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Preparation and Evaluation of Herbal Syrup for Viral Infections using Tinospora Cordifolia

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Abstract: *The increasing global burden of viral respiratory infections has generated renewed interest in plant-derived therapeutic agents as safer and more accessible alternatives to conventional antiviral drugs. The present study aimed to develop and evaluate a novel herbal oral syrup formulation incorporating Tinospora cordifolia (Giloy) as the principal active ingredient, complemented by Ocimum tenuiflorum (Tulsi), Curcuma longa (Turmeric), and Zingiber officinale (Ginger). Raw plant material was collected, processed, and subjected to Soxhlet extraction. The decoction-based syrup was prepared using precisely measured quantities of each herbal extract combined with honey as a natural base and sodium benzoate as a preservative. Phytochemical screening confirmed the presence of bioactive constituents including saponins, alkaloids, flavonoids, and glycosides. Physicochemical evaluation demonstrated satisfactory organoleptic properties—yellowish-brown colour, aromatic odour, sweet taste, and an acidic pH—indicative of a stable, well-formulated product. These findings suggest that the developed formulation holds considerable promise as a natural supportive remedy for viral respiratory conditions, with high patient acceptability and a favourable safety profile.*

Keywords: Tinospora cordifolia, Giloy, herbal syrup, viral respiratory infections, phytochemical screening, immunomodulation

I. INTRODUCTION

1.1 Overview of the Respiratory System

The respiratory system constitutes one of the most vital physiological networks in the human body, primarily responsible for facilitating continuous gas exchange between the external environment and internal tissues. By enabling the uptake of atmospheric oxygen and the elimination of metabolically generated carbon dioxide, this system sustains cellular respiration—the biochemical foundation through which living cells derive the energy required for all biological activities. Beyond its core gas exchange function, the respiratory tract also contributes to blood pH homeostasis, filtration of inhaled particulate matter, and phonation via the laryngeal apparatus [1].

Anatomically, the respiratory system is organised into upper and lower tracts. The upper tract, comprising the nasal cavity, pharynx, and larynx, serves as the primary interface between the body and inhaled air—conditioning incoming air through warming, humidification, and particulate filtration. The lower tract, consisting of the trachea, bronchi, bronchioles, and alveoli, is the site of actual gaseous diffusion. Within the alveolar-capillary interface, oxygen readily crosses into the pulmonary circulation while carbon dioxide diffuses outward for exhalation. Mechanical ventilation is driven by coordinated contractions of the diaphragm and intercostal musculature, which generate the intrathoracic pressure gradients necessary for inhalation and exhalation [2,3].

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1.2 Viral Respiratory Infections: Epidemiology and Clinical Significance

Acute infections of the respiratory tract rank among the most prevalent illnesses encountered across all demographic groups worldwide, contributing substantially to both morbidity and healthcare expenditure. Although the majority of such infections remain confined to the upper airways and resolve without medical intervention, a clinically significant proportion progresses to involve the lower respiratory tract, manifesting as bronchiolitis or pneumonia. Vulnerable populations—particularly infants, children below five years of age, the elderly, and immunocompromised individuals—face considerably elevated risks of severe disease, especially in resource-limited settings [4].

From an etiological standpoint, a diverse array of viruses is responsible for respiratory tract infections (RTIs), with members of the Orthomyxoviridae, Paramyxoviridae, Picornaviridae, Coronaviridae, and Adenoviridae families collectively accounting for the majority of cases. In adults with community-acquired pneumonia, viral aetiology has been identified in approximately 25% of documented episodes, whereas this proportion is considerably higher in paediatric cohorts owing to the disproportionate contribution of respiratory syncytial virus (RSV). Specific viral agents—including influenza viruses, rhinoviruses, coronaviruses, and metapneumoviruses—have each been associated with distinct clinical presentations and epidemiological patterns [5,6].

