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## Development and evaluation of confectionary food product based on Giloy (*Tinospora cordifolia*)

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### Abstract

Caramel candy, with its luscious texture and sweet taste, has enjoyed enduring popularity as a beloved confectionery. In recent years, there has been a growing interest in incorporating herbal ingredients into traditional treats to enhance their appeal and potential health benefits. This review explores the fusion of Giloy, a medicinal herb deeply rooted in Ayurvedic traditions, with caramel candy, resulting in a unique confection that combines indulgence with potential wellness advantages. By infusing caramel candy with Giloy, the rich, buttery flavours harmonize with the herbal essence, creating a tantalizing blend. Furthermore, Giloy's reputed antioxidant and immunomodulatory properties offer an additional layer of potential health benefits. This paper presents a comprehensive overview of the preparation method, highlighting the potential synergistic effects of combining caramel candy and Giloy. The results showed that the different concentrations of giloy Powder had a significant impact on several response variables. Moisture content ( $p \leq 0.0055$ ), total sugar ( $p \leq 0.0053$ ), reducing sugar ( $p \leq 0.0025$ ), ascorbic acid ( $p \leq 0.002$ ),  $\beta$ -carotene ( $p \leq 0.0065$ ), DPPH ( $p \leq 0.0106$ ), and sensory acceptability ( $p \leq 0.0204$ ) were all significantly affected by the varying concentrations of giloy powder.

**Keywords:** Candy, confectionary, Giloy, nutrition, health benefits

### Introduction

*Tinospora cordifolia*, also known as Guduchi or Giloy, is a large glabrous deciduous climbing shrub belonging to the family Menispermaceae. It is native to the tropical Indian subcontinent and China, thriving at altitudes of up to 300 meters [15]. *Tinospora cordifolia* has been widely used in traditional medicine systems like Ayurveda for its remarkable therapeutic properties. The plant's stem, in particular, is extensively utilized and recognized for its potential health benefits. The Sanskrit name for *Tinospora cordifolia*, "Guduchi," means "one which protects the entire body." This plant has been attributed with the ability to impart youthfulness, vitality, and longevity, leading to its comparison as the "Nectar of Immortality" [6]. In Hindi, it is also referred to as Giloy or Amrita, invoking the mythological concept of a heavenly elixir that preserves eternal youth [13].

The stems of *Tinospora cordifolia* are succulent, featuring long filiform fleshy aerial roots. The bark displays a creamy white to gray color, with rosette-like lenticels dotting the spaces between deep spiral indentations [13]. The leaves are cordate and membranous, while the small flowers range from yellow to greenish yellow. The plant produces ovoid, glossy, succulent, and pea-sized drupes, each containing a curved seed. The fruits are fleshy, pea-shaped, and turn red when boiled. In Ayurveda, *Tinospora cordifolia* is considered a potent Rasayana, a substance that enhances longevity, vitality, and overall well-being. It is widely employed in Ayurvedic medicine for various purposes, including inflammation, allergies, neurological disorders, glucose metabolism, general debility, fever, diabetes, dyspepsia, urinary infections, jaundice, and skin diseases [11]. The plant's versatile properties have earned it the reputation of being a "magical herb" in modern medicine, capable of addressing a wide range of ailments.

*Tinospora cordifolia* is known to be a rich source of trace elements such as zinc and copper [4], which act as antioxidants, protecting cells from the damaging effects of oxygen radicals generated during immune activation. Its Rasayana effect can be utilized to prevent and heal infections, making it a potential universal vaccine for various diseases [19].

Chemically, *Tinospora cordifolia* contains a diverse range of components belonging to different classes, including alkaloids, diterpenoid lactones, glycosides, steroids, sesquiterpenoids, phenolics, aliphatic compounds, and polysaccharides. These constituents contribute to the plant's therapeutic properties and make it a valuable resource for medicinal

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purposes. The nutritional composition of *Tinospora cordifolia* includes essential minerals such as calcium, phosphorus, iron, copper, zinc, and manganese, further adding to its health-promoting potential. Caramel candy, with its rich and creamy texture, has long been cherished as a delectable treat loved by many. Its sweet, buttery taste provides a delightful experience for those with a sweet tooth. But what if we told you there's a way to elevate this beloved confectionery to a whole new level by infusing it with the goodness of Giloy.

