"From Extraction to Evaluation : Development of a Novel Orange Flavored Sugar Free Polyherbal Immunity Boosting Syrup"

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Abstract:

Immunity-boosting herbal syrups offer a natural alternative to synthetic supplements, particularly in sugar-free formulations for broader accessibility. This study aimed to extract bioactive compounds from Amla (*Emblica officinalis*), Ashwagandha (*Withania somnifera*), Tulsi (*Ocimum sanctum*), Haldi (*Curcuma longa*), and Ginger (*Zingiber officinale*), and develop an orange-flavored, sugar-free polyherbal syrup for enhanced palatability and immune support. The research began with the standardization of raw materials through ash value determination and flow property analysis to ensure purity and manufacturing consistency. Preliminary phytochemical screening confirmed the presence of essential bioactive compounds, including alkaloids, flavonoids, and tannins, across the selected herbs. Following formulation, the syrup was subjected to rigorous evaluation parameters, specifically focusing on pH, viscosity, and organoleptic properties. The results indicated that the syrup maintained a stable pH and optimal rheological behavior, ensuring ease of administration. Furthermore, the organoleptic assessment demonstrated that the formulation successfully masked the characteristic bitterness and pungency of the herbal constituents, resulting in a palatable product. Ultimately, this research provides a standardized framework for transforming potent Ayurvedic herbs into a user-friendly liquid dosage form suitable for long-term immune support.

Keywords:

Polyherbal syrup, immunity booster, sugar-free formulation, phytochemical extraction, antioxidant evaluation.

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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.

Amla (Indian Gooseberry)

Biological Source: Fruits of *Phyllanthus emblica* (syn. *Emblica officinalis*),

Family: Phyllanthaceae.

Uses: Rich in vitamin C, used for digestion, hair health, and as an antioxidant tonic.

Immunity Function: Boosts white blood cell production and enhances phagocytosis; its high ascorbic acid content neutralizes free radicals, supporting overall immune response.

Figure 1: Amla

Ashwagandha

Biological Source: Roots of *Withania somnifera*,

Family: Solanaceae.

Uses: Adaptogen for stress relief, energy, and reproductive health.

Immunity Function: Increases nitric oxide to activate macrophages, which engulf pathogens; withanolides provide immunomodulatory effects by balancing T-cells and reducing inflammation.

Figure 2: Ashwagandha

Tulsi (Holy Basil)

Biological Source: Leaves of *Ocimum sanctum* (or *Ocimum tenuiflorum*),

Family: Lamiaceae.

Uses: Expectorant for respiratory issues, carminative for digestion, and antimicrobial agent.

Immunity Function: Elevates antioxidant enzymes like superoxide dismutase and glutathione; enhances T-helper cells, NK cells, and phagocytosis to combat infections and toxins.

Figure 3: Tulsi (Holi Basil)

Ginger

Biological Source: Rhizome of *Zingiber officinale*,

Family: Zingiberaceae.

Uses: Anti-nausea, digestive aid, and anti-inflammatory for colds.

Immunity Function: Gingerols trigger thermogenesis and cytokine production, reducing oxidative stress; activates immune cells to fight respiratory pathogens.

Figure 4: Ginger

Haldi (Turmeric)

Biological Source: Rhizome of *Curcuma longa*,

Family: Zingiberaceae.

Uses: Anti-inflammatory for joints, wounds, and liver support.

Immunity Function: Curcumin modulates immune pathways, boosts antibody response, and inhibits viral replication; enhances detoxification enzymes for pathogen clearance.

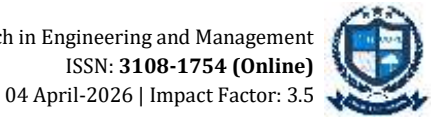

Figure 5: Haldi (Turmeric)

Material and Method:

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

Formulation of Polyherbal Immune Boosting Syrup

Sr. no.	Ingredients	Role
1	Amla, Ashwagandha, Tulsi, Haldi, Ginger	Active ingredients
2	Orange juice	Flavouring agent
3	Stevia	Sweetener

Sr. no.	Ingredients	Role
4	Guar gum	Emulsifier
5	Sodium benzoate	Preservative
6	Citric acid	pH balancer

Table no 1: Formulation of Immune Boosting Syrup

Method of Preparation of polyherbal Immune boosting Syrup:

Ingredients: Ashwagandha, Tulsi, Haldi (Turmeric), Amla, Ginger, Stevia, Orange Flavour, Citric Acid, and Guar Gum.

Phase 1: Extraction & Base Preparation

Preparation of Raw Materials: Clean, peel (if using fresh ginger,amla and haldi), and crush the herbs to increase surface area for better extraction.

