" Pre- formulation Assessment of Herbal Powders Intended for Orange Flavored Sugar free Polyherbal Syrup : Phytochemical, Rheological, Sensory and Physiochemical Studies "

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Abstract:
The present study had focused on the pre-formulation studies and formulation process of a poly-herbal syrup. Phytochemical screening had been carried out on five medicinal herbs, namely Amla(*Phyllanthus emblica*), Ginger(*Zingiber officinale)*, Turmeric(*Curcuma longa)*, Tulsi(*Ocimum sanctum*), and Ashwagandha(*Withania somnifera)*, using standard qualitative chemical tests to identify major classes of constituents, including tannins, saponins, flavonoids, alkaloids, phenolics, and terpenoids. On the basis of these findings, a reproducible method had been developed for preparing an aqueous herbal decoction from the selected plant materials and subsequently blending it with a natural sweetener (stevia) and orange flavour to obtain a palatable syrup. The formulated preparation had then been evaluated for its phytochemical profile and essential physicochemical characteristics to ensure acceptable quality and stability. Overall, the work had provided a scientific foundation for the development of a standardized poly-herbal syrup with potential health benefits, as substantiated by previously published research in herbal pharmaceutical science.

Key Words:
Polyherbal syrup, Pre-formulation studies, Herbal decoction, Phytochemical screening, Amla, Ginger, Turmeric, Tulsi, Ashwagandha, Tannins, Flavonoids, Alkaloids, Saponins, Phenolics, Terpenoids, Stevia, Natural sweetener, Orange flavor, Standardized herbal formulation, Herbal pharmaceutical science.

Introduction:

Immunity has formed the cornerstone of the body's defense system, encompassing innate barriers and adaptive immune responses that have neutralized invading pathogens through coordinated cellular and humoral mechanisms. In recent years, a growing demand for natural, sugar-free immunity-boosting formulations has emerged, particularly to support individuals with metabolic disorders such as diabetes, obesity, and metabolic syndrome, where conventional sugar-based syrups have posed additional health risks. To meet this need, phytochemical-rich citrus sources have been utilized, as they have provided abundant vitamin C, flavonoids, and other antioxidant constituents that have contributed to enhanced immune modulation, free-radical scavenging, and overall maintenance of physiological resilience. Within this context, the present study has focused on the formulation and systematic evaluation of an orange-flavoured, sugar-free herbal syrup incorporating selected herbal extracts and polyols as alternative sweetening and bulking agents. The formulation has been optimized for physicochemical stability, palatability, and patient acceptability, while its potential therapeutic efficacy as a herbal nutraceutical for immune support has been explored as a basis for further clinical and pharmacological investigation.

Material & Method:

1. Collection of herbs

Ashwagandha and tulsi powder were purchased from Tulsi Ayurvedic Store, amla was collected from the garden of Parijat College of Pharmacy, and fresh haldi, ginger and orange were bought from the local market. Stevia was bought from the local market.

Ingredients	Area	Quantity (gm)
Amla	College herbal garden	100
Ashwagandha	Tulsi ayurvedic store	100
Haldi	Local market	100
Ginger	Local market	100
Tulsi	Tulsi ayurvedic store	100

Table no 1: List of Ingredients

2. Organoleptic Properties

Organoleptic properties are the sensory characteristics of food, water, or other products—such as taste, smell, color, appearance, and texture—that are perceived by human senses. They are crucial for assessing product quality and safety.

Example : Colour, Odor, Taste, Texture etc.

3. Flow Properties

Flow property of powder refers to the ability of a powder to flow smoothly and uniformly under the influence of gravity or an external force.

i. Bulk Density : It is defined as the mass of a powder divided by the bulk volume.It depends on particle size distribution, particle shape and the tendency of particles to adhere together.

Procedure :

- Gently introduce an accurately weighed amount (5g) of each powder into a 10 ml graduated cylinder.
- Record the volume (Vo) of the powder and calculate "po".

$$Po = \frac{\text{Wt.(g)}}{\text{Vol}(cm^3)} = \frac{5}{V_0} = g/cm^3$$

ii. Tapped Density : Tapped density refers to the apparent density of a powder after it has been mechanically tapped or vibrated to settle the particles and minimize voids between them.

Procedure :

- Drop and tap the cylinder carefully onto a hard surface for 10 times from a height of 5 cm.
- Record the volume (V10) of the powder and calculate "P10" which is the loose bulk density.

$$P_{(tap)} = \frac{\text{Wt.(g)}}{Vol_{(tap)}}$$

iii. Hausner's Ratio : It measures the drug's flow characteristic.

$$\text{Hausner's Ratio} = \frac{P(\text{tapped})}{P(\text{bulk})}$$

iv. Carr's Index : It measures the relationship between a powder's ability to be compressed and its potential to flow.

$$\text{Carr's Index} = \frac{P(tapped) - P(bulk)}{P(tapped)}$$

V. Angle of Repose : Angle of repose is the maximum angle possible between the surface of the pile (heap) of powder and the horizontal plane. It gives a measure of the frictional forces which oppose the flow of a loose powder.

$$\tan\theta = \frac{2H}{D}$$

Procedure :

- Fix a funnel to a stand vertically above the center of a piece of paper so that the distance between the funnel tip and the paper is 5 cm.
- Allow 5 g of each sample to slide on the funnel wall slowly with a fixed rate by gentle tapping on the powder container so that the powder forms conical heap (pile) on the paper.
- Measure the diameter "D" of the bed in two planes at right angles taking the mean value. Also determine the bed height "H" using a ruler.

