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Formulation and evaluation of kiwi herbal syrup using holy basil and apple

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ABSTRACT: Herbal medicine encompasses the utilization of fruit extracts for therapeutic applications, with the majority of herbal syrups originally derived from plant sources. This category also includes syrups developed with specific dosages of herbal medications. In contemporary practice, syrups are employed to address a range of ailments and alleviate symptoms associated with various diseases. Antioxidant syrups are particularly utilized in the treatment of cancer and related conditions, as the body generates free radicals through various oxidative processes and stress-related factors. To inhibit bacterial growth, Tulsi leaf extract is incorporated as an antibacterial agent, while sugar and alcohol serve as preservatives. Additionally, kiwi extract is blended with apple fruit extract to enhance the syrup's flavor. During laboratory formulation, several parameters, such as pH, viscosity, and density, were assessed. The formulation demonstrated stability and was deemed ready for application upon evaluation. It was noted that the herbal formulation exhibited superior antioxidant activity compared to other formulations.

Keywords: Medicine, Herbal Syrup, Kiwi, Basil, Apple, Evaluation

I. INTRODUCTION:

Herbal Medicines:

Overview of the Historical Use of Traditional Herbal Medicines

The term 'traditional' in the context of herbal medicines denotes a significant historical application, which is indeed applicable to numerous products classified as 'traditional herbal medicines.' In various developing nations, a considerable segment of the population depends on traditional healers and their collection of medicinal plants to address healthcare requirements. While modern medicine may coexist alongside these traditional practices, herbal remedies have retained their appeal due to historical and cultural factors. In contemporary times, these products have become increasingly accessible in commercial markets, particularly in developed nations. Within this modern framework, certain ingredients are sometimes promoted for purposes that were not originally intended within the traditional healing paradigms from which they originated. A notable instance is the utilization of ephedra (Ma Huang) for weight management or enhancement of athletic performance (Shaw, 1998). Although some countries enforce stringent manufacturing regulations for herbal medicines, this is not universally the case. For instance, in Germany, herbal products are categorized as 'phytomedicines' and must adhere to the same standards of efficacy, safety, and quality as other pharmaceutical products. Conversely, in the United States, the majority of herbal products available are classified and regulated as dietary supplements, a category that does not necessitate prior approval based on these criteria.

The World Health Organization (WHO, 1977) defines a "medicinal plant" as any plant that contains one or more bioactive compounds in its different parts, which can be used for therapeutic purposes or serve as precursors in the creation of effective pharmaceuticals. This definition differentiates between plants with scientifically validated therapeutic properties and those considered medicinal without substantial research support. The term "herbal drug" refers to specific plant parts, such as leaves, flowers, seeds, roots, barks, and stems, that are used in the preparation of medicinal products.[1]

Advantages of Herbal Medicine:

- Herbal medicine has a rich history of use, leading to greater patient acceptance and tolerance.
- Medicinal plants are a renewable resource, providing a viable option for sustainably

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supplying more affordable medications to a growing global population.
- Access to medicinal plants is typically not a challenge, especially in developing countries like India, which enjoy diverse agro-climatic, cultural, and ethnic backgrounds.
- The long-standing and consistent use of herbal remedies may indicate their safety and effectiveness.
- Worldwide, herbal medicine has played a crucial role in the development of many effective treatments, enhancing the wide array of pharmaceuticals available in modern medicine, both in their natural state and as refined compounds that underpin contemporary drugs.[2]

Limitations of Herbal Medicines:

1. Ineffectiveness in the treatment of acute medical conditions.
2. Insufficient standardization and absence of quality control measures.
3. Deficiency of scientific evidence supporting their efficacy.[3]

Herbal syrup:

Herbal syrup is defined as a preparation that combines and concentrates an herbal decoction with honey, sugar, or occasionally alcohol. The foundation of this syrup is a potent herbal decoction, and the inclusion of sugar or honey serves to increase its thickness and prolong its shelf life [20].

