

Review Article



ISBN: 978-81-995400-3-3

" A REVIEW ON THE NATURE NOURISH DELICACIES."

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EMAILID:dhumaljeevan@gmail.com**FUNDING INFORMATION:****ABSTRACT:**

In the present review, we have compiled and analyzed data on Nature's Nourishing Delicacies, a category of traditional and innovative edible products enriched with herbal ingredients. These delicacies are not only appreciated for their distinctive flavors and textures but also for their functional and health-promoting properties. By integrating medicinal herbs, extracts, and natural bioactive compounds into conventional snack preparations, these products bridge the gap between taste and wellness, providing consumers with healthier alternatives to modern processed foods. The focus of this study revolves around popular Indian snack forms such as Herbal Chikki, Herbal Toffee, Herbal Biscuit, Herbal Chips, Herbal Snacks, and Herbal Laddoo. Each of these products represents a fusion of traditional food wisdom and modern nutritional understanding, making them valuable from both culinary and therapeutic perspectives.

Overall, Nature's Nourishing Delicacies represent a growing trend in food innovation where traditional recipes are revitalized with herbal fortification. These products serve a dual role—they are delicious treats that also function as health-promoting supplements. By striking a balance between flavor and function, they provide a promising pathway for promoting wellness through everyday dietary habits.

KEYWORDS:

Herbal Chikki, Herbal Toffee, Herbal Biscuit, Herbal Chips, Snacks, and Herbal Laddu.

INTRODUCTION

“Nature Nourish Delicacies” refers to the idea that the natural world provides us with a wide variety of delicious and nourishing foods. It highlights the concept that food sourced directly from nature can be both wholesome and enjoyable, emphasizing the richness and quality of natural ingredients in the preparation of delectable dishes.¹⁻³

A delicacy is generally defined as a food item considered especially delicious, rare, or luxurious, often distinguished by its unique flavors, textures, or methods of preparation. The term “nourish” implies the act of providing essential nutrients, sustenance, or support necessary for growth, health, and overall well-being. In the context of *Nature Nourish Delicacies*, this suggests foods enriched or sustained by natural elements such as organic ingredients, wild harvests, or traditional cultivation practices that contribute to their nutritional value, taste, and quality.^{4,5}

With the increasing emphasis on health and sustainability, there is a renewed appreciation for these natural delicacies. They not only supply essential nutrients but also encourage eco-friendly dietary practices through responsible harvesting and incorporation into daily meals. However, certain challenges remain. Limited awareness of the potential benefits of various wild and herbal ingredients, along with difficulties in adapting them to modern culinary systems, often hinders their wider acceptance.²

Currently, there is a lack of comprehensive sources that consolidate information about the nutritional significance and culinary applications of Nature Nourish Delicacies. To address this gap, the present study compiles data on selected products to explore their nutritional benefits and functional potential. The food products introduced in this review include Herbal Chikki, Herbal Toffee and Candy, Herbal Biscuit, Herbal Chips and Snacks, and Herbal Laddoo.^{2,5}

Herbal Chikki

Chikki is a popular Indian sweet traditionally made with peanuts and jaggery (unrefined cane sugar), resulting in a brittle, candy-like snack with a rich nutty flavor. In its herbal variation, additional herbs, spices, or medicinal plants are incorporated to enhance both the flavor profile and the health benefits of the product.

Herbal Chikki is typically prepared by heating jaggery or honey until it reaches a binding consistency, then mixing it with a combination of nuts, seeds, and selected herbs. The mixture is spread, cooled, and cut into bite-sized pieces. This process preserves the nutritional richness of the ingredients while creating a convenient and shelf-stable snack.

Commonly used herbal additions include tulsi (holy basil), ginger, turmeric, and ashwagandha, among others, chosen according to regional traditions and the knowledge of Ayurvedic remedies. Each herb contributes specific functional properties, such as immune support, anti-inflammatory effects, or digestive benefits.⁶

Thus, Herbal Chikki serves a dual purpose:

- As a delicious and energy-rich snack often enjoyed during festivals and special occasions.
- As a functional food, incorporating medicinal herbs into the daily diet in a simple and palatable form.