3. Phytochemical Screening

i. Test for Alkaloid

Mayer's test for alkaloids

Reagent used: Mayer's reagent (potassium mercuric iodide / potassium tetraiodomercurate).

Procedure:

- Take about 1–2 mL of plant extract (aqueous or alcoholic) in a clean test tube.
- Acidify the extract slightly by adding 1–2 mL of dilute HCl (optional, but often used to keep alkaloids in salt form).
- Add a few drops of Mayer's reagent to the test tube.
- Shake the tube gently and allow it to stand for a minute.

Observation (positive test):

- Formation of cream-colored, yellowish, or white precipitate indicates the presence of alkaloids.

Hager's test for alkaloids

Reagent used: Hager's reagent (saturated aqueous solution of picric acid).

Procedure:

- Take about 2 mL of plant extract (aqueous or alcoholic) in a test tube.
- Add a few drops of Hager's reagent (saturated picric acid solution) to it.
- Mix gently and let stand for a short time.

Observation (positive test):

- Formation of bright yellow crystalline precipitate indicates the presence of alkaloids in the extract.

ii. Test for Tannins/

Phenolics Lead Acetate Test

Reagent: 10% lead acetate solution.

Procedure:

- Take 1-2 mL of plant extract filtrate in a test tube; add 3 drops of 10% lead acetate solution.

Observation:

- Formation of white or cream-colored precipitate indicates tannins**.**

Ferric Chloride Test

Reagent : 5% ferric chloride ($FeCl_3$) solution**. Procedure :**

- Take 1 mL of plant extract, dilute with water (1:4 if needed).

Add 2-3 drops of 5% $FeCl_3$.

Observation :

- Dark green, blue-black, or bluish-green color confirms tannins.

iii. Test for

Terpenoids Salkowski

Test Reagents

- Chloroform (2 mL)
- Concentrated sulfuric acid (H_2SO_4, 3 mL)

Procedure

- Take 5 mL of the plant extract in a test tube.
- Add 2 mL of chloroform and shake vigorously to mix.
- Carefully add 3 mL of concentrated sulfuric acid along the side of the test tube to form a lower layer, without shaking further.
- Allow the mixture to stand for a few minutes to observe layer separation.

Observation

- A reddish-brown color at the interface (junction) between the chloroform and sulfuric acid layers confirms the presence of terpenoids.

iv. Test for Flavonoids

Shinoda test (Mg-HCl test)

Reagents used :

- Magnesium turnings/ribbon.
- Concentrated hydrochloric acid (HCl).

Procedure:

- Take about 1–2 mL of alcoholic plant extract in a clean test tube.
- Add a few pieces of magnesium turnings/ribbon to the extract.
- Add 2–3 drops of concentrated HCl and mix gently.
- Allow the mixture to stand for a few minutes and observe the color change.

Observation (positive result):

- Development of pink, red, scarlet, crimson, or sometimes orange–red color indicates the presence of flavonoids (especially flavones and flavonols).

Alkaline Reagent Test Reagents

used :

- Dilute sodium hydroxide (NaOH) solution (e.g., 5–10%).
- Dilute hydrochloric acid (HCl) for acidification.

Procedure:

- Take about 1–2 mL of the plant extract in a test tube.
- Add a few drops of dilute NaOH solution and shake.
- Note the color.
- Then add a few drops of dilute HCl to acidify the solution and note any change.

Observation (positive result):

- Immediate yellow color on addition of NaOH, which fades or disappears on acidification with HCl, indicates the presence of flavonoids.

v. Test for

Curcumin Reagent

- Glacial acetic acid (solvent for sample).
- 20% boric acid

Procedure:

- Take about 1–2 mL of the plant extract in a test tube.
- Add few drops of 20% boric acid and acetic acid.

Observation (positive result):

- A positive test shows a bright red to crimson color within minutes.

vi. Test for Eugenol

Borntrager's test

Reagent : 5% ferric chloride ($FeCl_3$) solution**. Procedure:**

- Take about 1–2 mL of the plant extract in a test tube.
- Add 2-3 drops of 5% $FeCl_3$.

Observation

- Characteristic blue- green colour

vii. Test for

Saponin Foam Test

Reagent:

- Distilled water

Procedure:

- Take 1ml extract; add 10ml distilled water.
- Shake vigorously for 15–30 seconds; let stand 5–10 min.

Observation

- Persistent foam shows presence of saponin.

