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Original Article

Formulation of Herbal Candies Containing Giloy Satva: A Nutritious and Palatable Herbal Confectionery Option

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ABSTRACT

Background: Giloy (*Tinospora cordifolia*) is an Ayurvedic herb known for its numerous health benefits. **Objectives:** In this study, we aimed to prepare Giloy Satva candy. **Materials and Methods:** The candy was prepared by incorporating Giloy Satva in various concentrations batch wise, with other natural ingredients to enhance its palatability and therapeutic value. Physicochemical and therapeutic evaluation of the Giloy Satva candies involved assessing parameters such as moisture content, ash value, Total Soluble Solids (TSS), phytochemical screening, pH, sensory evaluation and Antioxidant assay. **Results and Discussion:** The finalized batch candy exhibited a desirable moisture content (7.44±0.08%), ash value (1.26±0.67%), and TSS (69.05 °Brix). The pH of the candy was found to be within the acceptable range (4.8±0.30), ensuring its stability and suitability for consumption. In sensory evaluation, the candy received positive feedback for its taste, texture, aroma, and overall acceptability. Furthermore, the antioxidant activity of the Giloy Satva candy was determined using *in vitro* DPPH assays. The candy exhibited significant antioxidant activity (53.23±0.23 µg/mL), indicating its potential to combat oxidative stress and associated health issues. **Conclusion:** In conclusion, the Giloy Satva candy demonstrated promising physicochemical properties, excellent sensory attributes, and potent antioxidant activity. The developed candy formulation could serve as a convenient and palatable herbal preparation, offering the benefits of Giloy in an easily consumable form. Further investigations, including stability studies and clinical trials, are warranted to explore its therapeutic potential and commercial viability.

Keywords: Candy, Giloy satva, *T. crispa*, Immunomodulation, Hepatoprotective.

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INTRODUCTION

In recent years, there has been a growing interest in the utilization of traditional herbal remedies for promoting health and well-being. Giloy (*Tinospora cordifolia*) is one such herb that has garnered significant attention due to its therapeutic properties. *Tinospora cordifolia* is widely used in the Indian system of medicine for its immune-boosting capabilities and effectiveness in treating fever, inflammation, and liver disorders.[1] Reports indicate that a total of 34 species of Tinospora have been identified worldwide.[2] Among these, numerous herbal varieties have been utilized by indigenous communities across the tropical and subtropical regions of Asia, Africa, and Australia for their traditional medicinal purposes.[2] In India five species of Tinospora occurs *T. cordifolia* (Willd.) Miers. Ex Hook. f. and Thomson, *Tinospora sinensis* (Lour.) Merr. *Tinospora crispa* (L.) Miers. ex-Hook. f. and Thomson,*T. glabra* (Burm. f.) Merr. and the recently described *T. formanii* Udayan and Pradeep.[3] Among these various species, *Tinospora cordifolia* and *Tinospora crispa* are widely distributed across India. Scientific reports indicate that *T. crispa* has been linked to adverse effects.[4] In accordance with the guidelines established by AYUSH (the Ministry of Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homoeopathy), *T. cordifolia* and *T. crispa* can be distinguished based on their morphological characteristics.[5]

T. cordifolia lacks small rounded projections and does not secrete milk, unlike *T. crispa*. The leaves of *T. cordifolia* are heart-shaped with a groovy notch at the base, whereas *T. crispa* leaves are heart-shaped without a groovy notch at the base.[3,5] Therefore, accurately identifying the herb based on morphological characteristics is crucial when formulating herbal products to prevent any undesirable effects.

Several evidence-based studies have demonstrated the safety and therapeutic efficacy of *T. cordifolia*, with Giloy satva being a popular formulation available in the market.[6]

Nevertheless, the bitter taste, large doses, and difficulty in swallowing associated with traditional formulations have

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hindered patient compliance. Hence, there is a need to develop new methods that enhance patient compliance with Giloy satva. The inclusion of Giloy Satva in candies presents a practical solution, particularly for individuals who are deterred by the herb's bitter taste. This study aims to explore the formulation of Giloy candies. The development of these herbal candies entails a comprehensive analysis of various factors, including physicochemical properties and sensory characteristics, to ensure optimal consistency, taste, moldability, and color at room temperature. Through this rigorous formulation process, the Giloy candies not only offer the desired therapeutic effects but also provide an enjoyable and visually appealing confectionery experience.