Fig. 2. The Essence of Herbal Chikki

S. No.	Type of Chikki	Introduction	Formulation (Key Ingredients)	Highlights / Purpose	Health Benefits	Evaluation Parameters
1	Peanut–Pomegranate Chikki ^{7,8}	Traditional peanut chikki enriched with pomegranate seeds to add fruity flavor and antioxidants	Peanuts, pomegranate seeds, jaggery	Combines nutty taste with fruity texture	Antioxidant-rich, supports heart health	Sensory evaluation (taste, texture, color), moisture content, shelf-life
2	Multigrain Chikki ^{8,9}	Developed to provide balanced nutrition using cereals and pulses	Jaggery, multiple grains (wheat, rice, millets, pulses)	Improves dietary fiber and protein intake	Enhances satiety, supports digestion, sustained energy	Proximate analysis (protein, fiber, fat), texture analysis, acceptability tests
3	Fortified Chikki ^{10,11}	Peanut chikki fortified with essential micronutrients	Peanuts, jaggery, added vitamins/minerals	Addresses nutritional deficiencies	Boosts immunity, prevents malnutrition	Nutritional assay (vitamin/mineral content), stability studies, consumer acceptability
4	Flaxseed Chikki ¹²	Incorporates flaxseeds for omega-3 fatty acids	Flaxseeds, peanuts, jaggery	Functional food with added health value	Supports cardiovascular health, aids digestion	Fatty acid profiling, texture evaluation, antioxidant activity
5	Rosemary Extract Chikki ¹³	Infused with rosemary extract for medicinal value	Peanuts, jaggery, rosemary extract	Introduces herbal bioactive compounds	Antioxidant, anti-inflammatory effects	Phytochemical analysis, DPPH antioxidant assay, sensory evaluation
6	Nutraceutical-Based Chikki ¹⁴	Functional food combining nuts with bioactive compounds	Peanuts, jaggery, added nutraceuticals (e.g., herbal extracts, phytochemicals)	Traditional sweet with therapeutic benefits	Strengthens immunity, preventive health support	Nutraceutical content assay, in-vitro antioxidant tests, consumer acceptance

Table 1. “Formulation, Introduction, and Evaluation Parameters of Functional Chikki Variants”

nuts and fruit, offering antioxidant properties and heart health support, evaluated for taste, moisture, and shelf-life. Multigrain Chikki, rich in fiber and protein, is assessed for nutrition, texture, and overall acceptability. Fortified Chikki includes added vitamins and minerals to boost immunity, with evaluations focusing on nutrient content and stability. Flaxseed Chikki provides omega-3 fatty acids beneficial for heart and digestive health, analyzed for fatty acid composition, texture, and antioxidant activity. Rosemary Extract Chikki incorporates herbal bioactives for antioxidant and anti-inflammatory effects, with phytochemical and sensory testing. Nutraceutical-based Chikki integrates functional health compounds to support preventive health, evaluated for nutraceutical content and antioxidant activity. Overall, these products reflect a combination of traditional ingredients and modern formulation strategies, ensuring both health benefits and consumer acceptability.¹⁵

HERBAL TOFFEE AND CANDY

Herbal toffee is a type of toffee candy infused with herbs or botanicals, combining the traditional sweetness of toffee with unique flavors and potential health benefits. Toffee itself is a chewy, rich candy made with butter, sugar, and often milk or cream, characterized by its butterscotch-like flavor and smooth, sometimes sticky texture. The herbal component refers to the addition of herbs, spices, or other plant-based ingredients into the toffee recipe, which can be included in various forms such as dried herbs, essential oils, or extracts. By incorporating these herbal ingredients,

herbal toffee blends the classic toffee base with flavors and subtle health benefits from herbs. The choice of herbs determines the overall taste profile, with common options including mint, lavender, rosemary, and ginger. Some herbal toffees may also contain nuts, seeds, or dried fruits, adding texture and enhancing flavor. Depending on the herbs used, the toffee might offer additional benefits, such as calming effects from chamomile or digestive support from ginger; however, these effects are typically mild due to the small quantity of herbs in the candy. Herbal candy, in general, goes beyond traditional sweet treats by incorporating botanical ingredients, aiming to provide a delightful taste experience along with potential health advantages. The combination of unique flavors and subtle benefits has contributed to the growing popularity of herbal candies in the confectionery market.^{16,17}

