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Development of herbal medicated gummies for nicotine cessation support

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Abstract

Smoking cessation is challenging due to withdrawal symptoms. Herbal remedies can help with their stress-relieving and anti-inflammatory properties. This study aimed to create gummies with herbal extracts to support quitting smoking. Extracts from Ashwagandha, Ginger, Cinnamon, Licorice, and Tulsi were prepared using a Soxhlet extractor and a hydroalcoholic solvent. These extracts were mixed with agar, sugar, citric acid, and vegetable oil to form gummies. The gummies were then tested for quality and sensory properties.

The gummies were orange, uniform in shape and size, with a pleasant aroma and chewy texture. They had a slightly acidic pH, ensuring stability. The taste was balanced and sweet, with a strong orange flavor. The weight of individual gummies was consistent. The herbal gummies showed good physical and sensory qualities, making them a potential aid for smoking cessation. They can help reduce withdrawal symptoms and support overall well-being, offering a natural and enjoyable option to assist in quitting smoking.

Keywords: Nicotine cessation support; Gummies; Medicated Gummies; Nicotine withdrawal; Nicotine cessation.

1. Introduction

Nicotine addiction is complex, involving both physical and psychological elements. It's prevalent in individuals with a history of major depression, schizophrenia, or substance abuse, largely due to the rewarding effects of nicotine on the brain. Nicotine interacts with receptors in the brain, triggering the release of dopamine, which creates feelings of pleasure and reinforces smoking behavior. Over time, tolerance develops, leading to a need for more nicotine to achieve the same effects. Withdrawal symptoms, such as irritability and cravings, occur when nicotine levels drop. Treatment strategies include nicotine replacement therapy, medications like varenicline and bupropion, and behavioral counseling, with varying degrees of effectiveness. Alternative tobacco products like e-cigarettes are controversial and require further research into their role in cessation. Understanding these mechanisms is crucial for effective management of nicotine dependence and cessation.

1.1. Gummies

Gummies are a popular type of candy known for their chewy texture and diverse flavors. They come in various shapes and sizes, often resembling bears, worms, or fruits, and are enjoyed by both children and adults. The main components of gummies include sweeteners like sucrose, alternative sugars for specific textures, gelling agents such as gelatin or plant-based options like agar agar and pectin, acidulants like citric acid and malic acid for flavor balance, food-grade colorants for vibrant appearances, and flavorings to enhance taste. Gummies are particularly favored due to their organic and chewy nature, making them a widely consumed confectionery product.

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1.1.1. Advantages of gummies

Gummies have several advantages over pills, capsules, or liquids:

- Taste: They're often tastier and easier to swallow.
- Easy Consumption: They're simple to chew and swallow, suitable for all ages.
- Portability: They're individually wrapped or come in small packages, easy to carry.
- No Water Needed: Unlike pills, they don't require water for consumption.
- Mask Unpleasant Tastes: They can hide the taste of medications.
- Variety of Flavors: They come in many flavors to suit preferences.
- Less Intimidating: Their fun shapes and colors make them less scary for some people.

1.1.2. Herbal extract medicated gummies

Herbal extract medicated gummies blend the fun of gummy candies with the healing effects of herbal extracts. These gummies are infused with concentrated herbal extracts, derived from plants known for their medicinal properties. They offer an easy and enjoyable way to consume herbs, providing potential health benefits like immune support, relaxation, and sleep aid. They're popular for their convenience and tasty form, offering a delicious alternative for wellness support.

2. Material and methods

2.1. Materials Required

- Powder of herbs (such as ashwagandha roots, ginger rhizome, cinnamon bark, licorice root, and tulsi)
- Solvent (hydroalcoholic mixture of ethanol and water, in a ratio of 30:70)
- Soxhlet extractor setup
- Heating mantle
- Beaker
- filter paper, funnel

2.1.1. Preparation of Powder of Herbs for Extraction:

- Dried plant materials are pulverized into fine powders using a mortar and pestle.
- Care is taken to ensure uniform particle size for efficient extraction.
- Plant powders are dried to remove residual moisture.

2.1.2. Selection of Solvent:

- A hydroalcoholic solvent (mixture of ethanol and water) is chosen for improved extraction efficiency.
- The ethanol-water mixture ratio is 30:70.

2.1.3. Soxhlet Extraction Process:

- Assemble the Soxhlet apparatus, including a round-bottom flask, Soxhlet extractor, and condenser.
- Weigh and place the ground herb sample inside the Soxhlet extractor.
- Add the solvent into the round-bottom flask, ensuring it covers the sample in the extractor but does not overflow.
- Gently heat the round-bottom flask to initiate extraction.
- Vaporized solvent rises into the Soxhlet extractor and overflows into the condenser.
- In the condenser, the vaporized solvent condenses back into liquid form and drips back into the extractor.
- This cyclic process continues, allowing continuous extraction of compounds from the herb sample.
- The extraction process continues for 4 hours.
- After completion, turn off the heating mantle and allow the system to cool down.

2.1.4 Monitoring the Extraction:

- Keep vigilant watch over the Soxhlet extractor setup to ensure smooth operation throughout the extraction process.
- Adjust the heating mantle or temperature control as needed to maintain a gentle reflux of the solvent for optimal extraction.