The combination of a decoction with honey or sugar not only thickens the mixture but also acts as a preservative. This method prolongs the decoction's shelf life and often results in a soothing remedy that is advantageous for ailments such as sore throat, cough, dry irritated tissues, and digestive issues. Furthermore, adding a sweetener can improve the taste of certain herbs, making syrups more appealing to a wide audience, including children.

Herbal syrups provide a delightful addition to both drinks and culinary creations. By blending one or two spoonsful of syrup with carbonated water, one can create a flavorful and nutritious herbal soda. Additionally, a simple tea can be made by mixing a spoonful of syrup into hot water. The syrup can also be enjoyed by drizzling it over various foods such as yogurt, oatmeal, biscuits, and ice cream, or it can be consumed directly by the spoonful [21].

A variety of herbs can be used to create fragrant herbal syrups, with some species being particularly ideal for this method. Commonly used herbs in syrups include elderberry, ginger, Astragalus, hawthorn, rose hips, licorice, schizandra, and Echinacea, often enhanced with sweet spices like cinnamon, cloves, and cardamom. Additionally, herbs that may not be as flavorful, such as dandelion, horehound, elecampane, and vervain, are frequently transformed into syrups to make them more palatable. It's a good idea to try different combinations of herbs when crafting this delightful herbal treat.

Types of herbal syrup:

1.Flavored syrup
2.Medicated syrup
3.Artificial syrup

Advantages of herbal syrup:

- Absence of side effects
- Non-toxic nature
- Readily accessible
- Dosage can be easily adjusted based on a child's weight
- No assistance is required for administration, allowing both the caregiver and the patient to self-administer
- The liquid form is suitable for products such as cough syrups
- Herbs are commonly cultivated
- Acts as an antioxidant by slowing down oxidation as sugar is converted into cellulose and dextrose
- High patient adherence, particularly among pediatric patients, due to the sweet taste of syrups
- Functions as a preservative by inhibiting the growth of bacteria, fungi, and mold through osmotic pressure.

Disadvantages of herbal syrup:

- The sedimentation of solids may occasionally result in the formation of a product residue.
- Accurate dosing cannot be attained unless suspensions are formulated into unit dosage forms.
- Similar microbial contamination occurs during preservation when substances are not added in precise proportions.
- Additionally, herbal medicine presents another drawback, which is the potential risk of self-dosing with herbs, although this is quite uncommon.

International Journal of Pharmaceutical Research and Applications
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- Variations in storage temperature may lead to the crystallization of sucrose from a saturated syrup.

Following are the ingredients used in herbal syrup.

1. Kiwi Fruit:

Scientific name: Actinidia

Family: Actinidiaceae

Kiwifruit, commonly referred to as Chinese gooseberry, is the edible berry produced by various species of woody vines within the genus Actinidia. The most widely cultivated variety, Actinidia deliciosa 'Hayward', is oval in shape, resembling a large hen's egg, with dimensions ranging from 5 to 8 centimeters (2 to 3 inches) in length and 4.5 to 5.5 centimeters (1+3⁄4 to 2+1⁄4 inches) in diameter. This fruit is characterized by its thin, fuzzy, fibrous skin, which is light brown and tart but still edible. The flesh can be either light green or golden and contains rows of small, black, edible seeds. Kiwifruit has a soft texture and a sweet, distinctive flavor. It is native to central and eastern China, with the earliest recorded description dating back to the 12th century during the Song dynasty. In the early 20th century, kiwifruit cultivation spread from China to New Zealand, where the first commercial plantings occurred. The fruit gained popularity among British and American servicemen stationed in New Zealand during World War II, leading to its widespread export, initially to Great Britain and later to California in the 1960s. [22,23].

