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Formulation and Evaluation Study of Herbal Syrup of Indian Mulberry

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ABSTRACT
Morinda citrifolia, commonly known as noni, Indian mulberry, beach mulberry, or cheese fruit, is a fruit-bearing tree belonging to the Rubiaceae family. Native to Southeast Asia and Australasia, it was spread across the Pacific by Polynesian sailors and is now cultivated throughout tropical regions, where it has become widely naturalized. Noni is recognized for its extensive pharmacological properties, including anticancer, antidiabetic, antistress, antioxidant, anxiolytic, immunomodulatory, cholesterol-lowering, lipid-lowering, nephroprotective, and hepatoprotective effects. These properties contribute to its use in promoting overall health and combating conditions like oxidative stress and cancer.
A common dosage form of noni Is herbal syrup, formulated using its extract as the primary ingredient, combined with an invert sugar base. This syrup is popular for its ease of administration across all age groups. Noni syrup is particularly effective in addressing oxidative reactions in the body, helping neutralize free radicals and mitigate stress-related conditions. At a laboratory scale, various formulations of noni syrup (F1, F2, F3, and F4) were prepared with varying amounts of ingredients like alcohol, sugar, and syrup. These formulations were evaluated based on parameters such as pH, viscosity, density, specific gravity, stability, and organoleptic properties. Among them, Formula 4 (F4) demonstrated greater stability compared to the other formulations, making it the most suitable option for use.

KEY WORDS: Anthocyanin, Antioxidants, β-sitosterol, Flavonoids, Mulberry, Phytochemical

I. INTRODUCTION:

Mulberry, a member of the Morus genus within the Moraceae family, thrives in a wide range of climates, from tropical to temperate regions. The Moraceae family, also known as the mulberry or fig family, consists of over twenty-four species, including one subspecies and at least a hundred recognized varieties. The name “Morus” comes from the Latin word “mora,” meaning delay, likely referring to the slow growth of its buds. In addition to its significant role in sericulture, mulberry is an economically important woody plant with many valuable applications, contributing to its unique characteristics and widespread cultivation.[1,2]

Mulberry leaves have long been utilized for their therapeutic properties, including the treatment of hyperglycemia, inflammation, cough, hypertension, cancer, and fever. Due to its beneficial effects and low toxicity, Morus alba has become a key component in traditional Chinese medicine. Research indicates that Morus alba possesses a variety of health-promoting properties, such as neuroprotective, skin-toning, antioxidant, anti-hyperglycemic, antibacterial, antihypertensive, and anti-hyperlipidemic activities.[3,4]

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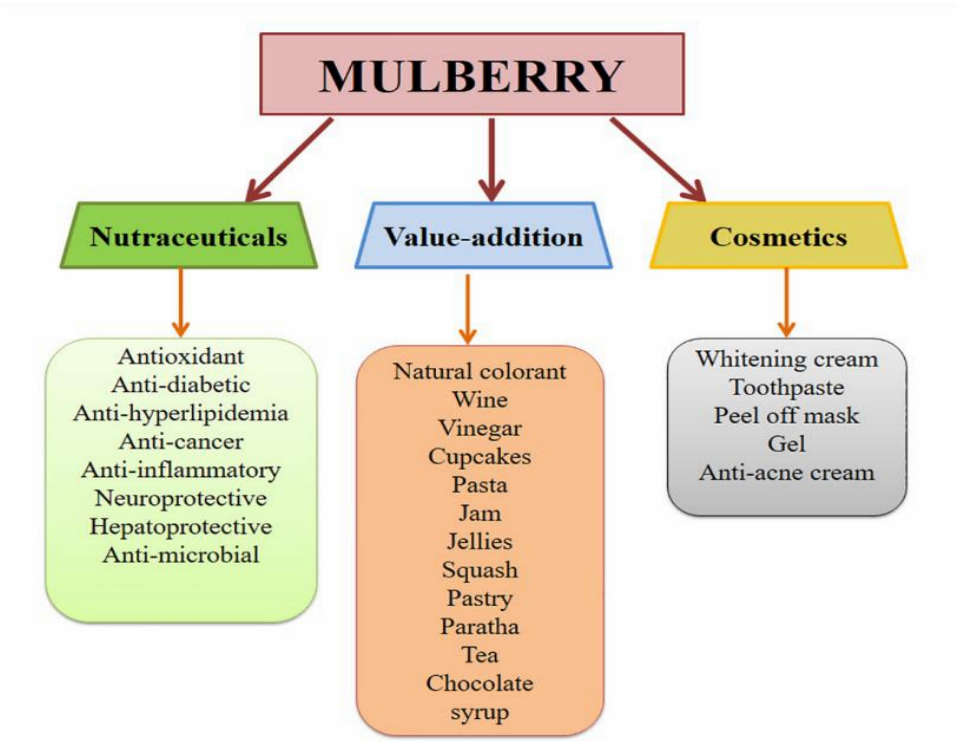

Fig. 1. Diverse application of mulberries in multiple areas.