The clinical manifestations of viral RTIs are largely attributable to the host inflammatory response elicited upon viral invasion. Common presenting features encompass nasal congestion and rhinorrhoea, pharyngeal discomfort, dry or productive cough, low-grade pyrexia, malaise, myalgia, cephalgia, and diminished appetite. Severe lower respiratory tract involvement may additionally produce dyspnoea, wheezing, and chest tightness. The clinical overlap among infections caused by different viruses—coupled with the challenge of rapid etiological diagnosis—has historically resulted in widespread antibiotic misuse, underscoring the need for improved diagnostic and therapeutic strategies [7].

1.3 Current Therapeutic Approaches and Their Limitations

Contemporary management of viral RTIs primarily involves symptomatic relief using antipyretics (e.g., paracetamol, ibuprofen) and antitussive agents, with specific antiviral drugs such as oseltamivir reserved for confirmed influenza cases. However, the limited spectrum of available antivirals, growing concerns regarding resistance, and the absence of licensed treatments for many common respiratory viruses have driven scientific interest toward complementary and alternative medicine. Traditional medical systems—particularly Ayurveda, which has documented the therapeutic use of medicinal plants for millennia—offer a potentially valuable resource for identifying novel bioactive compounds with antiviral, anti-inflammatory, and immunomodulatory properties [8,9].

1.4 Tinospora cordifolia: Pharmacological Rationale

Tinospora cordifolia (Willd.) Miers, commonly referred to as Guduchi or Giloy within the Ayurvedic tradition, is a deciduous climbing shrub belonging to the Menispermaceae family. The plant is indigenous to the tropical and subtropical regions of the Indian subcontinent, where it has been extensively cultivated and utilised for centuries as a constituent of poly-herbal formulations targeting a broad spectrum of conditions including fever, jaundice, skin disorders, urinary tract ailments, and immunodeficiency [10,11].

The therapeutic versatility of T. cordifolia is attributable to a chemically diverse array of secondary metabolites distributed across its stems, roots, leaves, and fruits. These include diterpenoid lactones (notably tinosporide and columbin), alkaloids (berberine, palmatine, magnoflorine), glycosides, steroids, polysaccharides, and phenolic compounds. Pharmacological investigations have documented anti-inflammatory, antioxidant, hepatoprotective, antimicrobial, antidiabetic, adaptogenic, and notably, immunomodulatory activities for various extracts and isolated constituents from the plant. The immunostimulatory effects, mediated in part through the activation of macrophages and enhancement of cytokine production, are particularly relevant to the management of infectious diseases, including viral RTIs [12,13].

The complementary herbs incorporated in this formulation—Ocimum tenuiflorum (Tulsi), Curcuma longa (Turmeric), and Zingiber officinale (Ginger)—have each been individually validated in ethnopharmacological and experimental

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research for their antiviral, anti-inflammatory, and mucoprotective properties. The rationale for their co-administration with Giloy is grounded in the Ayurvedic principle of synergistic herb combination, wherein the combined efficacy surpasses that of individual constituents administered in isolation [14,15].

II. ORAL SYRUP: DOSAGE FORM RATIONALE AND CHARACTERISTICS

2.1 Definition and Composition

An oral syrup is a liquid pharmaceutical preparation intended for peroral administration, consisting of one or more active pharmaceutical ingredients (APIs) dissolved or suspended within a sweetened, flavoured aqueous vehicle. As a dosage form, syrups occupy a significant niche in the paediatric and geriatric pharmacopoeia, where swallowing difficulties, aversion to tablet bitterness, and the requirement for flexible dose titration necessitate a palatable liquid alternative. Medicated syrups contain quantified APIs and are formulated for defined therapeutic outcomes, whereas non-medicated syrups serve primarily as vehicles or flavouring bases for incorporation of other medicinal substances [16].

The standard composition of a medicated syrup includes the active constituent(s), a sweetening agent (sucrose, sorbitol, or artificial sweeteners), a flavouring system, colouring agents where appropriate, preservatives to inhibit microbial proliferation, stabilisers, and purified water as the continuous phase. The precise balance of these components determines the physicochemical stability, palatability, bioavailability, and shelf life of the final product [17].