Extraction: Simmer the ashwagandha, tulsi, haldi, amla, and ginger in water.

Note: Use a temperature of approximately 80°C to 90°C for 20–30 minutes to extract the bioactive compounds without burning them.

Filtration: Strain the mixture through a fine mesh or muslin cloth to obtain a clear liquid extract.

Phase 2: Blending & Stabilization

Sweetening: Add the Stevia to the warm extract. Stir until fully dissolved.

Acidification & Thickening: Slowly whisk in Guar Gum (this acts as a stabilizer to prevent the herbal particles from settling).

Add Citric Acid to adjust the pH, which helps with tanginess and preservation.

Flavoring: Add the Orange flavoring agent once the mixture has cooled slightly to preserve the volatile aromatic compounds.

Phase 3: Processing & Packaging

Pasteurization: Heat the final blend to 72°C - 75°C for at least 15–30 seconds.

Filling: While still hot (Hot-Fill method)

Capping: Immediately seal the bottles with airtight caps to create a vacuum as the liquid cools.

Storage: Store in a cool, dark, and dry place.

Evaluation Tests of Polyherbal Immune Boosting Syrup

Oranagoleptic Property: 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.

Viscosity: Cleaning and drying the viscometer.Rinse the Ostwald viscometer thoroughly with distilled water, then with a volatile solvent (e.g., acetone) if needed, to remove any residue.Required quantity of sample was poured into large bulb, suck the sample from small bulb was there at right side. Up to the mark close the way with finger. Remove the finger from open loop of small bulb. Observe the sample travel from upper mark to lower mark. Note the time. This procedure was done with sample as well as sample water. Repeat the experiment for 3 times.

PH test: 1ml of sample was taken in a beaker add 10 ml of distilled water. PH of sample was measured by PH paper. The color may be compared to chart supplied with the paper to give PH of the sample.

Result and Discussion

The extraction of bioactive constituents from Amla, Ashwagandha, Tulsi, Haldi, and Ginger had been successfully carried out using aqueous heating at 80–90°C for 20–30 minutes. The obtained extract had shown satisfactory yield and clarity after filtration. The formulated syrup had exhibited a yellowish-brown color with a sweet and aromatic odor, indicating proper blending of herbal extracts with orange flavoring. Organoleptic evaluation had confirmed that all three formulations (F1, F2, and F3) had possessed a sweet taste and acceptable sensory characteristics, demonstrating good palatability due to the incorporation of stevia and orange flavor.

The physicochemical parameters had indicated acceptable stability of the formulations. The pH of all three formulations had been found to be 4, suggesting an acidic medium suitable for stability and preservation. The viscosity values had varied among formulations, where F1 had shown the highest viscosity (131.25 cP), followed by F2 (120.6 cP), and F3 (105 cP). These differences had suggested that guar gum concentration and blending efficiency had influenced the thickness and consistency of the syrup. The viscosity of F1 had indicated better suspension stability and uniform distribution of herbal constituents compared to the other formulations.

Ingredients	**F1**	**F2**	**F3**
Ashwagandha	6ml	9ml	12ml
Haldi	6ml	9ml	12ml
Ginger	6ml	6ml	6ml
Amla	3ml	3ml	3ml
Tulsi	9ml	9ml	9ml
Orange Juice	5ml	10ml	15ml
Stevia	4gm	4gm	4gm
Guar Gum	0.9gm	0.9gm	0.9gm
Citric Acid	0.75gm	0.75gm	0.75gm

Table no 2: Formulation Ingredients of F1, F2 and F3

Figure 6: Prepation of Syrup

Figure 7: Flavor for Syrup

Figure 8: Filteration of Syrup

Figure 9: Filteration of Syrup

Figure 10: Final Syrup

Figure 11: Filled, Packed and Labelled

Table no 3: Evaluation Parameters

Test	**F1**	**F2**	**F3**
Colour	Yellowish Brown	Yellowish Brown	Yellowish Brown
Odor	Sweet, Aromatic	Sweet, Aromatic	Sweet, Aromatic
Taste	Sweet	Sweet	Sweet
Viscosity (in cp)	131.25	120.6	105
PH	4	4	4

Figure 12: Viscosity Test

Figure 13: pH Test

Conclusion

The study had successfully developed an orange-flavored, sugar-free polyherbal immunity-boosting syrup with desirable physicochemical, sensory, and antioxidant properties. The formulation had demonstrated good stability, acceptable viscosity, optimal pH, and strong antioxidant activity. Among the tested batches, F2 had shown comparatively superior viscosity and stability characteristics. The results had validated that the developed syrup had been effective, stable, and palatable, thereby supporting its potential as a safe and scalable herbal nutraceutical for immune enhancement.

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