway between insulin and pcos.

Worldwide, affecting many females in the reproductive age group, polycystic ovary syndrome (PCOS) is considered to be a heterogeneous endocrine disorder characterized by hyperandrogenism, ovulation dysfunction, and the morphology of polycystic ovary (PCO).[2]

Depending on the parameters defined, PCOS has a reported prevalence in the community of 6%-10%.[3]

Potential PCOS Causes

1. Insulin resistance: Some women are less sensitive to insulin than normal, which makes their ovaries produce too many male hormones.

2. Genetics: PCOS appears to run in families, so having a mother or sister with the condition makes you more likely to have it.

3. Obesity: because women and girls with PCOS are more likely to gain excess weight and women and girls who are obese are more likely to have the condition, there is a tight, but not absolute, link between the two.[4]

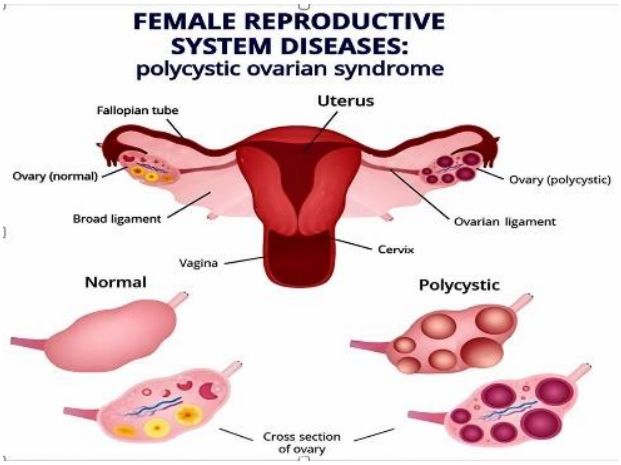

Figure 2: Normal vs polycystic ovary.

Polyherbal Formulation: polyherbal formulations, have recently became well-known throughout the world due to their unique advantages not found in allopathic medications. To begin with, PHFs are recognized for their high efficiency across a wide variety of illnesses. The medicinal effects of herbal remedies arises from the presence of diverse phytoconstituents, and this effect is enhanced when compatible herbs are combined in PHFs.[5]

2. PLANT PROFILE

TURMERIC

Figure 3: Turmeric.

Biological source: Turmeric consists of the dried rhizomes of *Curcuma longa* Linn., a perennial herb belonging to the family Zingiberaceae. The rhizomes are collected, boiled, dried before use.

Chemical Constituents: Curcuminoids like Curcumin, Demethoxycurcumin, Bisdemethoxycurcumin, Volatile oils like Turmerone and Zingiberene, Other constituents like Proteins, Resins, Sugars & Starch Geographical Source: Turmeric is widely cultivated in tropical regions. Major producer include India.

Role of Turmeric: Turmeric is used in the management of PCOS due to its curcumin content, which exhibits anti-inflammatory and antioxidant properties, improves insulin sensitivity, and helps regulate hormonal imbalance.[6]

Figure 4: Fenugreek.

FENUGREEK

Biological source: Fenugreek consist of the dried ripe seeds of *Trigonella foenum-graecum* Linn., belonging to the family Fabaceae.

Chemical Constituents: Fenugreek seeds contain steroidal saponins such as diosgenin, alkaloids like trigonelline, along with flavonoids mucilage, proteins, and fixed oils.

Geographical source: Fenugreek is widely cultivated in India, especially in Rajasthan, Gujrat, and MP, as well as in North African regions.

Role of Fenugreek: Fenugreek plays a supportive role in the management of PCOS by improving insulin sensitivity, helping regulate blood glucose levels, and contributing to hormonal balance, which may assist in reducing such as irregular menstruation.[7]

CINNAMON

Figure 3: Cinnamon.

Biological source: Cinnamon is consists of the dried inner bark of *Cinnamomum verum* J. Presl, belonging to family Lauraceae.

Chemical constituent: Cinnamon consists volatile oil rich in Cinnamaldehyde, along with eugenol, tannins, mucilage, and other polyphenolic compounds responsible for its activity.

Geographical source: It is mainly cultivated in Sri Lanka, India, and other tropical regions.

Role of cinnamon: Cinnamon plays a beneficial role in the management of PCOS by improving insulin sensitivity, reducing blood glucose levels, and helping regulate menstrual cycles, thereby supporting hormonal balance.[8]

ALOEVERA

Biological source: Aloevera consists of the fresh or dried juice obtained from the leaves of *Aloe barbadensis Miller*, belonging to the family of the Family Asphodelaceae.