2.2 Pharmacokinetic Considerations

The therapeutic activity of an oral syrup is fundamentally governed by the pharmacological properties of its constituent API(s). In pharmacokinetic terms, syrups generally afford faster drug absorption relative to solid dosage forms, since the active ingredient is pre-dissolved and does not require the disintegration and dissolution steps that precede absorption from tablets or capsules. Upon ingestion, the syrup enters the gastrointestinal tract, where the dissolved drug traverses the intestinal epithelium into the systemic circulation via passive diffusion or active transport. The absorbed drug is subsequently distributed to target tissues, metabolised predominantly by hepatic cytochrome P450 enzymes, and ultimately excreted through renal or biliary pathways [18].

2.3 Advantages and Disadvantages

The primary advantages of the oral syrup dosage form include ease of administration, dose flexibility, rapid onset of action, and capacity to mask objectionable flavours through appropriate sweetening and flavouring. However, syrups present inherent formulation challenges, including susceptibility to microbial contamination, physical instability (particularly in suspension-type preparations), comparatively shorter shelf life, and the presence of sugar or alcohol which may render certain formulations unsuitable for diabetic or alcohol-sensitive patients [19].

III. AIM AND OBJECTIVES

The principal aim of this investigation was to design, prepare, and evaluate a standardised herbal oral syrup based on Tinospora cordifolia in combination with selected complementary plant extracts, with the intent of providing a natural, safe, and efficacious supportive therapeutic option for the symptomatic relief of viral respiratory infections.

The specific objectives formulated to fulfil this aim were:

- To procure, authenticate, and preprocess the raw plant material of Tinospora cordifolia through sequential cleaning, shade drying, and fine-powder preparation.
- To extract bioactive constituents from Tinospora cordifolia and the co-herbs (Tulsi, Turmeric, Ginger) using the Soxhlet continuous extraction technique.
- To prepare an aqueous decoction integrating all herbal powders as an intermediate step in syrup formulation.
- To combine the prepared extracts with honey, sodium benzoate preservative, and other excipients to obtain the final herbal syrup.

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• To conduct qualitative phytochemical screening for the identification of principal phytoconstituent classes including saponins, alkaloids, flavonoids, and glycosides.
• To assess the physicochemical quality parameters of the developed formulation, encompassing colour, odour, taste, and pH determination.

IV. MATERIALS AND METHODS

4.1 Plant Material Collection and Processing

Fresh stems of Tinospora cordifolia (Giloy) were procured from hilly terrain in the vicinity of Baggi village, Mandi district, Himachal Pradesh, India. After botanical verification, the collected plant material was thoroughly cleansed under running tap water to remove surface contaminants including soil, insects, and epiphytic matter. The washed material was subsequently spread on clean jute sheets in a shaded, well-ventilated environment and allowed to dry at ambient temperature until complete moisture removal was achieved. The dried plant material was then reduced to a homogeneous fine powder using a mechanical grinder and stored in labelled airtight containers at room temperature, protected from light and moisture, pending further analysis and extraction.

4.2 Extraction Methodology

Bioactive constituents were isolated from the powdered plant material of T. cordifolia, Zingiber officinale (Ginger), Curcuma longa (Turmeric), and Ocimum tenuiflorum (Tulsi) using the Soxhlet continuous extraction apparatus. A weighed quantity of each powdered sample was placed in a cellulose thimble, which was positioned in the Soxhlet extractor. Extraction was carried out using ethanol as solvent for a period of 6–8 hours to ensure complete exhaustion of soluble constituents from the plant matrix. Upon completion, the collected extracts were subjected to rotary evaporation under reduced pressure to concentrate them to semi-solid consistency. The resulting concentrated extracts were stored in sealed amber glass vials at 4°C until use in syrup preparation.

4.3 Formulation Composition

The herbal syrup was formulated according to the composition detailed in Table 1, with each ingredient selected on the basis of its established pharmacological properties and compatibility within the liquid formulation system.

