

Development and Evaluation of a Herbal Nutraceutical Candy for Immune System Support

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Abstract: Herbal candy represents a novel approach to the traditional candy formulation by incorporating medicinal herbs with immunomodulatory properties. This study aimed to develop and evaluate herbal candy that utilize the therapeutic benefits of Shankhpushpi, Brahmi, Chirata, Nagarmotha and pumpkin seeds as primary ingredients. These herbs were chosen based on their known pharmacological activities, such as antioxidant, neuroprotective, anti-inflammatory and immunomodulatory effects, making the candy both a treat and a potential health supplement. The candy formulation involved grinding and accurately weighing each herb, boiling a sugar solution with butter and integrating the herbal powders to achieve the desired texture and consistency. The candies were physically evaluated based on colour, taste, odor, shape and texture, revealing a solid, pleasant-tasting product with a brown colour. Chemical evaluation through phytochemical testing confirmed the presence of key bioactive compounds, including carbohydrates, alkaloids, steroids, flavonoids, and polyphenols. These findings highlight the potential of herbal candy as a Nutraceutical delivery system for immune-boosting and health-promoting compounds, combining the enjoyment of a sweet treat with functional health benefits.

Keywords: Herbal candy, Immunomodulatory, Shankhpushpi, Pumpkin seeds.

1. Introduction

Candy is a widely enjoyed product by people of all ages, from children to the elderly. Its primary ingredient sugar, provides an immediate energy boost, often mixed with a wide range of flavors and colors for enhanced taste and visual appeal. Popular flavors include caramel, chocolate, peppermint, butterscotch and vanilla among many others, contributing to the over 2,000 varieties available.

Common types of candies are, Hard candies (e.g., lollipops), Soft candies (e.g., toffees), Chewing gum, gummies & jellies.



Figure 1: Sugar Candy

Sugar is a major contributor to the development of dental caries (cavities). Many types of bacteria present in the mouth particularly *Streptococcus mutans*, feeds on sugar. When these bacteria metabolize the sugars found in most candies, juices or other sugary foods, they produce acids that erode tooth enamel, leading to cavities. Frequent or excessive consumption of sugar-rich foods, especially lollipops, sugary cough drops and other candies that remain in the mouth for prolonged periods, raises the risk of tooth decay.

Candies containing enamel dissolving acids, such as acid drops, further increase the risk.

While synthetic flavors and colors are still prevalent, there is a growing trend toward using natural ingredients like herbs. Herbal products are known for their long-lasting effects, therapeutic properties and health benefits. The use of herbs in candy production offers several advantages, including safety, efficacy, fewer side effects, better compatibility with the human body, and widespread cultural acceptance. Herbal candies act as an effective medium for delivering vitamins, minerals, and bioactive compounds such as anthocyanin, lycopene, ascorbic acid, etc. They are often the preferred remedy for issues like coughs, sore throats and digestive or stomach ailments. The selection of herbs is usually guided by the specific health issue, reduced side effects, availability, and consumer preferences. In addition to sugar, sweeteners are also used in these candies. However, the consumption of sugar and sweeteners is sometimes viewed with skepticism due to health-related concerns. Greater acceptance of herbal candies due to cultural traditions and safer than synthetic additives. Cases of well-known herbal candies include Amla candy (Rich in Vitamin C & support immunity and digestion), Ginger cough candy (Known for soothing sore throats) and Ajwain candy (Helps in digestive issues like indigestion, etc.).

Herbal candies are popular due to their convenient use, delicious flavor, and potential medicinal benefits. They belong to the category of sugar confectionery.^[1]

Types of Candies:

Candies are primarily classified into two types:

- Crystalline Candies
- Non-Crystalline Candies

Rock candy also known as hard candies, is made from sugar. It is typically prepared by combining sugar and water. The crystallization process forms the basis of hard candy production. Hard candies differ from other types due to their minimal moisture content in the finished product. Candies are considered an instant source of energy due to their high calorie content. They are rich in flavor, easy to prepare and convenient to pack, transport and store.