2.1.4. Recovery of Extract:

- Once the extraction is complete, carefully remove the round-bottom flask containing the solvent extract.
- Transfer the solvent extract to another flask for further heating to evaporate the solvent, leaving behind the concentrated extract.

2.1.5. Storage

- Store the extracted Ashwagandha extract in a clean, airtight container away from light and moisture to preserve its potency for future use.

2.1.6. Preparation of Gummies:

- Agar powder, acting as a gelatin substitute, was dissolved in water to create a gel base.
- Sugar was added to the gel base for sweetness, ensuring the palatability of the gummies.
- Herbal extracts of ashwagandha, ginger, cinnamon, licorice, and tulsi, obtained through Soxhlet extraction for efficient extraction of bioactive compounds, were added to the gel base.
- Citric acid was introduced for flavor enhancement, enhancing the taste profile of the gummies.
- A small amount of vegetable oil was used as a coating agent to prevent sticking during preparation.
- The mixture was heated and stirred until all ingredients were thoroughly combined, ensuring uniform distribution of herbal extracts and other components.
- Once the mixture reached a uniform consistency, it was poured into molds, forming the desired gummy shape.
- The filled molds were allowed to set at room temperature, allowing the gummies to solidify and take shape.
- After solidification, the gummies were carefully removed from the molds, resulting in the final product being ready for subsequent evaluation.

2.2. Formulation table**Table 1** Formulation table

Sr. no.	Ingredient	F1	F2	F3	Uses
1	Agar Powder	10 g	12 g	8 g	Gelling agent
2	Water	100 ml	100 ml	100 ml	Solvent
3	Sugar	80 g	90 g	70 g	Sweetening agent
4	Ashwagandha Extract	9 g	9 g	9 g	Adaptogenic properties and stress reduction
5	Ginger Extract	7 g	7 g	7 g	Craving reduction
6	Cinnamon Extract	7 g	7 g	7 g	Lung health support
7	Licorice Extract	10 g	10 g	10 g	Respiratory health
8	Tulsi Extract	14 g	14 g	14 g	Stress reduction
9	Citric Acid	4 g	6 g	2 g	Flavour enhancer
10	Vegetable Oil	10 ml	10 ml	10 ml	Coating agent
11	Sodium Benzoate	2 g	2g	2 g	Preservative
12	Orange Flavor	QS	QS	QS	Additional flavor
13	Orange Colour	QS	QS	QS	Colouring agent

3. Result and discussion

Table 2 Results

Sr. no.	Parameters	F1	F2	F3
1	Appearance	Vibrant orange, consistant size and shape.	Vibrant orange, consistant size and shape.	Vibrant orange, consistant size and shape.
2	Texture	Soft and consistant	Soft and consistant	Soft and consistant
3	Odour	Characteristic orange odour	Characteristic orange odour	Characteristic orange odour
4	pH Value	4.5	5	4
5	Taste	Characteristic orange taste	Characteristic orange taste	Characteristic orange taste
6	Mouthfeel	Soft, smooth and chewy	Soft, smooth and chewy	Soft, smooth and chewy
7	Weight variation (Average weight)	2.38 gm	2.41 gm	2.39 gm



Figure 1 Gummies

3.1. Appearance

- The gummies exhibit a vibrant orange color, visually appealing and consistent across all formulations.
- Uniformly shaped and sized, ensuring consistency in product presentation.
- No signs of discoloration or uneven distribution of coloring observed.

3.2. Texture

- Upon handling, the gummies feel soft and consistent in texture.
- During chewing, they maintain a pleasant chewiness without excessive stickiness.
- The texture is smooth, with no noticeable grittiness, providing an enjoyable mouthfeel.

3.3. Odour

A strong and inviting orange aroma emanates from the gummies, consistent with the intended flavor profile.

3.4. pH

- The pH of the gummy formulations was assessed using pH paper.
- The average pH value across all formulations was visually estimated to be around 4.5, 5 and 4 indicating a slightly acidic environment conducive to stability and microbiological safety

3.5. Taste

- Ratings for sweetness, orange flavor intensity, and overall taste were consistent across all formulations.
- The gummies achieved a balanced sweetness level, with a strong and appealing orange flavor profile contributing to a positive overall taste experience.

3.6. Mouthfeel

- A soft, chewy texture with a smooth mouthfeel, indicating a pleasant sensory experience during consumption.
- The gummies did not adhere excessively to the teeth, facilitating ease of consumption.

3.7. Weight Variation

The weight of individual gummies within $\pm 10\%$ of the Average weight which is acceptable.

4. Conclusion

In conclusion, the formulation of medicated gummies for smoking cessation support involved a systematic approach encompassing the extraction of bioactive compounds from selected herbs, preparation of the gel base, incorporation of herbal extracts, and rigorous quality control testing. The use of Soxhlet extraction ensured efficient extraction of key compounds from the herbs, contributing to the therapeutic efficacy of the gummies. Quality control tests confirmed the consistency and quality of the final product, meeting established criteria for appearance, texture, taste, and weight variation. Overall, the formulated gummies exhibit promising attributes conducive to supporting individuals in their efforts to quit smoking.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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