1.1.Herbal syrup

Herbal syrup is created by combining a concentrated herbal extract with sugar, often with the addition of alcohol. Typically, it is prepared using a decoction of herbs, which is then mixed with sugar to achieve a thicker consistency and extend the shelf life. The sugar not only acts as a preservative but also enhances the flavor of the herbs, making the syrup more palatable. The final product is a thick, flavorful liquid that can serve both as a medicinal remedy and a tasty addition to various recipes.[5,8]

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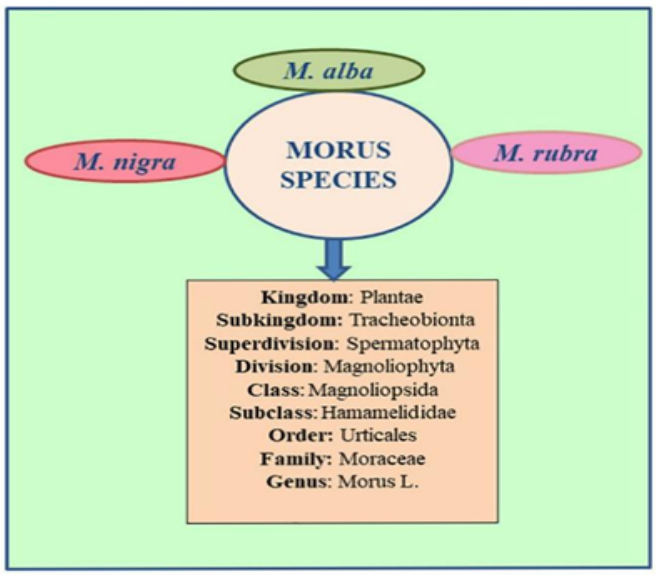

Fig. 2. Scientific classification of mulberry.

II. BOTANICAL DESCRIPTION OF MORUS(MULBERRY)

Mulberry is a deciduous or medium-sized woody perennial tree, typically growing to a height of 10–13 meters. It has upright, fissured bark and a cylindrical stem that contains milky sap. The leaves exhibit considerable variation in shape and size, generally measuring 5–7.5 cm in length and 6–10 cm in width. They are often deeply lobed with serrated margins, an acute apex, and a cordate or truncated base. The leaves feature three basal nerves, with lateral nerves that fork near the margins. The tree produces yellowish-green flowers, and its chromosome number is 2n = 28.

Male and female flowers differ in structure: male spikes, or catkins, are cylindrical, broad, and usually longer than the stalked, ovoid female spikes. The fruit of the mulberry is technically a syncarp, formed by clusters of small fruits arranged longitudinally around a central axis, resembling blackberries or loganberries. Each fruit comprises numerous small drupes encased in a fleshy perianth. The fruit is ovoid to sub-globose, measuring up to 5 cm in length, and changes color from white or pinkish-white to purple or black as it ripens. The mulberry ovary is unicellular, with a bifid stigma, sharing similarities with other fleshy drupaceous fruits.[1]

Fig.3-Mulberry Plant/Fruit

III. CHEMICAL COMPOSITION OF MULBERRY:

Mulberry leaves and fruits are rich in bioactive compounds such as alkaloids, anthocyanins, and flavonoids. Among these, alkaloids like 1-deoxynojirimycin (DNJ) are notable for their ability to inhibit glycosidase, which can help lower blood sugar levels. Hydroxystilbenes, including resveratrol (trans-3,4',5-trihydroxystilbene) and oxyresveratrol (trans-2,3',4',5-tetrahydroxystilbene), are also present in mulberries. These compounds have been recognized for their neuroprotective and cardioprotective properties. Additionally,

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oxyresveratrol exhibits tyrosinase inhibitory activity, making it useful in managing hyperpigmentation disorders and as an ingredient in cosmetics.