The outcomes of this study hold the potential to pave the way for the creation of new herbal confectionery products that combine traditional herbal remedies with modern formulations, thereby presenting a promising avenue for enhancing public health and well-being. Overall, the formulation of herbal candies containing Giloy Satva represents a significant advancement in the field of herbal medicine, offering individuals a delightful and accessible approach to harness the therapeutic properties of this remarkable herb.

MATERIALS AND METHODS

Chemicals

Ethanol, distilled water, Molisch reagent, and Dragendorff's reagent were procured from CDH Chemicals, New Delhi. Sugar and vanilla essence were purchased from the local market of Amravati.

Plant Material

Fresh thumb sized stems of fresh Giloy plants were collected from the Medicinal Garden (MAPA) of Government College of Pharmacy, Amravati, Maharashtra (Figure 1). The authentication of fresh stems was done at Pharmacognosy Department, Government College of Pharmacy, Amravati.

Preparation of Giloy Satva

Giloy Satva used for the preparation of candies was obtained following the procedure described in Ayurvedic literature, specifically Yogaratnakara Rajayakshama Chikitsa 1/11.[7] The process is as follows:

Fresh Giloy stems were carefully collected and thoroughly washed to remove any impurities. The stems were then dried and weighed for further processing. Approximately 5 kg of fresh Giloy stems, measuring 1.6-2.0 cm in thickness, were selected. These stems were chopped into pieces approximately 2-3 inches in length. The chopped Giloy stem pieces were subjected to thorough pounding until a slimy paste consistency was achieved. The slimy paste was transferred into a stainless-steel vessel and soaked overnight for duration of 12 hr. The soaking process involved adding four times the volume of potable water (w/v) to the Giloy paste. The next morning, the soaked paste was manually macerated in water for approximately 1 hr, ensuring thorough mixing. The mixture was then slowly filtered through a clean cotton cloth, to separate the liquid portion. The filtered liquid was set aside undisturbed for 4 hr, allowing the sediment to settle. After this time, the supernatant liquid was carefully siphoned off, leaving behind white and smooth starchy sediment at the bottom. The collected sediment, rich in Giloy Satva, was transferred into a stainless-steel tray. It was air-dried under the influence of a running fan until complete dryness was achieved. Finally, the dried Giloy Satva was stored in dry airtight glass jars under sterile conditions to maintain its quality and potency.[6]

Figure 1 a, b, c: Giloy Plant in MAPA – Ayush Garden, Government College of Pharmacy, Amravati.

Table 1: Giloy candy preparation method for batches F1, F2 and F3.

Sl. No.	Ingredient	F1	F2	F3
1	Giloy Satva	300 mg	500 mg	700 mg
2	Sugar	50 g	50 g	50 g
3	Water	25 mL	25 mL	25 mL
4	Vanilla Essence	2-3 drops	2-3 drops	2-3 drops

Preparation of Giloy Candies

Three different batches (F1, F2, and F3) of Giloy candies were prepared by varying the amount of giloy satva using following procedure (Table 1).

In a deep bottom saucepan or bowl, water and sugar were combined and mixed thoroughly. The mixture was heated over medium heat until it reached a boiling point. To ensure proper blending, the mixture was continuously stirred using a wooden spoon or spatula. Giloy Satva was added to the boiling water-sugar mixture. With constant stirring, the Giloy Satva was slowly and evenly incorporated into the mixture. The stirring process helped to ensure a homogeneous distribution of Giloy Satva within the candy mixture. Vanilla essence was added as a flavoring agent. The mixture was continuously stirred to ensure proper integration of the flavoring agent with the other ingredients. The prepared candy mixture was promptly poured into candy molds that had been sprayed with vegetable oil to prevent sticking. The molds were filled with the mixture, ensuring that each cavity was adequately filled. The filled molds were then allowed to cool by placing them on cooling racks or trays. During the cooling process, the candies gradually solidified and took on their desired shape. Once completely cooled and solidified, the Giloy candies were carefully removed from the molds. The candies were stored properly in suitable air tight containers in a cool and dry environment.