Health uses of kiwi fruit

Recent consensus among food scientists and nutrition experts highlights that daily consumption of fruits and vegetables significantly reduces the risk of diseases like cancer and cardiovascular conditions [29]. Antioxidants such as polyphenols, ascorbic acid, carotenoids, and tocopherols in these foods help neutralize free radicals and inhibit their formation. Kiwifruit, in particular, has shown protective effects against certain cancers, especially in the digestive system, as well as lung and liver cancers, due to its cytotoxic and antioxidant properties [30]. Its unique composition also suggests a potential to lower cardiovascular disease risk [31].

kiwi fruit is abundant in essential nutrients and beneficial phytochemicals, offering a wide range of health benefits and protection against various diseases. Incorporating this nutrient-dense fruit into your diet can be a delicious and effective way to support your overall health and well-being.

Therapeutic activities of kiwi fruit

Antioxidant Activity

Kiwis are rich in various biomolecules, such as ascorbic acid (vitamin C), vitamin E, phenolic compounds, and carotenoids (lutein and zeaxanthin), which serve as effective anti-inflammatory and antioxidant agents. Their primary mechanism involves the neutralization of reactive species, including both oxygen and nitrogen (Pal et al., 2015) [32]. These free radicals contribute to oxidative damage associated with a range of diseases, including cancer and cardiovascular disorders (Bursal and Gülçin, 2011). Consequently, these compounds can prevent oxidation and enhance oxidative defenses by upregulating genes responsible for deoxyribonucleic acid (DNA) repair. Bursal and Gülçin (2011) note that the antioxidant capacity of natural extracts is often quantified in terms of 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid, a potent antioxidant derived from vitamin E, commonly known as Trolox. This capacity can be evaluated through various assays, including the oxygen radical absorbance capacity (ORAC), ferric reducing antioxidant power (FRAP) based on metal ions, and methods utilizing organic radical producers such as 2,2′-azinobis (3-ethylbenzothiazoline-6-sulfonic acid) [ABTS] and 2,2-diphenyl-1-picrylhydrazyl [DPPH], which assess the ability of antioxidants to scavenge radicals (Bursal and Gülçin, 2011) [33].

Antitumor Activity

Cancer is a complex disease with challenging treatment options. Research has highlighted the preventive and palliative roles of diet and a healthy lifestyle in mitigating cancer's onset and effects (He et al., 2019) [36]. One study estimated that increasing fruit and vegetable consumption among half of the American population could prevent 20,000 cancer cases. Fruits, rich in micronutrients and bioactive compounds, are particularly beneficial (Jin-Tao et al., 2021) [37]. Thermolabile and water-soluble phenolic compounds in fruits may have antimutagenic properties. Kiwi, in particular, may serve as a dual-action preventive agent against tumors by reducing DNA damage and mutagenesis, especially when part of a balanced diet (Jin-Tao et al., 2021; He et al., 2019) [36,37].

International Journal of Pharmaceutical Research and Applications
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2.Basil leaves (Tulsi)
Scientific name: Ocimum basilicum
Family: lamiaceae

Tulsi, also known as holy basil (Ocimum sanctum), is a revered plant that holds a multifaceted significance in various cultural, religious, and medicinal contexts. Its cultivation is deeply rooted in the traditions of many communities, particularly in India, where it is celebrated not only for its aromatic qualities but also for its spiritual and therapeutic benefits.

In religious practices, Tulsi is considered a sacred herb in Hinduism, particularly within the Vaishnava tradition, which venerates Lord Vishnu and his avatars. The plant is often grown in home gardens and temples, where it is treated with great reverence. Devotees engage in daily worship rituals that include the offering of Tulsi leaves to deities, as it is believed to purify the environment and enhance spiritual well-being. The presence of Tulsi in a household is thought to invite divine blessings and protect against negative energies.

Health benefits of basil leaves

- Mitigate memory decline associated with stress and aging.
- Alleviate symptoms of depression linked to chronic stress.
- Diminish stroke-related damage and aid in recovery, whether administered prior to or immediately following a stroke.
- Enhance fasting blood glucose levels, cholesterol, and triglyceride levels.
- Lower blood pressure in individuals with hypertension.