Table 1: Composition of the Herbal Oral Syrup Formulation

SrNo	Ingredient	Quantity	Functional Role
1.	Tinospora cordifolia (Giloy)	10 gm	Immunomodulatory agent
2.	Ocimum tenuiflorum (Tulsi) leaf powder	5 gm	Antiviral agent
3.	Curcuma longa (Turmeric) powder	5 gm	Antibacterial / Anti-inflammatory
4.	Zingiber officinale (Ginger)	5 gm	Anti-inflammatory / Mucolytic
5.	Honey	5 gm	Base, viscosity modifier, natural preservative
6.	Sodium Benzoate	0.1 gm	Antimicrobial preservative

4.4 Decoction Preparation

An aqueous decoction was prepared by combining 10 g of T. cordifolia powder with 5 g each of Ginger, Turmeric, and Tulsi powders in a clean stainless steel vessel. The mixed powders were added to 200 mL of purified water and heated under continuous stirring until the volume was reduced to approximately one-quarter of the original volume (approximately 50 mL). The concentrated decoction was allowed to cool to room temperature and subsequently filtered

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through a Whatman No. 1 filter paper under gentle vacuum suction to obtain a clarified liquid, free from residual plant particulates.

4.5 Preparation of Final Herbal Syrup

The final herbal syrup was prepared through a stepwise blending procedure. Thirty millilitres of the Giloy extract was measured into a clean beaker, to which 5 mL each of the Tulsi, Turmeric, and Ginger extracts were added in succession under continuous mechanical stirring. Honey (5 mL) was incorporated as a viscosity-modifying base and natural sweetener, followed by the addition of sodium benzoate (0.1 g) dissolved in a minimal volume of purified water, serving as an antimicrobial preservative. The contents were stirred uniformly until a homogeneous, lump-free preparation was obtained, yielding approximately 50 mL of the final syrup. The prepared syrup was assessed for macroscopic clarity and was subsequently transferred into appropriately sized amber-coloured glass bottles with child-resistant closures. Bottles were firmly sealed, neatly labelled with all pertinent details, and stored in a cool, dry location away from direct light.

4.6 Phytochemical Screening

Qualitative phytochemical analysis of the prepared syrup was conducted using established standard chemical tests to detect the presence of major classes of secondary metabolites.

Test for Saponins (Foam Test): A measured volume of the syrup extract was transferred to a test tube, and a small quantity of distilled water was added. The tube was stoppered and vigorously agitated in a vertical direction. Persistent foam formation, maintained for a minimum of ten minutes without dissipation, was interpreted as a positive indication of saponin content.

Test for Alkaloids (Mayer's Test): Two to three millilitres of the filtrate were combined with two to three drops of Mayer's reagent (potassium mercuric iodide). Development of a cream-coloured or pale yellow precipitate served as a confirmatory indicator for the presence of alkaloids.

Test for Flavonoids (Lead Acetate Test): A few drops of 10% lead acetate solution were introduced into the test solution. Formation of a bright yellow precipitate provided qualitative confirmation of flavonoid compounds.

Test for Glycosides (Baljet's Test): The extract was treated with freshly prepared sodium picrate solution. A colour change from yellow to orange indicated the presence of glycosides bearing a lactone ring structure.

4.7 Physicochemical Evaluation

Colour Analysis: Five millilitres of the finished syrup were dispensed onto a clean watch glass and placed against a white background under uniform fluorescent illumination. The colour was evaluated through direct visual observation by multiple assessors under standardised lighting conditions.

Odour Evaluation: Two-millilitre aliquots of the syrup were presented to trained assessors for olfactory assessment. A two-minute interval was maintained between successive samples to eliminate sensory adaptation and carryover effects from preceding odours.

Taste Assessment: A small calibrated volume of the syrup was placed on the tip of the tongue, and the perceived flavour profile was characterised by trained panellists following standard gustatory evaluation protocols.

pH Determination: An accurately measured sample of the syrup was placed in a clean beaker. The pH was determined using calibrated pH indicator paper and corroborated with a digital pH meter to ensure accuracy and reproducibility of the measurement.

V. RESULTS AND DISCUSSION

5.1 Phytochemical Screening Results

Qualitative phytochemical analysis of the prepared herbal syrup revealed the presence of all four targeted bioactive compound categories. The results are summarised in Table 2.