Anthocyanins, responsible for the vibrant coloration of fruits, flowers, and leaves, are another key group of bioactive compounds in mulberries. These natural phenolics provide significant health benefits due to their antioxidant and anti-inflammatory properties. Mulberry anthocyanin extracts, in particular, demonstrate strong lipid oxidation inhibition and possess antimetastatic properties by limiting the migration of B16-F1 cells. Flavonoids, commonly found in plants, are also abundant in mulberries, with rutin being one of the identified types. Known for their diverse biological activities, flavonoids exhibit anti-inflammatory, antioxidant, antiviral, hepatoprotective, and antithrombotic effects. In addition to these bioactive components, mulberry leaves and fruits contain nutritive compounds like crude protein, crude fat, mineral elements, and total sugars, which contribute to their overall health benefits and antioxidant activities.[9-20]

IV. ANTI-OXIDANT PROPERTIES OF MULBERRY

Free radicals are chemical species with unpaired electrons, often formed as fragments of molecules, and are typically highly reactive. These radicals are continuously produced in cells, either as unintended by-products of metabolic processes or as part of deliberate cellular activities, such as during phagocytosis. Reactive Oxygen Species (ROS), a group of oxygen-derived reactive molecules, include superoxide radicals ($O2^-$), hydrogen peroxide (H2O2), hydroxyl radicals (OH), and alkoxyl radicals (RO). Plant cells naturally generate low levels of ROS as part of their normal metabolism. Under typical conditions, a balance is maintained between ROS production and their removal by antioxidant enzymes, ensuring cellular homeostasis. However, when plants are exposed to environmental stresses, this balance can be disrupted, leading to excessive ROS accumulation and resulting in oxidative stress.[21,24]

V. INGREDIENTS USED IN FORMULATION

I. IndianMulberry:

Widely used in herbal and Ayurvedic remedies, this plant's alcoholic extract is prepared using the Soxhlet extraction method. The extract is then filtered for further use.

II.OrangeOil:

Derived from the fruit of Citrus aurantium of the Rutaceae family, orange oil contains a minimum of 2.5% volatile oils. It is known for its antioxidant properties and its potential in addressing cancer and neurodegenerative disorders.

III.Alcohol:

Used in small amounts, alcohol acts as a preservative in formulations.

IV. InvertSugarBase:

This is made by combining 480 mL (2 cups) of water, 1 kg (4.4 cups) of granulated sugar, and ¼ teaspoon of cream of tartar in a pot. The mixture is heated over medium heat, stirring occasionally, until it reaches 114°C (236°F). It is then removed from heat, covered, and allowed to cool.[25,26]

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Table 1 : Role of ingredients in herbal syrup

Sr. No	Ingredients	Role
1.	Indian Mulberry	Antioxidant,Free Radical Scavenging
2.	Orange Oil	Flavouring Agent
3.	Sugar Base Invert	Preservative
4.	Alcohol	Preservative
5.	Amaranth Red	Coloring Agent

VI. MATERIALS AND METHODS:

Herbal syrup was prepared using the decoction method. The process began with obtaining Indian Mulberry Extract, which was sourced as a fine extract from Herbal Creations Pvt Ltd. To isolate ethanol-specific active constituents, the extract underwent Soxhlet extraction using ethanol. The resulting extract was filtered, and specific aliquots, as detailed in the table, were used to create formulations F1 to F4. The extracts were combined, yielding 50 ml of syrup. Coloring and flavoring agents were added to enhance the product. The prepared syrup was transferred to an amber-colored bottle, sealed tightly, and stored in a cool place. The preparation followed the quantities outlined in Tables 2, 3, 4, and 5, with evaluation parameters summarized in Table 6.

Table 2: Formulation No.1 (F1) For 50ml

Sr.No	Ingredient	Quantity
1.	Indian Mulberry Extract	7ml
2.	Orange Oil	5ml
3.	Sugar Base Invert	38ml

Table 3: Formulation2 (F2)For 50 ml

Sr.No	Ingredient	Quantity
1.	Indian Mulberry Extract	5ml
2.	Orange Oil	2ml
3.	Sugar Base Invert	33ml
4.	Alcohol	10ml

In formulation F2, alcohol was included because, in the previous formulation (F1), sugar alone was insufficient to prevent fungal growth. The addition of alcohol addressed this issue by enhancing the formulation's antifungal properties.

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Table 4: Formulation 3(F3) For 50 ml

Sr.No	Ingredient	Quantity
1.	Indian Mulberry Extract	8ml
2.	Orange Oil	2ml
3.	Sugar Base Invert	33ml
4.	Alcohol	7ml

Formulation number 2 was rejected due to the excessive amount of alcohol used. In the revised formulation, the alcohol content was minimized to address this issue.