Chemical constituents: Aloevera consists anthraquinones glycosides such as aloin, along with polysaccharides, enzymes, vitamins, minerals, and amino acids.

Figure 6: Aloevera.

Geographical source: It is cultivated in tropical and subtropical regions, including India, Africa, and the Mediterranean countries.

Role of Aloevera: It helps regulate blood glucose level, improving insulin sensitivity, and supporting hormonal balance.[9]

SPIRULINA

Biological source: Spirulina consists of the dried biomass of *Spirulina plantesis*, a blur-green algae, belonging to the family Oscillatoriaceae.

Chemical constituents: It's rich in proteins, essential amino acids, vitamins especially B-complex, minerals, chlorophyll, and pigments such as phycocyanin, along with essential fatty acids.

Figure 7: Spirulina.

Geographical source: It is found in alkaline freshwater lakes and is cultivates commercially in countries such as India, China, and parts of Africa.

Role of Spirulina: It supports management of PCOS by improving lipid profile, reducing oxidative stress, and assisting in metabolic regulation, which contribute to better hormonal balance.[10]

STEVIA

Figure 8: Stevia.

Biological source: Stevia is derived from the dried leaves of *Stevia Rebaudiana* Bertoni, which belongs to the family Asteraceae.

Chemical constituents: Stevia contains diterpene glycosides such as stevioside and rebaudioside, along with flavonoids, tannins, and essential oils.

Geographical source: It is native to South America and is now cultivates in various parts of the world, including India, China, and Brazil.

Role of Stevia: It supports the management of PCOS by regulating blood glucose levels and reducing calorie intake, thereby indirectly contributing to improved metabolic and hormonal balance.

It is incorporated as a natural sweetening agent to improve palatability and patient acceptability of the syrup while providing a low-calorie alternative to sugar due to the presence of steviol glycosides.[11]

3. RESEARCH METHODOLOGY

SELECTION OF HERB: Based on literature review, the herbs were selected.

COLLECTION OF MATERIAL: Selected herbs was collected and cleaned.

EXTRACTION OF HERBS: The extraction of the selected herb were done by the decoction method.

3.1 Extraction of Turmeric

- The rhizome of were collected and dried in shade.
- Dried rhizome powdered in mortal pestle.
- 5 gm of powder added in 50ml 0f purified water.

- The mixture were heated on heating mantle for 20min at 60℃.
- After 20 min the extract was filtered.
- Extract is used in the formulation.

Figure 9: Turmeric extract.

3.2 Extraction of Fenugreek

- The seeds were collected and dried in shade.
- Dried seeds powdered in mortal pestle.
- 5 gm of powder added in 50ml 0f purified water.
- The mixture were heated on heating mantle for 20min at 60℃.
- After 20 min the extract was filtered.
- Extract is used in the formulation.

Figure 10: Fenugreek extract.

3.3 Extraction of Cinnamon

- The bark were collected and dried in shade.
- Dried bark powdered in mortal pestle.
- 5 gm of powder added in 50ml 0f purified water.
- The mixture were heated on heating mantle for 20min at 60℃.
- After 20 min the extract was filtered.
- Extract is used in the formulation

Figure 11: Fenugreek extract.

3.4 Extraction of Aloevera

Took fresh and healthy leaves of aloevera and wash them thoroughly with purified water.

Removed thorny edges using a clean knife.

Cut the leaves into two halves.

Carefully peel the outer green layer.

Collected the inner transparent gel using a spoon.

Transfer the gel into a beaker and crush it gently to obtain uniform consistency.

Filter the gel using muslin cloth to remove fiber.

Collect the clear gel extract and this extract is used in formulation.

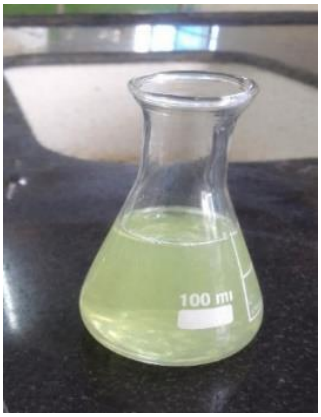

Figure 12: Aloevera extract.

3.5 Extraction of Spirulina

- The bark were collected and dried in shade.
- Dried bark powdered in mortal pestle.
- 2 gm of powder added in 50ml 0f purified water.
- The mixture were heated on heating mantle for 20 min at 60℃.
- After 20 min the extract was filtered.
- Extract is used in the formulation.