Giloy, scientifically known as *Tinospora cordifolia*, is a remarkable herb deeply that not only satisfies your taste buds but also offers potential health benefits. Infusing caramel candy with Giloy involves incorporating the extract or powdered form of the herb into the candy-making process<sup>[18]</sup>. As the caramel cooks and caramelizes, it melds with the herbal essence of Giloy, creating a harmonious blend of flavors. This innovative combination not only retains the classic allure of caramel candy but also introduces a new dimension of wellness to the indulgent experience<sup>[17]</sup>.

By infusing Giloy into caramel candy, you can enjoy a treat that not only tantalizes your taste buds but also provides a potential boost to your immune system. Giloy's renowned properties, such as its antioxidant and immunomodulatory effects, add an extra layer of goodness to this already delightful confection. So, whether you seek the nostalgic comfort of caramel candy or the wellness benefits of Giloy, this unique fusion is a delicious way to savor the best of both worlds. Indulge in the sweetness of rooted in Ayurvedic traditions. Renowned for its medicinal properties, Giloy has been revered for centuries as an immune-boosting herb with numerous health benefits<sup>[7]</sup>. Its vine-like stems and heart-shaped leaves hold the secret to its healing powers, making it a sought-after ingredient in traditional medicine. Now, imagine blending the rich, buttery goodness of caramel candy with the natural goodness of Giloy. The result is a fusion of tradition and sweet indulgence a unique treat tradition while embracing the potential wellness perks of Ayurvedic wisdom. Giloy-infused caramel candy invites you to embark on a flavorful journey where sweetness meets herbal goodness in every delectable bite. Giloy powder has been shown to have antidiabetic activity, which means that it can help to lower blood sugar levels<sup>[8]</sup>. This is due to the presence of compounds in giloy powder that can help to increase insulin sensitivity and improve the body's ability to use glucose for energy. Giloy powder is a rich source of antioxidants, which can help to protect cells from damage caused by free radicals. Free radicals are unstable molecules that can damage cells and lead to a variety of health problems, including cancer, heart disease, and neurodegenerative diseases<sup>[20]</sup>. Giloy powder has been shown to have hepatoprotective activity, which means that it can help to protect the liver from damage<sup>[9]</sup>. This is due to the presence of compounds in giloy powder that can help to reduce inflammation and improve liver function. Giloy powder has been shown to have anti-inflammatory activity, which means that it can help to reduce inflammation<sup>[8]</sup>. This is due to the presence.

Giloy powder has been shown to have antipyretic activity, which means that it can help to reduce fever. This is due to the presence of compounds in giloy powder that can help to lower body temperature<sup>[20]</sup>. Giloy powder has been shown to have immunomodulatory activity, which means that it can help to boost the immune system<sup>[9]</sup>. This is due to the presence of compounds in giloy powder that can help to increase the

production of white blood cells and improve the body's ability to fight infection. Giloy powder has been shown to have tonic activity, which means that it can help to improve overall health and well-being. This is due to the presence of compounds in giloy powder that can help to increase energy levels, improve digestion, and reduce stress. Giloy powder has been shown to have antimicrobial activity, which means that it can help to kill bacteria and other microorganisms<sup>[2]</sup>. This is due to the presence of compounds in giloy powder that can help to disrupt the cell membranes of microorganisms.

Overall, the potential benefits of infusing giloy powder into caramel candy are numerous and varied. Giloy powder is a safe and effective herb that has been used for centuries in traditional medicine to treat a variety of health conditions. The addition of giloy powder to caramel candy can provide a delicious and nutritious way to enjoy this of compounds in giloy powder that can help to block the production of inflammatory mediators beneficial herb.