Physicochemical Analysis of Giloy Candies

The physicochemical evaluation of Giloy Satva Candies was done as per the standard methods of AOAC 930.15. (AOAC International, 1990) by using following parameters:

Organoleptic Evaluation

The preliminary organoleptic evaluation of prepared candies was done by using parameters like Color, Taste, Flavor, Consistency, and shape

Moisture Content

The moisture content of the candy was determined using the hot-air oven technique. A 5 g sample was subjected to a temperature of 100±5°C in a hot air oven for duration of 4 hr. Subsequently, it was allowed to cool in desiccators and then weighed again. Readings were taken in triplicate. The difference in weight indicated the amount of moisture present in the sample. % of moisture content was determined using following formula:[8]

$$\text{Moisture content (\%)} = \frac{\text{W1} - \text{W2}}{\text{W}} \times 100$$

Where, W1= Wt of Dish and Candy before drying (g); W2 = Wt of Dish and Candy in gm after drying (g); W = Weight of the empty dish (g).

Ash content

To determine the ash content, a precise weight of 5g of the candy sample was measured. The sample was then heated in a crucible using a muffle furnace set at 560°C for duration of 6 hr. After ash formation, the sample was allowed to cool in desiccators and subsequently weighed. The resulting ash should have a grayish-white color. Readings were taken in triplicate. The ash content was calculated using the following formula:[8]

$$\text{Ash content (\%)} \frac{\text{W1} - \text{W2}}{\text{W}} \times 100$$

Where, W1=Wt of crucible+Candy before ash (g); W2=Wt of crucible+candy ash (g); W=Weight of the empty crucible (g).

pH measurement

The pH measurement was conducted using a digital PH meter. A 5 g sample was taken and finely ground before being mixed with 30 mL of distilled water to form a pulp. The mixture was thoroughly blended using a homogenizer and subsequently filtered. PH of the filtrate was measured using pH paper. Readings were taken in triplicate.[8]

Total Soluble Solids (TSS)

The determination of the Total Soluble Solids (TSS) in the candy sample was carried out using a handheld Refractometer (ERMA, ATC). A small amount of the sample was evenly distributed across the prism of the Refractometer. By facing the eyepiece towards bright sunlight, the scale on the Refractometer was observed. The dioptre adjusting ring was manipulated until the scale became clear and easily visible. The calibrated scale displayed a transparent section, allowing for a direct reading in degrees Brix (°Brix).[8]

Sensory evaluation

To conduct the sensory analysis of the Giloy satva candy samples, a straightforward hedonic scale with a limited number of points ranging from 1 to 4 was employed. The scale allowed participants to rate their preferences from 1 to 4, with 1 representing "I don't like it" and 4 indicating "I like it very much." The evaluation encompassed various aspects, including the initial impression, appearance, flavor, texture, taste, and aroma of the Giloy satva candies.[9] Phytochemical screening of Giloy Satva candies by Chemical tests.

The presence of bioactive principles like carbohydrate and alkaloids in Giloy satva candy were detected by chemical tests like the Molisch Test, Iodine Test (for carbohydrates) and Dragendorff's test, Mayer's Test (for alkaloids) respectively.[10]

Estimation of therapeutic efficacy of Giloy Satva Candy

DPPH Assay

Prepared giloy satva candies were analyzed for antioxidant effect by DPPH method using UV Spectrophotometer. Giloy Satva candies were crushed. Approximately 12 mg of DPPH was dissolved in 100 mL ethanol in a volumetric flask and placed in dark covered with aluminum foil. A stock solution of 1 mg/mL was prepared by solublising 10 mg crushed candy in 10 mL ethanol. Serial dilutions of 10, 20, 30, 40 and 50 mg/mL were prepared from the stock solution. Ascorbic acid was used as standard drug. The assay was conducted as follows:

3 mL of each dilution was taken in a test tube. 2 mL of DPPH was added to the sample and the test tube was kept in dark for 30 min. After 30 min, the absorbance of each sample was taken at 520 nm on UV against the blank. The percentage of free radical scavenging by samples was determined by the following formula:[11]

$$\% \text{ RSA} = \frac{\text{Abs of blank} - \text{Abs of sample}}{\text{Abs of blank}}$$

Statistical Analysis

All the readings of physicochemical parameters and antioxidant activity study were taken in triplicate. The values are expressed as mean±SD.