4. Physiochemical Test

i. Ash Value : Ash value is defined as the weight of the inorganic residue remaining after the complete combustion of a sample, expressed as a percentage of the original sample weight by the formula:

$$\text{Ash Value}(\%) = \frac{\text{Weight of Ash residue}}{\text{Weight of Sample}} \times 100$$

Result & Discussion

The present study had evaluated five medicinal herbs—Amla, Ashwagandha, Tulsi, Ginger, and Haldi— through systematic pre-formulation and phytochemical investigations to assess their suitability for incorporation into a multi-herbal syrup. The collected crude drugs had exhibited characteristic organoleptic properties (colour, odour, and taste) consistent with their traditional descriptions, thereby confirming proper identity and absence of gross adulteration. Evaluation of flow properties had shown that most powders possessed good to fair flow, with acceptable bulk and tapped densities, Carr's index values generally below 20%, and Hausner's ratios around 1.1–1.2, indicating that the materials were suitable for uniform mixing and decoction preparation despite some cohesiveness observed in Ashwagandha and Tulsi. Ash value determination had revealed moderate and acceptable levels of total inorganic content for all samples, suggesting limited contamination with extraneous matter and supporting their quality for further processing. Qualitative phytochemical screening had demonstrated a broad and complementary spectrum of secondary metabolites across the selected herbs: Amla had contributed tannins, phenolics, saponins, flavonoids, alkaloids, and terpenoids; Ashwagandha had supplied alkaloids, tannins/phenolics, and saponins; Tulsi had provided tannins/phenolics, saponins, flavonoids, and eugenol; Ginger had shown the presence of alkaloids, tannins/phenolics, terpenoids, and flavonoids; while Haldi had been the specific source of curcumin. This diversified phytochemical profile had suggested the potential for synergistic antioxidant, anti-inflammatory, and immunomodulatory effects when the herbs were combined in a single formulation. Overall, the generated data had confirmed both the pharmaceutical suitability of the crude drugs and the scientific rationale for their combination in a standardized, sugar-free polyherbal syrup intended for immune support.

1. Organoleptic Property

Parameter	Obeservation				
	Amla	**Ashwagandha**	**Haldi**	**Ginger**	**Tulsi**
Colour	Light Brown	Off White	Yellow	Pale Yellow	Dull Green
Odor	Fruity	Strong earthy	Characterstics aromatic	Spicy	Strong aromatic
Taste	Sour	Pungent	Bitter	Pungent	Pungent

Table no 2: Organoleptic Property

2. Flow Properties

Ingredient	Bulk Density g/cm^3	Tapped Density g/cm^3	Carr's Index %	Hausner's Ratio	Angle of repose
Amla	0.55	0.66	16.66	1:20	33.7°
Ashwagandha	0.33	0.37	10.81	1:12	45.0°
Tulsi	0.33	0.41	19.5	1:24	48.8°
Ginger	0.33	0.41	19.5	1:12	33.7°
Haldi	0.5	0.55	9.09	1:10	42.3°

Table no 3: Flow Properties

Figure 1: Bulk Density

Figure 2: Tapped Density

Figure 3: Angle of Repose

3. Physiochemical Properties (Ash value)

Ingredient	Sample wt. (In gm)	Ash wt. (In gm)
Amla	1	0.13
Ashwagandha	1	0.24
Tulsi	1	0.19
Ginger	1	0.13
Haldi	1	0.22

Table no 4: Physiochemical Properties (Ash value)

Figure 4: Ash Value

4. Phytochemical Screening

Phytochemical Constituent	Test performed	Amla	Ashwagandha	Tulsi	Ginger	Haldi
Alkaloids	Mayer's Test, Hager's Test	+ve	+ve	-ve	+ve	-ve
Tannins/ Phenolics	Lead Acetate test, FeCl2	+ve	+ve	+ve	+ve	-ve
Saponins	Foam test	+ve	+ve	+ve	-ve	-ve
Terpenoids	Salkowski test	+ve	-ve	-ve	+ve	-ve
Flavonoids	Shinoda test, Alkaline reagent test	+ve	-ve	+ve	+ve	-ve
Curcumin	-	-ve	-ve	-ve	-ve	+ve
Eugenol	Borntrager's test	-ve	-ve	+ve	-ve	-ve

Table no 5: Phytochemical Screening

Figure 4: Amla

Figure 5: Ashwagandha

Figure 6: Ginger

Figure 7: Haldi

Figure 8:Tulsi

Conclusion

The findings of this work had established that the selected herbal ingredients met essential pre-formulation criteria and possessed rich, complementary phytochemical profiles appropriate for a multi-herbal syrup. Acceptable organoleptic characters, flow properties, and ash values had indicated good quality and processability of the crude drugs, while phytochemical screening had verified the presence of multiple classes of bioactive constituents relevant to immune modulation and antioxidant activity. Together, these results had provided a strong foundation for the successful development and further optimization of a standardized, orange-flavoured, sugar-free polyherbal syrup, and had justified subsequent studies on its physicochemical stability and therapeutic performance as a herbal nutraceutical.

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