3.Apple fruit
Scientific name: malus domestica
Family: Rosaceae

Apple is abundant in vitamins, particularly provitamin A and vitamins B1, B2, B6, C, and E. It also contains essential minerals such as potassium, iron, calcium, and zinc, along with trace elements, fiber, antioxidants, polyphenols, flavonoids, and organic acids. Notably, 75 percent of these beneficial compounds are located in or just beneath the apple's skin.

Ripe fruits typically consist of approximately 84.1% water, 1.0% fiber, and trace amounts of proteins, fats, minerals, and organic acids such as malic acid. The distinctive taste and fragrance of the fruit can be attributed to the presence of esters and essential oils

4.Sugar

Sugar encompasses a wide range of sweet-tasting, soluble carbohydrates that are frequently used in numerous food products. Simple sugars, referred to as monosaccharides, include glucose, fructose, and galactose. Compound sugars, or disaccharides, are formed by the chemical bonding of two monosaccharides; prominent examples are sucrose (which consists of glucose and fructose), lactose (made up of glucose and galactose), and maltose (composed of two glucose units). White sugar is a refined form of sucrose. In the human body, compound sugars are hydrolyzed to produce simple sugars. These sugars are found in the tissues of most plants, with honey and fruits being particularly rich natural sources of simple sugars. Sucrose is especially prevalent in sugarcane and sugar beet, which are ideal for the efficient commercial production of refined sugar. [42].

Table. 1: Role of ingredients in herbal syrup.

Sr. No	Ingredient	Role
1.	Kiwi fruit	Antioxidant
2.	Basil leaves	Antibacterial
3.	Apple fruit	Flavoring agent
4.	Sugar	Preservative
5.	Alcohol	Preservative

II. MATERIAL AND METHODS

Preparation of herbal syrup

Extraction procedure: When herbal syrup is prepared by decoction method. Steps are as follows.

1. **Kiwi fruit extract:** Four kiwi fruits, each weighing approximately 30 grams, were carefully selected for the extraction process. The first step involved removing the outer skin of the kiwis, ensuring that only the vibrantgreen flesh was retained. Once the skin was discarded, the fruit was cut into small, uniform pieces to facilitate the extraction of flavors and nutrients.

Next, these kiwi pieces were combined with 100 milliliters of water in a suitable container. The mixture was then subjected to gradual heating, allowing the flavors, vitamins, and other beneficial compounds from the kiwi to infuse into the water. This gentle heating process was crucial, as it helped to preserve the delicate properties of the fruit while ensuring an effective extraction.

After reaching the desired temperature and allowing sufficient time for the infusion, the

International Journal of Pharmaceutical Research and Applications
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resulting mixture was carefully filtered to separate the liquid extract from the solid kiwi pieces. This filtration process ensured that only the clear, flavorful extract remained, free from any pulp or fibrous material.

Once filtered, the extract was set aside to cool. This cooling step was important for both safety and to enhance the flavor profile of the extract, making it suitable for various culinary applications or as a refreshing beverage. The final product was a vibrant, aromatic kiwi extract, rich in the fruit's natural sweetness and nutritional benefits.

2. **Basil leaves extract:** To obtain the extract, 20 grams of Tulsi leaves were combined with 100 milliliters of water and heated gradually. The resulting extract was then filtered and allowed to cool.
3. **Apple fruit extract:** Place the diced apples into a pot filled with water. The quantity of water should be adjusted based on the desired intensity of the apple flavor; for a more pronounced taste, utilize a smaller amount of water. Optionally, incorporate sugar and a dash of lemon juice to enhance the flavor profile. Allow the apples to simmer for a duration of 30 to 45 minutes, enabling them to impart their flavor into the water. The objective is to draw out the apple essence into the liquid. Use a cheesecloth or a fine mesh strainer to filter the liquid, separating it from the apple solids. You may press the solids to extract additional flavor.

Fig No.1: extraction of herbal ingredients.