Table 5: Formulation 4 (F4) For 50 ml

Sr.No	Ingredient	Quantity
1.	Indian Mulberry Extract	15ml
2.	Orange Oil	4ml
3.	Sugar Base Invert	20ml
4.	Alcohol	11ml

Following evaluation parameters were performed onFormulation 4 (F4).

6.1 Evaluation Parameters

6.1.1 Density

The density of the syrup was found by dividing its weight by its volume:

= /

=

6.1.2 Specific Gravity

Specific gravity was calculated by comparing the weight of the syrup to the weight of the same amount of water:

=

6.1.3 Viscosity

Viscosity was determined by comparing how long the syrup takes to flow to how long water takes, adjusted by their densities:

/

6.1.4 pH

The pH of the syrup was checked using a pH meter.

VII. RESULT AND DISCUSSION:

The final formulation (F4) demonstrated greater stability compared to the earlier formulations, F1, F2, and F3. This improved stability was achieved by addressing and minimizing the errors identified in the initial formulations. Additionally, formulation F4 possesses antioxidant properties, making it a valuable resource for researchers and industries aiming to develop large-scale formulations.

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Sr.No	Parameters	F1	F2	F3	F4
1.	Density	1.50gm	1.43gm	1.29gm	1.50 gm
2.	Specific Gravity	0.6289	0.6195	0.6135	0.6135
3.	Viscosity PH	3.75cp	3.67cp	3.66cp	3.66cp
4.	Determination a) pH Paper b) pH Meter	 Neutral 7.01	 Neutral 7.44	 Neutral 7.54	 Neutral 7.61
5.	Organoleptic Character 1) Color 2)Odor 3)Taste 4) Apperance	 Reddish Aromatic Sweet Turbid	 Reddish Alcoholic Sweet Turbid	 Reddish Aromatic Sweet Clear	 Reddish Aromatic Sweet Clear

VIII. CONCLUSION:

The formulation and evaluation of the herbal syrup prepared from Indian Mulberry (Morinda citrifolia) were successfully conducted, showcasing its therapeutic potential. Among the four formulations (F1, F2, F3, and F4), Formulation 4 (F4) emerged as the most stable and effective. By optimizing the composition, particularly the balance of alcohol and sugar, F4 demonstrated improved stability, superior organoleptic properties, and favorable physicochemical parameters, including ideal pH, density, specific gravity, and viscosity. Additionally, the antioxidant properties of Indian Mulberry extract in F4 highlight its potential for combating oxidative stress and promoting health. These findings provide a promising basis for the further development and large-scale production of Indian Mulberry-based herbal syrups for medicinal use.

REFERENCES

[1]. Kang TH, Hur JY, Kim HB, Ryu JH, Kim SY. Neuroprotective effects of the cyaniding-3-O-ß-glucopyranoside isolated from mulberry fruit against cerebral ischemia. Neurosci Lett, 2006; 391: 168-172.

[2]. Li LN. Biologically active components from traditional Chinese medicines. Pure Appl Chem, 1998; 70: 547-554.

[3]. Nomura T, Fukai T, Kuwanon G. A new flavone derivative from the root barks of the Cultivated mulberry tree (Morus alba L.). Chem Pharm Bull, 1980; 28: 2548-2552.

[4]. Butt MS, Nazir A, Sultan MT, Schroen K. Morus alba L. nature‟s functional tonic. Trends Food Sci Technol, 2008; 19: 505-512.

[5]. Raju K, Rose AS, Rohini B, Sahaja P, Shylaja G, Simran S.Formulation and evaluation of anti-diabetic herbal syrup. Res J Pharmacognosy Phytochem. 2020;12(3):141–4.

[6]. Aziz A, Khan IA, Afzal A, Munawar SH. Formulation and Evaluation of herbal Antitussive syrup of methanolic extract ofLycopus europaeus in mice. Am J Phama Health Res. 2013;1(8):121–9.

[7]. Sheikh ZA, Zahoor A, Khan SS, Usmanghani K. Design, developmentAnd phytochemical evaluation of a poly herbal formulation linkusSyrup. Chin Med. 2014;5(2):47016–9.

[8]. Jadhao AG, Sanap MJ, Patil PA. Formulation and Evaluation of HerbalSyrup. Asian J Pharma Res Dev. 2021;15(3):16–22.