The areal roots of *Tinospora cordifolia* are so thin yet so strong that they can be used for suturing surgical wounds<sup>[6]</sup>. The plant extract has potent wound healing properties. This can help wounds to heal quickly and reduce the risk of infection.

### Materials and Methods

Giloy powder will be purchased from nearby patanjali store. Cane sugar, condensed milk, lecithin, hydrogenated palm oil will be purchase from departmental store high fructose corn syrup will order from online website. Department of Food Science and Technology, school of Agriculture, LPU, Jalandhar, and Punjab.

### Procedure of candy making (R. Peethi et al 2012)

Caramel is produced using either a batch or continuous process. Pre-mixing, emulsification, cooking, cooling, and shaping, either through slab formation or depositing, are the five essential processes in the process.

### Premix

Ingredients are pre-mixed separately for the fat and aqueous phases. Butter/milk fat is combined with melted vegetable fat and emulsifier at the correct speed for fat phase formulations. Sugar is dissolved in the amount of water required, then combined with milk solids and melted corn syrup.

### Emulsification

A high-speed mixer is used to emulsify both the aqueous and fat phases. To get the necessary texture and other quality qualities in the end product, emulsification must be adequate. Emulsification is aided by an emulsifier and milk protein.

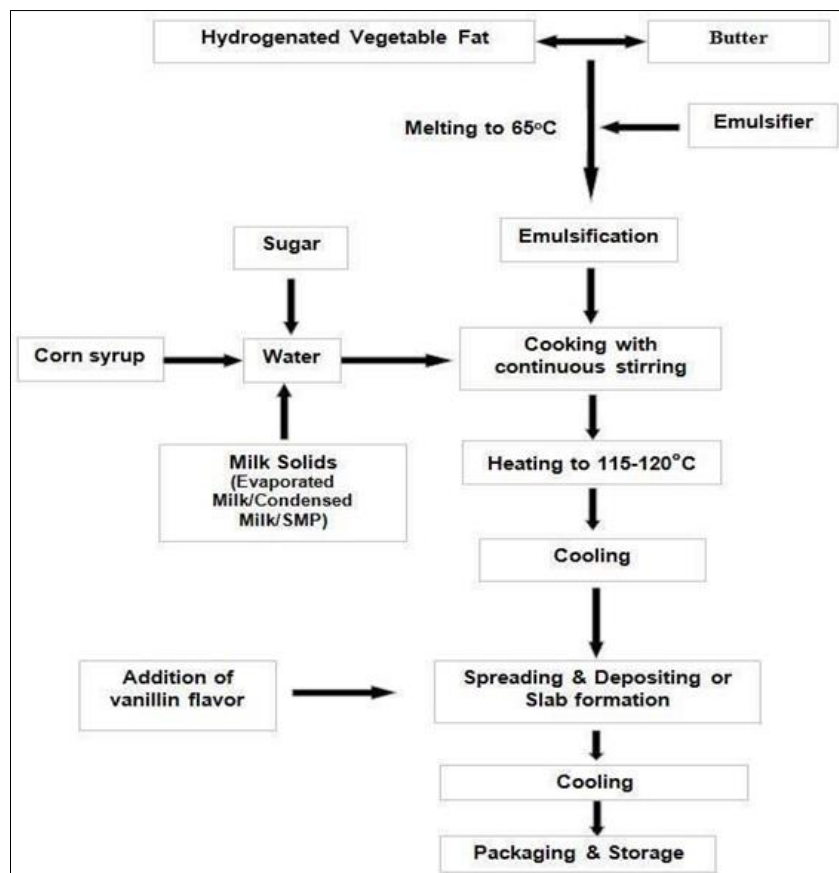
### Cooking

To generate suitable texture and organoleptic quality, especially the flavour and colour, caramel or toffee must be cooked at the desired temperature. The final moisture content, as well as the texture and chewiness, are influenced by the cooking temperature. In caramel cooking, the final cooking temperature controls the moisture content of the finished product. 6-8 percent moisture is present in caramel or toffee cooked at 125-130 degrees Celsius. The product generated will have a nice chewing property if enough fat is present. With these items designed for hot climates, higher cooking temperatures of up to 145 degree C are required. During storage, these are less likely to grain (crystallize).