Formulation of herbal syrup of ingredient:All necessary extracts for the herbal syrup have been prepared.

Firstly, a measured amount of kiwi fruit extract, specifically 9 ml of the solution, was taken. Next, 3 ml of basil leaf extract was incorporated, and the mixture was stirred continuously. Subsequently 3 ml of apple extract was added, followed by continuous stirring. Then, 33.3 ml of sugar solution was introduced and stirred thoroughly. Finally, a small quantity of alcohol was added, and the mixture was stirred continuously. The herbal syrup was then prepared.

The syrup obtained was transferred into an amber-colored bottle, which was then sealed securely and stored in a cool location.

Formulation of herbal syrup (50ml):

Table.2: formulation of herbal syrup(50ml)

Ingredients	F1 (ml)	F2 (ml)	F3 (ml)
Kiwi fruit	9	9	9
Basil leaves	3	2	4
Apple fruit	3	3	2
Sugar	33.3	34.3	33.3
Alcohol	2	2	2

Fig. no.02: formulation of herbal syrup.

EVALUATION PARAMETER

1. Procedure to determine density

1. Begin by carefully cleaning the specific gravity bottle with either chromic acid or nitric acid.
2. Rinse the bottle at least two to three times with distilled water.
3. If necessary, perform an additional rinse with an organic solvent like acetone and ensure the bottle is completely dry.
4. Weigh the empty, dry bottle along with the capillary tube stopper (w1).
5. Add the unknown liquid to the bottle, secure the stopper, and wipe away any excess liquid from the outside of the tube with tissue paper.
6. Use an analytical balance to determine the weight of the bottle containing the unknown liquid (w2).
7. Finally, calculate the weight in grams of the unknown liquid (w3).

International Journal of Pharmaceutical Research and Applications
Volume 9, Issue 6 Nov - Dec 2024, pp: 1310-1319 www.ijprajournal.com ISSN: 2456-4494

Formula for density: Density of liquid under test (syrup) = weight of liquid under test /Volume of liquid under test = w3/v

2. Procedure to determine specific gravity

1. Begin by thoroughly cleaning the specific gravity bottle with either chromic acid or nitric acid.
2. Rinse the bottle at least two to three times with purified water.
3. If required, perform an additional rinse with an organic solvent, such as acetone, and allow the bottle to dry completely.
4. Weigh the empty, dry bottle together with the capillary tube stopper.
5. Fill the bottle with distilled water, insert the stopper, and eliminate any excess liquid from the side tube using tissue paper (w2).
6. Measure the weight of the bottle containing the stopper and water using an analytical balance (w2).
7. For the liquid being tested, repeat the process by emptying and drying the bottle as outlined in steps 4 to 6, substituting the water with the new liquid.
8. Weigh the bottle with the stopper and the liquid under examination on the analytical balance (w3).

Formula for specific gravity: Specific gravity of liquid under test (syrup) = weight of liquid under test /weight of water = w5/w4.

3.pH determination: The pH determination of syrup by using two techniques.
a) Glass electrode. b) pH paper.

Procedure for glass electrode

1. Prepare 30 ml of buffer for each specified pH level by determining the required volume of the stock solution. Mix the appropriate volumes to create the buffer.
2. Allow the solution to equilibrate for 15 minutes.
3. measure the pH of the solution using a pH meter.

4. procedure to determine viscosity

1. Begin by thoroughly cleaning the Ostwald viscometer using warm chromic acid, and if necessary, employ an organic solvent such as acetone.
2. Secure the viscometer in a vertical orientation on an appropriate stand.
3. Introduce water into the dry viscometer until it reaches mark G.
4. Measure the time, in seconds, taken for the water to flow from mark A to mark B.
5. Repeat step 3 a minimum of three times to ensure accurate readings.
6. Rinse the viscometer with the test liquid, then fill it to mark A and determine the time required for the liquid to flow to mark B.
7. Proceed with the determination of the densities of the liquid as outlined in the density determination experiment.