Figure 2: Herbal Candy

Herbal candies are highly flavored by consumers for their excellent taste, appealing flavors, vibrant appearance, and colors. Flavored and sweetened candies effectively mask the bitter or unpleasant taste of active drug ingredients. They are especially appreciated by patients who find it difficult to swallow medications. A wide variety of herbal candy products are readily available in the market. [2] - [3]

2. Selected Drug in Herbal Candies

The herbs selected on the basis of their application as followed.

2.1 Shankpushpi:

Shankpushpi also known as *Convolvulus pluricaulis* / *Canscora decussata* / *Clitorea ternate*. It consists of whole herb of *Evolvulus alsinoides* Linn. belonging to family Convolvulaceae. Shankpushpi is used for various medicinal properties like antioxidant, hypolipidemic, immunomodulatory, analgesic, antifungal, antibacterial, antidiabetic, antiulcer and cardiovascular activity. [4]



Figure 3: Shankpushpi

2.2 Brahmi: Brahmi is also referred to as *Bacopa monnieri*. The term Brahmi is as often as possible utilized to allude *Bacopa monnieri*, *Centella asiatica* (too called Gotu Kola), or occasionally a mixture of both botanicals. It specifically refers to the entire herb of *Bacopa monnieri*, which belongs to Apiaceae family. *Bacopa monnieri* possess neuroprotective action. Brahmi advances mental clarity,

confidence, insights and memory review. The key compound asiaticoside demonstrates immunomodulatory effect by boosting the phagocytic index and increasing the total White Blood Cell (WBC) count. [5] - [6]



Figure 4: Brahmi

2.3 Nagarmotha

Nagarmotha also known as *Cyperus rotundus*. It consists of dried rhizomes of *Cyperus rotundus* from the Cyperaceae family. It exhibits a wide range of properties including analgesic, anti - allergic, anti - arthritic, anti - diarrheal, anti - emetic, anti - hypertensive, anti - malarial, anti - cancer, cardioprotective, neuroprotective and wound healing as well as the inhibition of brain Na⁺, K⁺ ATPase activities. It is widely used as a raw material in the production of perfume and soap. [7]



Figure 5: Nagarmotha

2.4 Chirata

It also known as *Swertia chirayita*, Chiretta, Anaryatikta, Bhunimba, Chiratitka, Kairata in Sanskrit. Dried plant of *Swertia chirayita* belonging to family Gentianaceae. It shows digestive, hepatic and bitter tonic properties. Chirata also have antidiabetic, anti - malaria, antipyretic as well as antitussive activities. The xanthones compounds found in *Swertia chirata* form an important group that exhibits anticancer property. [8]



Figure 6: Chirata

2.4 Pumpkin seeds

Pumpkin also known as *Pepita*. It is derived from seeds of *Cucurbita moschata* belonging to family Cucurbitaceae. It shows antidiabetic, anticancer activities, antioxidant, antimicrobial, anti - inflammatory, cholesterol - lowering, etc. [9]



Figure 7: Pumpkin seeds

As per literature survey the above mention drugs/ herbs have **immunomodulatory properties**.

Immunomodulation is the process of changing the body's immune system, either by stimulating or suppressing its function. Immunomodulators can help the body fight infection, cancer, and other diseases by altering the immune responses.

There are two general categories:

- Immunomodulatory may *decrease* immune response, they are called as *immunosuppressants*. It inhibits or decrease the intensity of the immune response in the body. Immunosuppressants is used in organ transplantation.
- Immunomodulatory may *increase* immune response. *Immunotherapy* can be utilized alone or combined with other cancer treatment. Immunotherapy is the frame of treatment that utilized or coordinate the body's immune response to target and battle cancer. It improves immune system and destroy cancer cells. [10]

3. Materials and Methods

3.1 (a) Formula for herbal candy:

Table 1: Formula for herbal candy

Sr. No	Name of Ingredients	Quantity
1.	Shankhpushpi	233 mg (0.233 gm)
2.	Brahmi	233 mg (0.233 gm)
3.	Nagarmotha	100 mg (0.10 gm)
4.	Chirata	166 mg (0.166 gm)
5.	Pumpkin seeds	80 mg (0.08 gm)
6.	Sugar	250 gm
7.	Water	QS
8.	Butter	QS

3.1 (b) Herbal Ingredient used:

Table 2: Herbal ingredients

Sr. No	Ingredient	Biological source	Part used	Quantity
1.	Shankhpushpi	<i>Convolvulus pluricaulis</i>	Dried whole plant	0.233 gm
2.	Brahmi	<i>Bacopa monnieri</i>	Dried Aerial parts	0.233 gm
3.	Chirata	<i>Swertia chirata</i>	Dried stem	0.166 gm
4.	Nagarmotha	<i>Cyperus rotundus</i>	Dried rhizome	0.100 gm
5.	Pumpkin seeds	<i>Cucurbita moschata</i>	Dried seeds	0.08 gm

3.2 Procedure

- Grind Shankhpushpi, Brahmi, Nagarmotha, Chirata, and pumpkin seeds into a fine powder.
- After grinding, weigh Shankhpushpi 233mg, Brahmi 233mg, Nagarmotha 100mg, Chirata 166 mg, and pumpkin seeds 80 mg accurately.
- Weigh sugar 250 gm accurately. Take sufficient water in a deep bottom saucepan and add sugar in it, then mixed it.
- Boil the mixture, add slight butter in it and mixed the blend with a wooden spoon.
- Now add all powders one by one in mixture with constant stirring.
- Immediately pour the mixture into the candy mold (coat with butter so the mixture does not stick with the candy mold) and allowed to cooled by placing in refrigerator.
- After cooling, put away legitimately at appropriate temperature.
- Pack the candy into air tight container. [5] - [11]

4. Evaluations

4.1. Physical Evaluation:

The parameters include colour, taste, odor, appearance (shape/size), texture (consistency). [5]

4.2. Chemical Evaluation

It includes Phytochemical analysis (i. e. Test for Carbohydrates, flavonoids, alkaloids, polyphenols, steroids) and pH determination.

4.2.1 Preliminary Phytochemical Analysis:

Phytochemical analysis includes detection of bioactive compounds (test for availability of carbohydrates, flavonoids, steroids, alkaloids, etc.) in formulated candy. [5]

1) Test for Carbohydrates:

- Fehling's Test:** Crushed the candy. Add the crushed candy in 1ml Fehling's A solution and 1ml Fehling's B solutions. Mixed the solution and boiled for 1 minute. After that, heat the solutions on water bath for 5 - 10 minutes.
- Test for Steroids:** Steroids compounds like Beta - sitosterol, stigmasterol, phytosterols, campesterol, etc., are present in Brahmi and Pumpkin seeds respectively.

- c) **Salkowski reaction:** Add 1gm of smashed candy to 2ml chloroform and 2ml concentrated sulphuric acid. Shake well, chloroform and acid layers get form.
- 2) **Test for Alkaloids:** Alkaloids like Convolamine, Convolin, herpestine, rotundine, chiratin, etc., are present in Shankpushpi, Brahmi, Nagarmotha, Chirata, respectively.
- a) **Dragendorff's Test:** Add few drops of Dragendorff's reagent in crushed candy.
- 3) **Test for Flavonoids:** Flavonoids like quercetin, rutin, luteolin, apigenin, isovitexin, etc., are present in Shankpushpi, Brahmi, Nagarmotha, Chirata, respectively.
- a) **Shinoda test:** Make a powder of candy. Add 5ml of ethanol, few drops of concentrated Hydrochloride acid (HCl) and 0.5g of magnesium turnings. To small amount of residue, added lead acetate solution.
- 4) **Test for Polyphenols:**
 - a) **Ferric chloride test:** Crushed candy was added with 5% freshly prepared ferric chloride solution.

4.2.2 pH determination:

The pH of candies falls within the range of **4.5 to 6.0**, Shankpushpi and other ingredients contains compounds like flavonoids and alkaloids that are relatively stable within this pH range. Extreme acidic or alkaline conditions may reduce the therapeutic efficacy.