## Cooling and Deposition

The cooked mixture is delivered to the depositor or forming unit, where it is cooled and shaped. The chilling is necessary to

prevent the caramel or toffee from overcooking. There could be three unique shaping processes. The slab process, the cut and wrap process, and the depositing process are all included.



## Results

Proximate and physicochemical analysis of candy with different concentrations of gilyo powder were measured. Moisture content, ash, titratable acidity, fat, crude fiber, total sugar, and reducing sugar were expressed in percentage (%). B-carotene was expressed in  $\mu\text{g}/100\text{g}$  of sample. All these proximate physicochemical parameters were estimated using the methods adopted from [39]. The measurement of total soluble solids was conducted using a manual refractometer, and the results were expressed in degrees Brix ( $^{\circ}\text{B}$ ) [35]. The estimation of ascorbic acid or vitamin C was performed using volumetric titration, following the method described by [46], with L- ascorbic acid as the standard. The concentration of vitamin C was expressed in milligrams per 100 grams of the sample.

The evaluation of 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical inhibition activity was performed using a UV-Visible spectrophotometer, measuring the absorbance at 517 nm [47]. The results were expressed as a percentage, indicating the extent of Estimation of Sensory Attributes of Candy Sensory evaluation of the samples was conducted using a 9-point hedonic scale [55]. The scale included 9 liking points ranging from "Like Extremely" to "Dislike Extremely," providing a range of preferences for the panelists. For the analysis, a total of 10 panelists within the age DPPH radical inhibition.

Total phenol content was estimated using UV- Visible spectrophotometer at an absorbance of 675nm against the standard gallic acid and was expressed as mg GAE/100 g [47]. group of 20-50 were selected. These panelists underwent training in sensory analysis and were chosen from research

students and teaching staff members with expertise in sensory evaluation.

The sensory evaluation took place in a well-lit sensory booth with fluorescent lighting, and the temperature was maintained at  $22\pm 3^{\circ}\text{C}$  to ensure consistent conditions. To eliminate bias, the samples were assigned 5 different codes and distributed in petri plates for evaluation. The panelists considered attributes such as color, taste, flavor, and mouthfeel during the evaluation process. Additionally, an overall acceptability score was calculated to assess the overall perception of the samples.

## Effect of Concentration on physicochemical and proximate analysis of candy

The proximate and physicochemical parameters of CG candy prepared with varying concentrations of gilyo Powder. The moisture content of CG candy showed an increasing trend as the concentration of gilyo powder decreased. The lowest moisture content was observed in CG-1, with a value of  $2.678\pm 0.273\%$ , while the highest was found in CG-2 candy, with a value of  $4.347\pm 0.46\%$ . The total soluble solids (TSS) were maintained at  $75^{\circ}\text{B}$ , except for CG-1, which had a TSS of  $76\pm 0.816^{\circ}\text{B}$ . The ash content was the lowest in CG-1 ( $0.32\pm 0.035\%$ ), while the highest was in CG-5 ( $1.14\pm 0.12\%$ ). CG -1 had the highest titratable acidity, measuring  $0.742\pm 0.017\%$ , whereas the lowest titratable acidity was observed in CG-1, with a value of  $0.576\pm 0.054\%$ . The fat content of the candy increased as the gilyo concentration decreased. Both total sugar and reducing sugar content showed an increasing trend from CG-1 to CG-2 candies. The highest total sugar content was  $48.68\pm 2.63\%$ , and the highest reducing