RESULTS AND DISCUSSION

Preparation of Giloy Satva Candies

Giloy satva was prepared from the fresh stems of *T. cordifolia* by Traditional method. The % yield of giloy satva was found to be 36.4%. Giloy satva was added in varying quantity of 300 mg, 500 mg and 700 mg in batches F1, F2, F3 respectively to optimize the correct amount of Giloy satva to be added to get perfect candy formulation. All three batches were analyzed for physicochemical parameters to identify the appropriate batch of Candy for final formulation as per the AOAC 930.15 guideline (AOAC International, 1990). Prepared candies were stored for 28 days at normal temperature for study.

Physicochemical evaluation of the Giloy Satva Candies

In organoleptic evaluation, all three batches of candy, F1, F2 and F3 were analyzed for color, odor, taste and appearance. The outcomes of organoleptic evaluation are as shown in Table 2 Batch F3 found to be comparatively more bitter in taste and rough in appearance than remaining two batches F1 and F2. Moisture content of prepared candies of all batches was monitored in between storage of candies. Estimation of moisture content is an important parameter from stability and microbial contamination during storage point of view.[12] In all batches, moisture of the candies found to be decreased when stored for longer period of time might be due to evaporation (as shown in Table 2). Candies of F1 batch found more brittle as compared to F1 and F2 batch candies when examined on 28th day of storage. The Average Ash value content in Giloy Satva candies of batches F1, F2 and F3 was found to be ranging from 1.25-1.34% (as shown in Table 2). The PH values of all three batches of candies were found to be in the range of 5.6-5.9. According to previous studies, PH is inversely proportional to the concentration of sugar in candies.[13] In order to determine a high positive correlation with reducing sugar content, total soluble solids in each candy sample were determined using a handheld Refractometer (ERMA, ATC). The TSS of the candies F1, F2 and F3 found to be in the range of 67-70° Brix. According to previous studies, during storage of candies, the value of TSS increases due to the reduction of moisture content and osmotic inhibition of sugar.[14] According to the sensory analysis results, the aspect, taste, and flavor were appreciated by scoring higher the batch F1, F2 candies as compared to batch F3. In phytochemical screening of sugar candies, carbohydrates and alkaloids were found to be present (as shown in Table 2).

For antioxidant activity, since the antioxidant effect of drug highly related to the hepatoprotective activity as well as immunomodulating activity, antioxidant activity of Giloy satva candies was performed to confirm their therapeutic efficacy as an immunomodulator as well as hepatoprotective. In this study, the % free radical scavenging activity was found to be moderate as compared to the standard drug Ascorbic acid. According to a study, Giloy satva consists of approximately 0.31% of Alkaloid. Hence, the antioxidant activity of Giloy satva candy might be attributed to the presence of alkaloids in satva. The % free radical inhibition pattern was found to be directly proportional to the quantity of Giloy satva in candy (as shown in Table 2). Thus, from overall study, Giloy Satva Candies F2 fond to be appropriate based on sensory evaluation, physicochemical evaluation and Anti-oxidant activity and finalized for the further studies before commercialization (as shown in Figure 2).

Table 2: Organoleptic, Physicochemical, sensory evaluation and Antioxidant study outcomes of Giloy satva candy batches F1, F2, F3.

Sl. No.	Parameters	Batches								
		F1			F2			F3		
1	Organoleptic Evaluation									
	Color	Golden Brown			Golden Brown			Golden Brown		
	Taste	Sweet			Sweet			Sweet		
	Flavor	Vanilla			Vanilla			Vanilla		
	Consistency	Solid (Hard)			Solid (Hard)			Solid (Hard)		
	Shape	Star Shape			Star Shape			Star Shape		
2	Moisture Content %	1st	14th	28th	1st	14th	28th	1st	14th	28th
		19.20± 0.12	12.04± 0.45	9.32± 0.04	14.24 ± 0.56	10.04± 0.23	7.44± 0.08	12.11± 0.33	8.65± 0.45	9.32± 0.04
3	Ash Content %	1.25±1.02			1.26±0.67			1.34±1.10		
4	Total Soluble Solid (TSS) (°Brix)	67.21			69.05			70.32		
5	PH	4.6±0.55			4.8±0.30			4.9±0.12		
6	Phytochemical screening by Chemical test	Carbohydrates, alkaloids			Carbohydrates, alkaloids			Carbohydrates, alkaloids		
7	% Free radical inhibition at 50 µg/mL concentration	45.98±0.11			53.23±0.23			54.37±0.44		

±Values are the means of triplicate standard deviations. All the parameters are on a dry basis except moisture.