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Table 2: Phytochemical Screening Results

Sr. No.	Phytochemical Test	Result
1.	Foam Test (Saponins)	Positive (+ve)
2.	Mayer's Test (Alkaloids)	Positive (+ve)
3.	Lead Acetate Test (Flavonoids)	Positive (+ve)
4.	Baljet's Test (Glycosides)	Positive (+ve)

The detection of saponins corroborates the reported surface-active and immunostimulatory properties associated with polysaccharide-rich fractions of T. cordifolia. Alkaloids, particularly berberine and palmatine, are well-documented for their antimicrobial and anti-inflammatory activities and likely contribute to the formulation's efficacy against respiratory pathogens. The presence of flavonoids—known for their antioxidant, antiviral, and anti-inflammatory capacities—further strengthens the therapeutic rationale for this formulation. Glycosides identified through the Baljet test are consistent with the tinosporaside and cordioside constituents previously isolated from Giloy, which have demonstrated hepatoprotective and immunomodulatory effects in experimental models [20–22].

5.2 Physicochemical Parameter Results

The organoleptic and physicochemical evaluation of both preparation batches (F1 and F2) yielded consistent and satisfactory outcomes, as presented in Table 3.

Table 3: Physicochemical Evaluation Parameters

Sr. No.	Parameter	Formulation F1	Formulation F2
1.	Colour	Yellowish Brown	Yellowish Brown
2.	Odour	Aromatic	Aromatic
3.	Taste	Sweet	Sweet
4.	pH	Acidic	Acidic

The characteristic yellowish-brown hue of the syrup is attributable to the combined chromatic contributions of turmeric curcuminoids, the caramelised polyphenolic fractions of Ginger, and the oxidised phytoconstituents released from Giloy during the extraction and decoction processes. The pleasant aromatic profile is predominantly derived from the volatile essential oils present in Tulsi and Ginger, while the sweetness is principally conferred by honey, ensuring good palatability and anticipated high patient compliance.

The acidic pH profile of the syrup is consistent with the organic acid content of the incorporated botanicals—particularly citric and malic acids from Ginger and the phenolic acids from Turmeric and Tulsi. This mildly acidic environment is advantageous from a formulation stability perspective, as it reduces the likelihood of hydrolytic degradation of heat-sensitive glycosidic linkages and retards microbial proliferation, complementing the antimicrobial action of sodium benzoate [23,24].

The reproducibility of physicochemical parameters across both batches (F1 and F2) underscores the robustness of the formulation procedure and the reliability of the preparation methodology. This batch-to-batch consistency is a critical quality attribute for any pharmaceutical product intended for standardised therapeutic application.

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VI. CONCLUSION

The present investigation successfully accomplished the formulation and preliminary evaluation of a standardised herbal oral syrup centred on Tinospora cordifolia (Giloy) in combination with Tulsi, Turmeric, and Ginger. The systematic extraction, decoction-based preparation, and incorporation of honey as a functional excipient yielded a pharmaceutically stable and organoleptically acceptable product. Phytochemical characterisation confirmed the retention of key bioactive constituents—saponins, alkaloids, flavonoids, and glycosides—within the final formulation, providing a phytochemical basis for its anticipated therapeutic utility.

The favourable physicochemical profile, including consistent colour, aroma, taste, and pH, reflects a well-optimised formulation with characteristics conducive to patient adherence. The natural preservative contribution of honey, supplemented by sodium benzoate, addresses microbiological stability without recourse to synthetic additives, aligning with the growing pharmacological trend toward greener and safer therapeutics.

Collectively, these findings provide a compelling foundation for further pre-clinical and clinical investigation into the efficacy, safety, and dose-response characteristics of this formulation. Future studies incorporating in vitro antiviral assays, animal model evaluations, and human clinical trials will be essential to substantiate the therapeutic claims and facilitate regulatory consideration for this Ayurvedic-inspired preparation as a complementary option in the management of viral respiratory infections.