sugar content was  $30 \pm 2.82\%$ . The candy with a lower giloy concentration had the highest ascorbic acid content, with CG-5 candy sample containing  $198 \pm 2.16$  mg/100 g. On the other hand, the candy with a higher giloy concentration, CG-1, had the lowest vitamin C content, measuring  $175.5 \pm 1.870$  mg/100 g of the sample. The  $\beta$ -carotene content decreased with a decrease in giloy concentration. CG-1 had the highest  $\beta$ -carotene content, with  $186.5 \pm 1.224$   $\mu$ g/100 g sample, while CG-5 had the lowest, with  $144.6 \pm 3.6$   $\mu$ g/100 g sample. The increase in moisture content and fat retention in the candy with an increase in giloy concentration can be attributed to the improved shelf-life properties of giloy. It has been observed that the presence of giloy in certain products leads to a reduction in moisture and fat content, thus enhancing their shelf life [22]. Additionally, research has indicated that giloy contains a higher concentration of  $\beta$ -carotene compared to Caramel. Therefore, CG candy with a higher concentration of giloy will likely exhibit a higher presence of  $\beta$ -carotene [20, 21].

The numerical optimization process involved analyzing various response variables, including moisture content, total sugar, reducing sugar, ascorbic acid,  $\beta$ -carotene, DPPH, total phenolic content, and overall sensory acceptability of CG candies. These responses were evaluated based on the factors

mentioned in Table 1. A first-order linear model was employed for the optimization and analysis of variance, as only a single factor was considered for the optimization criteria.

The results showed that the different concentration of giloy Powder had a significant impact on several response variables. Moisture content ( $p \leq 0.0055$ ), total sugar ( $p \leq 0.0053$ ), reducing sugar ( $p \leq 0.0025$ ), ascorbic acid ( $p \leq 0.002$ ),  $\beta$ -carotene ( $p \leq 0.0065$ ), DPPH ( $p \leq 0.0106$ ), and sensory acceptability ( $p \leq 0.0204$ ) were all significantly affected by the varying concentrations of giloy powder. However, the total phenolic content ( $p \leq 0.8882$ ) was not found to be significantly affected by the changes in giloy powder concentrations. To assess the desirability of these responses in relation to the factor of different giloy powder concentrations added to CG candy, adequate precision was calculated. The results revealed that, except for the total phenolic content, all other responses were deemed desirable.

The analysis of variance, fit statistics, and regression coefficient of the first-order linear model for the response variables utilized in the numerical optimization of giloy powder- incorporated Caramel candy.

## Discussion

**Table 1:** Proximate and physicochemical parameters of Caramel-giloy candy with different concentrations of giloy Powder

Nutritional Parameters	Caramel-giloy Candy				
	CG 1	CG 2	CG 3	CG 4	CG 5
Moisture (%)	2.648 $\pm$ 0.273	3.125 $\pm$ 0.56	3.376 $\pm$ 0.468	4.156 $\pm$ 1.066	4.327 $\pm$ 0.46
TSS ( $^{\circ}$ B)	75 $\pm$ 0.817	75 $\pm$ 0.826	75 $\pm$ 0.856	75 $\pm$ 0.826	75 $\pm$ 0.826
Ash (%)	0.33 $\pm$ 0.034	0.58 $\pm$ 0.073	0.86 $\pm$ 0.033	1.02 $\pm$ 0.07	1.13 $\pm$ 0.12
Titratable acidity (%)	0.743 $\pm$ 0.016	0.628 $\pm$ 0.025	0.626 $\pm$ 0.052	0.50 $\pm$ 0.13	0.577 $\pm$ 0.055
Fat (%)	0.05 $\pm$ 0.021	0.09 $\pm$ 0.021	0.09 $\pm$ 0.008	0.14 $\pm$ 0.043	0.16 $\pm$ 0.043
Crude Fibre (%)	8.3 $\pm$ 0.357	7.4 $\pm$ 0.495	8.2 $\pm$ 0.942	7.0 $\pm$ 0.077	7.5 $\pm$ 0.476
Total sugar (%)	41.01 $\pm$ 1.075	41.69 $\pm$ 1.76	42.13 $\pm$ 1.47	44.35 $\pm$ 48.68	2.62 $\pm$ 2.034
Reducing sugar (%)	22.05 $\pm$ 0.155	23.43 $\pm$ 25.86	1.018 $\pm$ 0.84	26.78 $\pm$ 1.46	30 $\pm$ 2.83
Ascorbic acid (mg/100g)	175.5 $\pm$ 1.873	181.8 $\pm$ 186.3	1.018 $\pm$ 186.3	$\pm$ 0.84 26.78	$\pm$ 198 $\pm$ 2.16
B-carotene ( $\mu$ g/100g)	176.5 $\pm$ 1.222	169.2 $\pm$ 157.8	2.433 $\pm$ 3.84	142.5 $\pm$ 143.6	7.355 $\pm$ 3.5