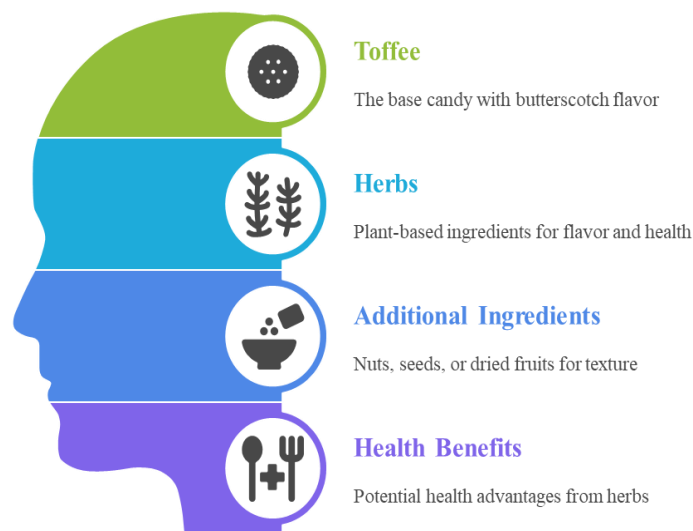


Fig. 3. Exploring Herbal Toffee and Candy

S.No	Product Name	Introduction	Formulation	Evaluation Parameter	Health Benefits
1	Milk Toffee with O. bracteatum ¹⁸	O. bracteatum (Gaozaban), rich in fat, carbs, and alkaloids; memory-boosting, anti-	120 mg extract per 5 g toffee; improved sensory and nutritional qualities; two samples (with and without extract).	Hedonic 9-point method for sensory evaluation; moisture, pH, ash,	Memory enhancement; anti-malarial and anti-diarrheal effects.

		malarial, anti-diarrheal.		color, sucrose, reducing sugar, fat, peroxide, calorific value; stored at 5±2°C for 6 months.	
2	Morinda citrifolia Toffee ¹⁹	5% Mungkudu juice or powder from roots, leaves, bark; Rubiaceae family; superior aroma, taste, texture with juice.	Sugar 25.1%, glucose syrup 20.1%, condensed milk 25.1%, HPKO 14.5%, cream 9.7%, salt 0.5%, lecithin 0.3%, water 4.8%; 5% juice/powder; cooked to 124°C Brix 92°.	Sensory evaluation for smell, taste, texture, overall quality; microbiological quality; shelf life 6 months.	Treats toothache, gingivitis, inflammation, fever, arthritis, respiratory illness, infections, diarrhea, ulcers.
3	Guava Toffee ²⁰	From Psidium guajava L.; Myrtaceae family; whitening and sulphitation for preservation.	Sugar 70%, chocolate 10%, pineapple 0.5%; pulp extraction, blanching, preparation; DPPH for antioxidant assay.	Flavonoid, polyphenol, antioxidant levels; DPPH radical scavenging activity.	Antioxidant properties, enhances nutritional profile.
4	Anti-Aging Toffee ²¹	Enriched with Beta Vulgaris, Punica granatum, Saccharum officinarum; improved nutritional quality; suitable for elderly.	Heat stick sugar, add beetroot, pomegranate seed powder, lemon/vanilla/strawberry extract, CMC; mold and heat for 3 hours.	Moisture, ash, protein, fiber, reducing sugar, water activity, deformation, energy content.	Anti-aging, nutritional support for seniors.
5	Fruit Toffee with Bael ²²⁻²⁴	From Aegle marmelos; sticky, suitable for jam or marmalade; therapeutic uses.	400g sugar + 500g bael pulp; add lemon juice, butter, optional cardamom/salt; cook to soft ball stage; cool, cut, wrap. ²⁴	Texture analysis (2mm/s), moisture, ash (1-5%).	Anti-inflammatory, antioxidant, antiseptic, anti-diabetic, hepatoprotective, immunomodulatory.
6	Dheu Toffee ^{24,25}	From jackfruit (Artocarpus lakoocha); high in minerals, vitamins, protein, fat,	Dheu + papaya pulp, sugar, hydrogenated fat, glucose powder, skim milk powder; wrap in butter paper and store.	Moisture (1.76%), acidity (0.60-0.81%), ascorbic acid	Reduces cholesterol, prevents colon cancer, aids weight loss, prolongs life,