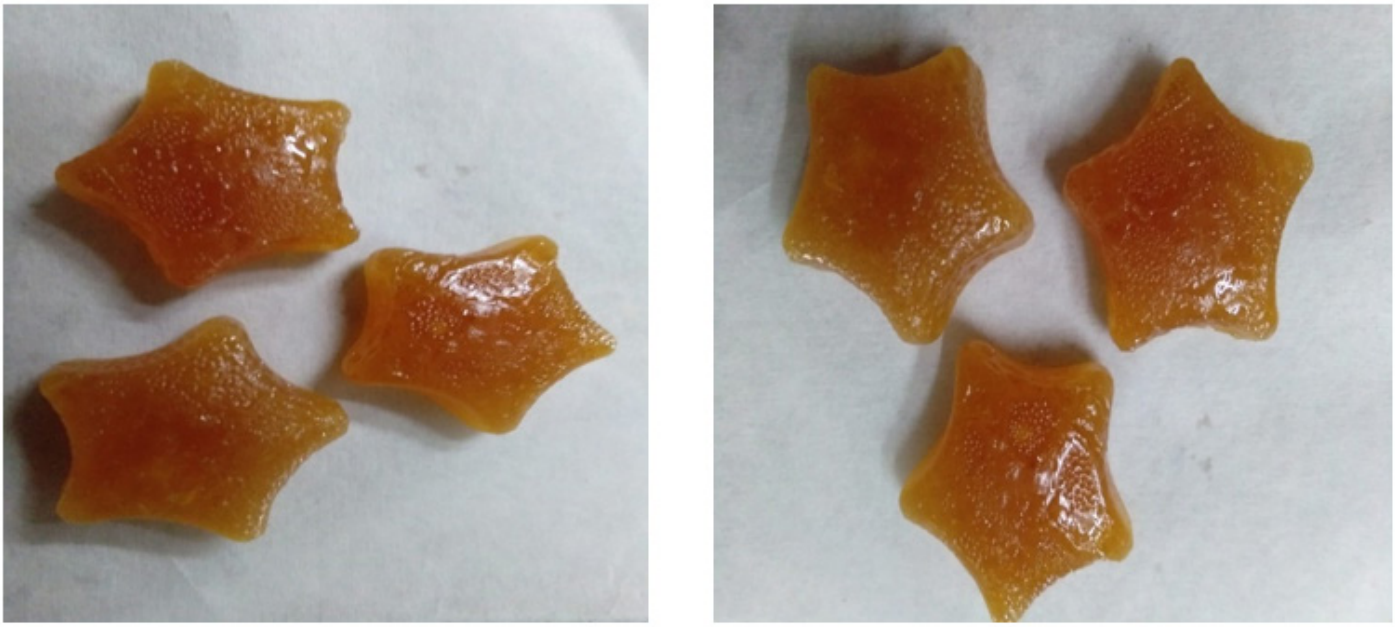

Figure 2: Giloy Satva Candies of Batch F3.

CONCLUSION

In conclusion, the incorporation of Giloy satva in candies holds promise for enhancing immunity. Giloy satva acts as an antioxidant, combating free radicals and supporting the body's defense mechanisms against infections. The utilization of herbal candies as a positive immunomodulator is a noteworthy recommendation. The development of herbal candies containing Giloy satva not only provides a convenient and enjoyable means of consumption but also opens up avenues for incorporating traditional remedies into daily life. Further research and studies are warranted to elucidate the precise mechanisms of action, optimal dosages, and long-term effects of Giloy satva in candy formulations. This will contribute to a better understanding of its immunomodulatory properties and its potential as a valuable addition to healthcare practices. Overall, the utilization of Giloy satva in candies represents an exciting area of research and innovation, offering a natural and palatable approach to immunomodulation. It also highlights the broader potential of botanicals in the development of novel therapeutics with enhanced efficacy and reduced side effects.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

AOAC: Association of Official Agricultural Chemists; **DPPH:** 2,2-diphenyl-1-picryl-hydrazyl-hydrate

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