\*Values shown here are mean of triplicates  $\pm$ S.D

**Table 2:** Sensory parameters of Caramel-giloy candy with different concentrations of giloy Powder

Sample	s	Colour	Taste	Flavour	Mouthfeel	Overall acceptability
CG-1		6.34, 0.50	$\pm$ 6.8 $\pm$ 0.43	6.65 $\pm$ 6.8 $\pm$ 0.33	6.65 $\pm$ 0.31	0.45
CG-2		6.45, 0.54	$\pm$ 7.2 $\pm$ 0.5	6.2 $\pm$ 0.45	6.95 $\pm$ 0.47	6 $\pm$ 0.22
CG-3		7 $\pm$ 0.32	7.85 $\pm$ 0.55	7.25 $\pm$ 8.15 $\pm$ 0.217	6 $\pm$ 0.3,	0.34
CG-4		7.65, 0.55	$\pm$ 8.6 $\pm$ 0.54	8.2 $\pm$ 0.24	8.4 $\pm$ 0.43	8.2 $\pm$ 0.2
CG-5		8.15, 0.58	$\pm$ 8.5 $\pm$ 0.24	8.5 $\pm$ 0.38	8.8 $\pm$ 0.33	8.5 $\pm$ 0.22

\*Values shown here are mean values of 10 panellist  $\pm$ S.D

**Table 3:** Analysis of Variance (ANOVA), fit statistics and regression coefficient of first order linear model for the response variables used in numerical optimisation of giloy powder impregnated Caramel candy

Responses	df	F-value	p-value	Estimated coefficient	Adequate Precision
Moisture (%)	1	50.95	0.0055	3.91	15.1360
Total sugar (%)	1	194.78	0.0049	42.65	24.1330
Reducing sugar (%)	1	97.62	0.0019	25.70	20.9619
Ascorbic acid (mg/100 g)	1	168.1	0.001	186.92	27.5116
B- carotene ( $\mu$ g/100 g)	1	45.4	0.0059	166.34	14.319
DPPH radical inhibition (%)	1	33.64	0.0112	23.22	12.3050
Total phenol content (mg GAE/100 g)	1	0.0252	0.8867	55.44	3.1180

The potential benefits of infusing giloy powder into caramel candy are numerous and varied. Giloy powder is a safe and effective herb that has been used for centuries in traditional medicine to treat a variety of health conditions. The addition of giloy powder to caramel candy can provide a delicious and

nutritious way to enjoy this beneficial herb. It is important to note that more research is needed to confirm the efficacy and safety of infusing giloy powder into caramel candy. However, the available evidence suggests that this practice may have a number of potential health benefits.

If you are interested in trying giloy powder, it is important to talk to your doctor first. Giloy powder can interact with certain medications, so it is important to make sure that it is safe for you to take. You should also start with a small dose and gradually increase the dose as needed.

Overall, the potential benefits of infusing giloy powder into caramel candy are numerous and varied. Giloy powder is a safe and effective herb that has been used for centuries in traditional medicine to treat a variety of health conditions. The addition of giloy powder to caramel candy can provide a delicious and nutritious way to enjoy this beneficial herb.

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Overall, the potential benefits of infusing giloy powder into caramel candy are promising. However, more research is needed to confirm these findings. If you are interested in trying giloy powder, it is important to talk to your doctor first.

## Conclusion

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