[9]. Vijayan K, Srivastava PP, Awasthi AK. Analysis of phylogenetic relationship among five mulberry (Morus) species

International Journal of Pharmaceutical Research and Applications
Volume 9, Issue 6 Nov - Dec 2024, pp: 551-557 www.ijprajournal.com
ISSN: 2456-4494

using molecular markers. Genome, 2004; 47: 439-448.

[10]. Hasimoto NM, Genovese MI, Lajola FM. Absorption and metabolism of cyaniding-3-Glucoside and cyaniding-3-rutinoside extracted from wild mulberry (Morus nigra L.) in rats. Natr Res, 2008; 28(3): 198-207.

[11]. Kimura T, Nakagawa K, Kubota H. Food-grade mulberry powder enriched with1-Deoxynojirimycin suppresses the elevation of postprandial blood glucose in humans. J Agri Food Chem, 2007; 55: 5869-5874.

[12]. Nakagawa K, Ogawa K, Higuchi O, Kimura T, Miyazawa T, Hori M. Determination of Iminosugars in mulberry leaves and silkworms using hydrophilic interaction chromatography –tandem mass spectrometry. Analytical Biochem, 2010; 404: 217-222.

[13]. Bae SH, Suh HJ. Antioxidant activities of five different mulberry cultivars in Korea. LWTFood Sci Technol, 2007; 40: 955-962.

[14]. Chao WW, Kuo YH, Li WC, Lin BF. The production of nitric oxide and prostaglandin E2 in peritoneal macrophages is inhibited by Andrographis paniculata, Angelica sinensis and Morus alba ethyl acetate fractions. J Ethnopharmacol, 2009; 122(1): 68-75.

[15]. Choi EM, Hwang JK. Effects of Morus alba leaf extract on the production of nitric oxide, Prostaglandin E2 and cytokines in RAW2647 macrophages. Fitoterapia, 2005; 76: 608-613.

[16]. Zheng ZP, Tan HY, Wang M. Tyrosinase inhibition constituents from the root of Morus Australis. Fitoterapia, 2012; 83(6): 1008-1013.

[17]. Nitra N, Kornkanok I, Wiroje K, Sathaporn W, Bhinai H. Quantitative determination of 1-deoxynojirimycin in mulberry leaves using liquid chromatography-tandem mass Spectrometry. J Pharmaceut Biomed Analysis, 2007; 44(4): 853-858.

[18]. Cui XQ, Wang L, Yan RY, Tan YX, Chen RY, Yu DQ. A new Diels-Alder type adducts And two new flavones from the stem bark of Morus yunanensis Koidz. J Asian Nat Prod Res, 2008a; 10(3-4): 361-366.

[19]. Ozgen M, Serce S, Kaya C. Phytochemical and antioxidant properties of anthocyanin rich Morus nigra and Morus rubra fruits. Sci Hortic, 2009; 119: 275-279.

[20]. Daimon T, Hirayama C, Kanai M, Ruike Y, Meng Y, Kosegawa E, Nakamura M, Tsujimoto G, Katsuma S, Shimada T. The silkworm Green b locus encodes a quercetin f-O-glucosyltransferase that produces green cocoons with UV-shielding properties. Proc Natl Acad Sci USA, 2010; 107(25): 11471-11476.

[21]. Ajitha M, Rajnarayana K. Indian Drugs. 2001; 38(11): 545-553.

[22]. Elfalleh W, Tlili N, Nasri N, Yahia Y, Hannachi H, Chaira N. Antioxidant capacities of Phenolic compounds and tocopherols from tunisian pomegranate (Punica granatum) Fruits. J Food Sci, 2011; 76: 707-713.

[23]. Goud PB, Kachole MS. Antioxidant enzyme changes in neem, pigeonpea and mulberry Leaves in two stages of maturity. Plant Signal Behav, 2012; 7(10): 1258-1262.

[24]. Sreelatha S, Padma PR. Antioxidant activity and total phenolic content of Moringa Oleifera leaves in two stages of maturity. Plant Foods Hum Nutr, 2009; 64: 303-311.

[25]. Vora JD, Matthews RF, Crandall PG, Cook R. Preparation andChemical composition of orange oil concentrates. J Food Sci. 1983;48(4):1197–206.

International Journal of Pharmaceutical Research and Applications
Volume 9, Issue 6 Nov - Dec 2024, pp: 551-557 www.ijprajournal.com
ISSN: 2456-4494

[26]. Sale JW, Skinner WW. Relative sweetness of invert sugar. IndEngineering Chem. 1922;14(6):522–6.