		carbs; 50:50 ratio with papaya pulp.		content (31.2 → 24 mg/100g).	anti-diabetic.
7	Herbal Candy with Ginger Oil ²⁶⁻²⁸	Ginger oil from Zingiber officinale; candy with sugar, water, coloring, flavor, sometimes fruits/nuts.	Sugar, glucose syrup, water, ginger oil; heat to 145°C, mold, cool.	Moisture 1.85%, reducing sugar 60.7%, total sugar 92.85%, titratable acidity 0.81%; sensory scores for color, flavor, texture, mouthfeel, overall acceptability.	Promotes digestion, reduces pain, edema, stiffness; treats respiratory infections.
8	Herbal Candy with Giloy Satva ²⁹	From Tinospora cordifolia stem; provides convenient intake of Giloy Satva; ensures uniformity, flavor, aesthetic appeal.	Giloy Satva extract + sugar + glucose syrup + other ingredients; cooked, stirred, molded, cooled.	pH 5.6–5.9; total soluble solids 67–70°; phytochemical screening shows 0.31% alkaloids.	Controls blood sugar, anti-inflammatory, antioxidant, supports wound healing and renal function.
9	Herbal Papaya Candy ³⁰⁻³²	From Carica papaya L.; contains ~300 volatile compounds; pretreatment and ripeness affect water loss and solids.	Raw papaya cubes, blanch, soak in salt, cook in sugar syrup 20–25 min, soak 8–9 h; add herbal flavors, citric acid, coloring; pack in containers.	Sensory evaluation (T6 superior); total soluble solids, titratable acidity, pH, color, flavor, texture, overall acceptability; benefit-cost ratio.	High nutritional content; low calories; rich in vitamin A, C, carotenoids.
10	Mango Candy with Mangifera indica ^{33,34}	Mango fruit; over 1000 varieties; tropical/subtropical; rich in vitamin A; used in pickles, pulps, jams, chutneys.	Standardized recipes with sugar, mint syrup, tulsi syrup, lemongrass syrup, cinnamon syrup; various treatment combinations.	Shelf life influenced by moisture, sugar content; monitored TSS, acidity, ascorbic	Nutritional benefits, high vitamin A, enhances taste and flavor retention.

				acid, reducing/non -reducing sugar, total sugar; sensory scores decrease over time.	
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Table 2. “Formulation, Introduction, and Evaluation Parameters of Functional Toffee and Candy Variants”

The reviewed herbal toffees and candies incorporate various plant-based ingredients to enhance nutritional, therapeutic, and sensory properties. Milk toffee with *O. bracteatum* boosts memory and offers anti-malarial and anti-diarrheal effects, while *Morinda citrifolia* toffee improves aroma, taste, and treats a wide range of ailments. Guava toffee exhibits antioxidant properties, and anti-aging toffee with beetroot, pomegranate, and cane sugar provides nutritional support for the elderly. Bael and jackfruit (dheu) toffees offer anti-inflammatory, antioxidant, and metabolic health benefits. Herbal candies with ginger oil aid digestion and respiratory health, whereas Giloy Satva candies help control blood sugar and support renal function. Papaya and mango candies are rich in vitamins and minerals, with added herbal flavors enhancing taste, shelf life, and overall acceptability. Collectively, these products combine traditional confectionery with functional ingredients to provide both indulgence and health benefits.³⁵