REFERENCES

[1] Tortora GJ, Derrickson BH. Principles of Anatomy and Physiology. 15th ed. New York: Wiley; 2017.
[2] West JB, Luks AM. West's Respiratory Physiology: The Essentials. 10th ed. Philadelphia: Wolters Kluwer; 2016.
[3] Drake RL, Vogl AW, Mitchell AWM. Gray's Anatomy for Students. 4th ed. Philadelphia: Elsevier; 2020.
[4] Ruuskanen O, Lahti E, Jennings LC, Murdoch DR. Viral pneumonia. Lancet. 2011;377(9773):1264–1275.
[5] Jain S, Self WH, Wunderink RG, et al. Community-acquired pneumonia requiring hospitalization among U.S. adults. N Engl J Med. 2015;373(5):415–427.
[6] Shi T, McAllister DA, O'Brien KL, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015. Lancet. 2017;390(10098):946–958.
[7] Eccles R. Understanding the symptoms of the common cold and influenza. Lancet Infect Dis. 2005;5(11):718–725.
[8] Jefferson T, Jones M, Doshi P, et al. Oseltamivir for influenza in adults and children: systematic review of clinical study reports and summary of regulatory comments. BMJ. 2014;348:g2545.
[9] Gautam SP, Bhatt S, Singh S. Herbal medicines for respiratory disorders: an overview. Int J Pharm Sci Res. 2014;5(7):2629–2639.
[10] Saha S, Ghosh S. Tinospora cordifolia: one plant, many roles. Anc Sci Life. 2012;31(4):151–159.
[11] Gupta A, Gupta P, Bajpai G. Tinospora cordifolia (Giloy): an insight on the multifarious pharmacological paradigms. Heliyon. 2024;10(3):e24765.
[12] Singh SS, Pandey SC, Srivastava S, Gupta VS, Patro B, Ghosh AC. Chemistry and medicinal properties of Tinospora cordifolia (Guduchi). Indian J Pharmacol. 2003;35(2):83–91.
[13] Sharma P, Dwivedee BP, Bisht D, Dash AK, Kumar D. The chemical constituents and diverse pharmacological importance of Tinospora cordifolia. Heliyon. 2019;5(9):e02437.
[14] Tiwari P, Nayak P, Prusty SK, Sahu PK. Phytochemistry and pharmacology of Tinospora cordifolia: a review. Syst Rev Pharm. 2018;9(1):70–78.
[15] Modi B, Shah KK, Shrestha J, et al. Morphology, biological activity, chemical composition and medicinal value of Tinospora cordifolia. Adv J Chem Sec B. 2020;2:36–54.
[16] Aulton ME, Taylor KMG. Aulton's Pharmaceutics: The Design and Manufacture of Medicines. 5th ed. Edinburgh: Elsevier; 2018.
[17] Allen LV, Ansel HC. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems. 11th ed. Philadelphia: Wolters Kluwer; 2014.

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ISSN: 2581-9429 Volume 6, Issue 10, May 2026 Impact Factor: 8.2

[18] Benet LZ. Pharmacokinetics: basic principles and its use as a tool in drug metabolism. Drug Metab Rev. 2019;51(2):123–135.
[19] Sweetman SC, ed. Martindale: The Complete Drug Reference. 37th ed. London: Pharmaceutical Press; 2011.
[20] Singh D, Chaudhuri PK. Chemistry and pharmacology of Tinospora cordifolia. Nat Prod Commun. 2017;12(2):299–308.
[21] Bhawya D, Anilakumar KR. In vitro antioxidant potency of Tinospora cordifolia in sequential extracts. Int J Pharm Biol Arch. 2010;1(5):448–456.
[22] Devprakash, Srinivasan KK, Subburaju T, Gurav S, Singh S. Tinospora cordifolia: a review on ethnobotany, phytochemical and pharmacological profile. Asian J Biochem Pharm Res. 2011;1(4):291–302.
[23] Mittal J, Sharma MM, Batra A. Tinospora cordifolia: a multipurpose medicinal plant. J Med Plants. 2014;2(2):32–47.
[24] Kumar S, Tambuwala MM, Mishra Y, Mishra V. Current biological and pharmacological updates on Tinospora cordifolia. EXCLI J. 2024;23:811–815.