4.3 Moisture Content:

Weigh 2 gm of powdered drug and place it in a porcelain dish. Dry the sample in an oven, set to 100°C or 105°C. Permit it to cool in a desiccator and then weigh the sample. Record the loss in weight as the moisture content. ^{[12] - [13]}

To maintain the moisture into candies is one of the important parameters. Due to moisture gain, candies become sticky and due to moisture loss, candies texture become too hard.

4.4 Ash Value

Weigh approximately 3 g of the powdered drug in a silica crucible. Place the crucible containing the sample on a burner and heat until the material is completely reduced to ash. Allow the crucible to cool to room temperature, then weigh the ash. Calculate the percentage of total ash. ^[3]

5. Results and Discussion

Physical evaluation of candies showed that they are brown in colour, sweet in taste, pleasant in odor and had solid consistency. Phytochemical analysis of these candies revealed the presence of carbohydrates, alkaloids, steroids, flavonoids and polyphenols. The pH determination, Moisture content and Ash value are calculated. The study aimed to assess the immunomodulatory potential of Indian medicinal plant. The primary role of the immune system is to defend the body against infectious agents and potential pathogens, placing it in a crucial position between a healthy and diseased state. Study reviews the traditional use of each herb

in the formulation as immune stimulants. Candy provides a rapid and efficient delivery system for medications, and a candy was developed using Shankpushpi, Brahmi, Nagarmotha, Chirata, and pumpkin seeds. Phytochemical and physical evaluations of the herbal candy showed that preparation, produced the best consistency, moldability, thread - forming ability, brittleness, and desirable taste and color.

5.1 Physical evaluation of herbal candy:

Table 3: Physical evaluation parameters

Sr. No.	Parameters	Results
1.	Colour	Brown
2.	Odor	Pleasant
3.	Taste	Sweet
4.	Shape	Rose and Star
5.	Texture	Hard (solid consistency)



Figure 8: Prepared Herbal Candy

5.2 Evaluation of herbal candy:

Table 4: Evaluation Parameters

Sr. No.	Parameters	Results
1.	pH determination	5.0
2.	Moisture content	1.8%
3.	Ash Value	2.5%

5.3 Phytochemical evaluation of herbal candy

Table 5: Phytochemical evaluation

Sr. No.	Test	Observation	Results
1.	Carbohydrates	Brick red precipitate	Present
2.	Alkaloids	Orange precipitate	Present
3.	Steroids	Red – Greenish layer	Present
4.	Flavonoids	Yellow colour	Present
5.	Polyphenols	Deep blue colour	Present

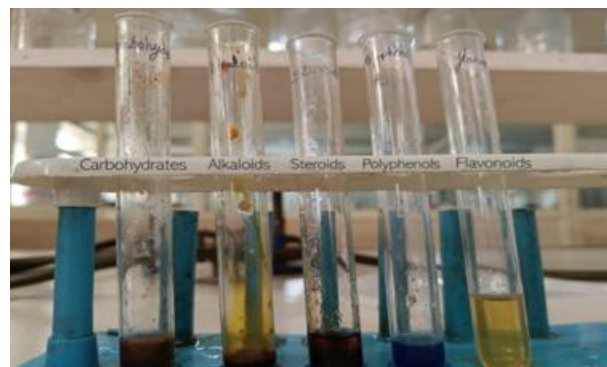


Figure 9: Performed Phytochemical Test

6. Conclusion

The study Successfully formulated and evaluated herbal candy incorporating Indian medicinal herbs; including Shankpushpi, Brahmi, Nagarmotha, Chirata, and Pumpkin seeds, each known for their therapeutic properties and immunomodulatory effects.

This formulation offers a convenient and appealing way to consume herbal ingredients that support immune function. The use of herbs in candy provides not only a safe and effective delivery system for therapeutic benefits but also aligns with growing consumer seeking a palatable, functional food that promotes health and well - being through natural, plant - based ingredients.

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