HERBAL BISCUITS

Herbal biscuits are a type of biscuit or cookie that incorporates herbs or herbal extracts into the dough. These biscuits often offer a unique flavor profile and may provide potential health benefits associated with the herbs used. Herbal biscuits can be made with a variety of herbs, such as rosemary, lavender, thyme, basil, or mint, depending on the desired flavor and intended health benefits. These biscuits may be crafted using traditional baking methods, blending the herbal ingredients

enjoyed as a standalone snack, paired with tea or coffee, or incorporated into desserts or savory dishes for added flavor complexity. In addition to their taste, herbal biscuits are sometimes valued for their potential health benefits. Certain herbs used in these biscuits may contain antioxidants, vitamins, and minerals that contribute to overall well-being. However, it's essential to note that the health benefits can vary depending on the specific herbs used and the quantity consumed. Overall, herbal biscuits offer a flavorful and potentially healthful twist on traditional biscuits, providing a unique culinary experience that combines taste and wellness. Herbal biscuits are a twist on classic biscuits, adding medicinal herbs or extracts for potential health benefits alongside flavor. While not guaranteed to be a cure-all, they offer a tasty way to enjoy a snack with a potential health boost. Depending on the herbs used, the biscuits might have some added nutrients or health benefits. For example, rosemary has antioxidant properties, while parsley is a good source of vitamins. However, their nutritional value varies based on factors like ingredients and processing methods. Herbal laddus are traditional Indian sweets incorporating medicinal herbs into their recipe, offering both sweetness and potential health benefits.³⁶

S. No.	Type of Biscuit	Introduction	Formulation (Key Ingredients)	Highlights / Purpose	Health Benefits	Evaluation Parameters
1	Ashwagandha & Ragi Herbal Biscuit ^{37,38}	Substitution of ghee for butter improved sensory quality and nutrition.	Wheat flour (30%), ragi (23–28%), sugar (20%), ashwagandha (2–7%), ghee/white butter (30%).	Fusion of herb and millet for improved nutrition and taste.	Stress relief, stamina, rich in calcium & fiber, better digestion.	Thickness, diameter, volume (digital vernier caliper).
2	Herbal Orange Peel Biscuit ³⁸	Orange peel adds dietary fiber and bioactive compounds.	Maida, orange peel powder (10–20%), sugar, fat, SMP, baking powder.	Utilization of fruit waste for functional snack.	Prevents constipation, colon cancer risk reduction, regulates cholesterol & blood sugar.	Moisture, ash, acidity.
3	Fiber-Rich Sugar-Free Biscuit ^{39,40}	Wheat & ragi-based biscuits with sugar replaced by stevia/sorbitol.	Wheat flour, ragi flour, stevia, sorbitol, lecithin, skimmed milk powder, butter, baking agents.	Designed for diabetics & health-conscious consumers.	Low calorie, fiber-rich, helps regulate blood sugar & weight management.	Moisture, protein, fat, dietary fiber, sensory scores (color, taste, texture).
4	Protein-Rich Herbal Biscuit ^{41,42}	Combination of cereals & pulses with spirulina/cowpea flour.	Maida, germinated cowpea flour (5–20%), spirulina powder, butter, sugar, baking powder.	Protein enrichment with plant-based functional herbs.	Improves muscle health, energy, immunity, shelf-stable protein snack.	Moisture (BIS 2002), peroxide value (stability).
5	Sugar-Free Fenugreek Biscuit ⁴³	Developed for diabetic-friendly snacking.	Wheat flour, butter, stevia,	Fortified with fenugreek for	Regulates insulin, prevents obesity,	Hardness (texture analyzer), DPPH