Formula for viscosity

$$\text{Viscosity} = \frac{\text{Density of test liquid} \times \text{Time required to flow test liquid}}{\text{Density of water} \times \text{Time required to flow water}} \times \text{Viscosity of water}$$

III. RESULT

1. Test of organoleptic evaluation:

Table no. 03 Organoleptic properties

Sr. No.	Organoleptic Characters	F1	F2	F3
1.	Color	Yellowish green	Yellowish green	Yellowish green
2.	Odor	Aromatic	Aromatic	Aromatic
3.	Taste	Sweet	Sweet	Sweet

International Journal of Pharmaceutical Research and Applications
Volume 9, Issue 6 Nov - Dec 2024, pp: 1310-1319 www.ijprajournal.com ISSN: 2456-4494

2. Test of evaluation parameter

Table no. 04 evaluation parameter

Sr. No.	Parameter	F1	F2	F3
1.	Density	1.07gm.	1.09gm.	1.06gm.
2.	Specific gravity	0.5289	0.5135	0.5135
3.	Viscosity	3.70cp.	3.60cp.	3.66cp.
4.	pH determination			
	pH paper	Neutral	Neutral	Neutral
	pH meter	6.01	6.03	5.43

IV. DISCUSSION

In today's era the herbal products are increasingly recognized as symbols of safety, particularly when compared to synthetic drugs, which are often perceived as hazardous to both human health and the environment. For centuries, herbs have been valued for their medicinal, flavoring, and aromatic properties. It is now imperative to advocate for their global promotion.

The herbal syrup prepared from these ingredients exhibits significant antioxidant properties. A single kiwi fruit contains approximately 100 mg of vitamin C. Clinical studies have demonstrated that after 28 days of consuming this fruit, there is a notable reduction in platelet aggregation and plasma triglyceride levels. Regular consumption of kiwi fruits has been associated with a decreased risk of cancer, particularly colon cancer. Additionally, kiwi is utilized in the treatment of insomnia and other sleep disorders, aiding in the promotion of natural sleep.

Research has generated considerable interest in the antioxidant properties of vitamin C, as studies have demonstrated its ability to neutralize free radical molecules that, when present in excess, can cause cellular damage. Additionally, vitamin C plays a crucial role in the immune system by enhancing the activity of white blood cells.

V. CONCLUSION

The formulation studies conducted for all the preparations strictly adhered to the specified criteria, ensuring that each aspect of the development process met the established standards. This meticulous approach was crucial in achieving a high-quality end product. Furthermore, the characteristics of the prepared syrup were thoroughly evaluated, and it was determined that attributes such as color, odor, taste, density, and viscosity were all found to be satisfactory. These sensory and physical properties are essential for consumer acceptance and overall product performance.

Among the various formulations tested, the final formulation, designated as F1, exhibited superior stability when compared to formulations F2 and F3. This enhanced stability is a significant advantage, as it suggests that formulation F1 is less likely to undergo degradation or changes in quality over time, making it a more reliable option for both storage and use. The development of formulation F1 involved a careful analysis of the shortcomings identified in formulations F2 and F3, leading to a reduction of errors and an overall improvement in the formulation process.

Importantly, formulation F1 is enriched with vitamin C, a well-known antioxidant that offers numerous health benefits. The inclusion of this vital nutrient not only enhances the nutritional profile of the syrup but also contributes to its functional properties, making it an attractive option for health-conscious consumers. The antioxidant properties of vitamin C can help protect the body from oxidative stress, thereby supporting overall health and wellness.

Given these advantages, formulation F1 holds significant potential for both researchers and industries looking to produce similar formulations on a larger scale. Its successful development can serve as a model for future projects, guiding the formulation of other products that require similar characteristics and benefits. The findings from this study may encourage further exploration and innovation in the field of syrup formulations, ultimately leading to the creation of high-quality, health-promoting products that meet consumer demands.

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