Figure 13: Spirulina extract.

3.6 Extraction of Stevia

Take dried leaves of *Stevia rebaudiana* and wash with purified water to remove impurities.

Dry the leaves and grind them into coarse powder.

Add 15 grams of powdered drug to 100 ml of purified water.

Heat the mixture in a beaker at about 60-70°C for 20-30 minutes.

Allow the extract to cool at room temperature.

Filter the extract using muslin cloth or filter paper.

Collect the clear filtrate.

This extract is used in formulation.

Figure 14: Stevia extract.

4. FORMULATION OF SYRUP

➢ Procedure

1. Mix each extract (8 ml each).
2. Addition of Stevia Syrup: Added 60 ml of stevia syrup and preservatives Methyl paraben and propyl paraben in a small amount.
3. Added Water-Soluble Vitamin: Dissolve water-soluble vitamins like Vitamin C in sterile water. Mix 5 ml of each vitamin solution into the syrup solution.
4. Addition of flavouring agent: Few amounts of natural Raspberry syrup.
5. The final product is labelled and passed for evaluation.[12]

Figure 3: mixing of extracts, preservatives and vitamin.

Figure 15: addition of flavouring agent.

Figure 16: Final product.

5. FORMULA

Table 1: Formula for Syrup.

Sr. No.	Contents	Quantity [Each 5ml contains]
1.	Turmeric extract	0.4ml
2.	Fenugreek extract	0.4ml
3.	Cinnamon extract	0.4ml
4.	Aloevera extract	0.4ml
5.	Spirulina extract	0.4ml
6.	Stevia extract	3ml
7.	Vitamin C	40mg
8.	Propyl paraben	1mg
9.	Methyl paraben	1mg
10.	Flavouring agent	Q.S.

6. EVALUATION TEST

Organoleptic Properties

Colour and Appearance: The formulation was visually examined under proper lighting. A uniform colour without discoloration indicates good stability.

Odour: Odour was checked by gentle inhalation. A pleasant and characteristic smell confirms absence of degradation.

Taste (Palatability): Taste was evaluated to ensure the formulation is acceptable and suitable for patient compliance.

Clarity: The syrup was inspected visually. A clear and transparent solution without particles indicates good quality.

Consistency (Viscosity): Flow behaviour was observed. Suitable viscosity ensures easy pouring and stability.

Homogeneity: The formulation was checked for uniformity. Absence of phase separation indicates proper mixing.

pH Determination: The pH was measured using a calibrated pH meter. The sample was taken in a beaker, and the electrode was immersed to record the stable reading.

Density: Density was determined using a pycnometer by comparing the weight of the syrup with water.

Viscosity: Viscosity was measured using a viscometer at constant temperature. The flow time between two marks was recorded and averaged.

Table 2: Evaluation result of Syrup.

Sr. no.	Evaluation Parameter	Results
1.	Color	Reddish brown
2.	Appearance	Slightly opaque
3.	Odour	Raspberry sugary with mild herbal aroma
4.	Taste (palatability)	Sweet raspberry with mild herbal aftertaste
5.	Clarity	Free from suspended particles
6.	Homogeneity	Uniform
7.	Consistency	Smooth , syrupy
8.	Viscosity	150 cP
9.	pH	4-5
10.	Density	1.05 g/cm3

7. SUMMARY AND CONCLUSION

The present study was undertaken to formulate and evaluate a polyherbal syrup for the supportive management of Polycystic Ovary Syndrome (PCOS). The formulation

incorporated Curcuma longa, Trigonella foenum-graecum, Cinnamomum verum, Aloe barbadensis, Spirulina platensis, and Stevia rebaudiana, selected for their reported antihyperglycemic, antioxidant, and hormone-regulating properties. The syrup was prepared using a decoction method and subjected to organoleptic and physicochemical evaluation. The formulation exhibited a reddish-brown, slightly opaque appearance with a pleasant raspberry-like odour and acceptable taste. It showed good homogeneity and smooth consistency, with no visible particulate matter. The physicochemical parameters were within acceptable limits, with pH in the range of 4–5, viscosity around 150 cP, and density approximately 1.05 g/cm^3, indicating suitable stability and formulation characteristics.

In conclusion, the developed polyherbal syrup demonstrated satisfactory evaluation parameters and may offer a promising natural approach for managing PCOS by targeting metabolic and hormonal imbalance.

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