			fenugreek seed powder, baking agents.	antidiabetic benefits.	lowers cholesterol, antioxidant properties.	inhibition, factorability .
6	Cereal–Legume Based Biscuit ⁴⁴	Combines cereals & legumes to balance amino acids.	Wheat (30%), satu flour (45%), soya flour (25%), ashwagand ha (3–5%).	High-protein, balanced amino acid profile.	Rich in protein & fiber, immune support, functional herb benefits.	Nutritional analysis, ANOVA, shelf stability (2 months).
7	Tea Biscuit (Betel & Green/Black Tea) ⁴⁵	Infused with betel oil and tea extracts for medicinal value.	Wheat flour, butter, eggs, sugar, baking powder, betel leaf oil (0.025–0.1%), tea powder.	Innovative herbal biscuit for flavor & therapeutic value.	Provides calcium, improves digestion, antioxidant & stimulant effects.	Spread ratio, hardness, colorimetry, proximate analysis.
8	Gluten-Free Biscuit ^{46,47}	Designed for celiac patients & gluten intolerance.	Rice flour, maize flour, soybean flour, palm oil, honey, sugar, eggs, baking agents.	Alternative to wheat-based biscuits.	Safe for celiac patients, improves digestion, balanced nutrients.	Width, thickness, weight, spread ratio, volume.
9	Tulsi Herbal Biscuit ^{48,49}	Fortified with Tulsi leaves for medicinal benefits.	Wheat flour, Tulsi leaves, sugar, skim milk powder, egg white, baking powder, vegetable oil.	Combines Ayurveda herb with bakery product.	Supports heart, liver, lungs; regulates BP & blood sugar; immunity booster.	Organoleptic evaluation (appearance, color, taste, texture).
10	Fortified Herbal Biscuit (Multi-Herb) ⁵⁰	Multi-plant fortified biscuit targeting diabetes & lifestyle diseases.	Wheat flour, aloe vera, bitter gourd, moringa, tulsi, menthe, thankuni	Multi-herbal functional snack for diabetics.	Anti-diabetic, antioxidant, supports metabolism & immunity.	Moisture, protein, fat, carbohydrate, ash content.

			leaves, butter, eggs.			
11	Dragon Fruit Biscuit ⁵¹	Dragon fruit added for fiber & antioxidants.	Wheat flour, dragon fruit powder (30–60%), butter, lecithin, glucose, baking agents.	Novel fruit-based nutraceutical biscuit.	Rich in fiber, vitamin C, antioxidants, supports digestion.	Water/oil absorption, sensory evaluation (appearance, taste, texture).
12	Jamun Seed Powder Biscuit ⁵²	Low-fat, high-fiber option beneficial for diabetics.	Wheat flour, jamun seed powder, refined flour, butter, sugar, baking powder.	Functional bakery product using medicinal fruit seed.	Rich in vitamin C, B-complex, potassium, iron; regulates blood sugar.	Nutritional analysis, sensory attributes.

Table 3. “Formulation, Introduction, and Evaluation Parameters of Functional biscuits Variants”



Fig. 4. Exploring the Multifaceted World of Herbal Biscuits

This table presents a variety of functional or herbal biscuits, each designed with specific health benefits and unique formulations. For instance, the Ashwagandha & Ragi Herbal Biscuit uses a blend of wheat flour, ragi, and ashwagandha to enhance nutrition and

taste while offering stress relief, stamina, and improved digestion. Similarly, the Herbal Orange Peel Biscuit utilizes orange peel to add fiber and bioactive compounds, helping with digestion and potentially reducing the risk of colon cancer. Other biscuits, such as the Fiber-Rich Sugar-Free Biscuit, cater to health-conscious consumers or diabetics by replacing sugar with stevia or sorbitol and incorporating fiber-rich ingredients like wheat and ragi, aiding in blood sugar regulation and weight management. The Protein-Rich Herbal Biscuit combines cereals and pulses with spirulina to provide a plant-based protein source, boosting muscle health and immunity.⁵³

Each biscuit has specific evaluation parameters used to test its quality, such as moisture content, texture, sensory attributes (taste, appearance, texture), and nutritional analysis (protein, fat, fiber). For example, the Sugar-Free Fenugreek Biscuit is evaluated for its hardness, antioxidant properties (via DPPH

inhibition), and its ability to regulate insulin and cholesterol. Other biscuits, like the Gluten-Free Biscuit, are aimed at consumers with specific dietary needs, providing a safe alternative for those with gluten intolerance, and are assessed for consistency in width, thickness, and volume. Finally, biscuits like the Dragon Fruit Biscuit introduce novel ingredients such as dragon fruit powder, providing fiber, antioxidants, and supporting digestion, and are evaluated for sensory qualities and oil absorption.

These biscuits represent the fusion of herbal, functional ingredients with traditional bakery products, aiming not only to provide enjoyment but also to support health in various ways, from boosting immunity to managing chronic conditions like diabetes. Each biscuit's formulation and testing ensure its effectiveness, taste, and market viability.⁵⁴

HERBAL CHIPS AND SNACKS

Herbal chips and snacks are a category of snack foods that incorporate herbs or herbal extracts into their recipes, offering a flavorful and possibly healthful alternative to traditional snacks. These snacks can come in various forms, such as chips, crisps, crackers, or even popcorn, and they often boast unique flavor profiles derived from the herbs used. In herbal chips and snacks, herbs like rosemary, thyme, basil, oregano, or dill are commonly employed to infuse the snacks with distinctive tastes and aromas. These herbs can be blended into the snack base, such as potato or corn chips, or used as seasoning to add depth of flavor. Beyond their taste appeal, herbal

chips and snacks may also offer potential health benefits associated with the herbs incorporated. Many herbs contain antioxidants, vitamins, and minerals that can contribute to overall well-being. For instance, rosemary is believed to have antioxidant properties, while thyme is often associated with antibacterial and antifungal effects. These snacks can be enjoyed as a standalone treat, as part of a party spread, or paired with dips and spreads for added flavor. They offer a satisfying snacking experience while potentially providing a dose of herbal goodness. Overall, herbal chips and snacks provide a delicious and possibly healthful option for those seeking unique and flavorful snack choices.^{55,56}



Fig. 5. The Holistic Benefits of Herbal Snacks

S. No.	Type of Chips / Snacks	Introduction	Formulation (Key Ingredients)	Highlights / Purpose	Health Benefits	Evaluation Parameters
1.	Bamboo Shoot Chips ⁵⁷	Bamboo shoots rich in fiber, nutrients; healthy alternative to junk food;	Young bamboo shoots (7–15 days), cornstarch, palm oil; processes:	Healthy veggie chips	Weight loss, cholesterol control, cancer-fighting	Sensory (flavor, texture, taste, acceptability); microbiological (coliforms, yeast, molds,

		medicinal uses (weight loss, cholesterol, cancer). (Maroma, 2015)	washing, sanitization, boiling, blanching, dredging, frying			APC, aureus) S.
2.	Organic Vegetable Chips ^{58,59}	Study on Romanian consumer preferences for organic chips vs. potato chips; addresses health concerns and organic demand. (Barbu & Bădulescu, 2023)	Carrots, beets, sweet potatoes; drying/freezing; blanching, slicing, packaging	Organic & sustainable snack	Nutrient-rich, lower fat, reduced microbial growth, high antioxidants	Socio-demographics, Pearson chi-square, logistic regression, sensory (color, texture, nutrients)
3.	Maize Chips with Moringa ⁶⁰	Developed to improve nutrition for children; funded by Nestlé Africa. (Govender et al., 2020)	Maize flour, moringa (1–2 g per 22 g); hybrid maize chip + flatbread process	Fortified snack for child nutrition	Vitamin A, calcium, protein, immune support	Sensory (taste, texture, hedonic scale), nutrient analysis (fat, carb, protein, minerals), microbiological safety
4.	Potato, Green Pea & Lupine Flour Chips ⁶¹	Designed to combat malnutrition; potatoes provide carbs, proteins, vitamins. (Mousa & Hassan)	Potato, lupine, green pea flour blends	Nutritious chips for malnourished children	Rich in protein, minerals (Fe, Ca, K, Zn), fiber	Sensory (color, taste, odor, texture, acceptability); proximate analysis; ANOVA & t-test
5.	Mushroom Chips with Herbs & Spices ^{62–64}	Developed at IIUM; aimed at students; tested 6 formulations; garlic/turner ic absence least liked,	Rice straw mushroom + spices (ginger, garlic, basil, turmeric, onion, cinnamon)	Nutritious, herbal alternative to junk food	Antioxidant, antimicrobial, digestive, immune-boosting	Sensory (appearance, crispiness, taste, aroma, acceptance, hedonic scale)

		ginger absence most liked. (Muzaffar & Khattak, 2020)				
6.	Basil Leaf Chips ^{65,66}	Highlights basil's nutrition (flavonoids, arginine, boron, essential oils). (Wirawan & Sudiarta, 2018)	Basil leaves, flour, spices, boiled water → dough → pan-cooked	Value- added use of basil	Antioxidant, antimicrobia l, immune- boosting	Organoleptic test (color, taste, aroma, texture); endurance test (shelf life ~5 days)
7	Beetroot & Multi- Seed Chips ⁶⁷	Beetroot functional food for women's health; enriched with flaxseed, pumpkin seed. (Thakur & Singh, 2022)	Beetroot powder (dried 60– 65°C), wheat flour, flaxseed, pumpkin seed	Functional, nutrient- dense snack	High in iron, nitrates, antioxidants ; supports women's health	Nutrient content, shelf life (low moisture, bioactive retention)
8	Bitter Gourd Chips ^{68,69}	Bitter gourd valued for anti-diabetic & medicinal properties; methods to reduce bitterness & fat. (Solanke & Khandekar, 2020)	Bitter gourd (Phule Priyanka variety), rice flour, corn flour, salt, spices, oil	Turning bitter gourd into an acceptable snack	Anti- diabetic, antioxidant, nutrient-rich	Sensory (appearance, color, taste, odor, acceptability); frying time/temp; storage/stabili ty

Table 4. “Formulation, Introduction, and Evaluation Parameters of Functional Snacks Variants”

The table on herbal chips and snacks provides a comparative overview of different innovative chip varieties developed with herbal or functional ingredients. It covers multiple types, such as herbal-infused commercial snacks, bamboo shoot chips, organic vegetable

chips with herbs and spices, basil leaf chips, beetroot and multi-seed chips, and bitter gourd chips.

Each product highlights unique raw materials and formulations, ranging from herbs (garlic, basil, lemongrass, ginger) to nutrient-rich vegetables (bamboo shoots,

beetroot, bitter gourd) and functional flours (lupine, green pea, maize). These snacks are designed not only for taste and consumer appeal but also for added nutritional and medicinal benefits, such as antioxidants, weight management, improved digestion, cholesterol control, and diabetes management.

Evaluation parameters across studies include **sensory attributes** (flavor, texture, aroma, crispiness, overall acceptability), **nutritional analysis** (vitamins, protein, mineral content), and **safety testing** (microbial load). Together, these innovations demonstrate how herbs and functional ingredients can transform conventional chips into healthier, value-added snacks that meet modern consumer preferences for taste, health, and quality.⁷⁰

HERBAL LADDU

Herbal laddus, also known as "ladoo," are a cherished Indian confection made by melding an array of herbs, spices, nuts, seeds, and natural sweeteners. These delectable treats not only tantalize the taste buds but also boast a wealth of health benefits courtesy of their medicinal ingredients. Ingredients like ashwagandha, tulsi, and shatavari, along with spices such as turmeric, ginger, and cinnamon, lend their therapeutic properties. Almonds, cashews, sesame seeds, and sweeteners like jaggery or honey complete the ensemble. Crafting these laddus involves grinding the ingredients, blending them with sweeteners, shaping them into small

balls, and allowing them to solidify. Whether enjoyed as a nutritious snack or dessert, these laddus offer both sweetness and the wholesome essence of herbs and spices. Renowned for their potential to alleviate stress, boost immunity, enhance digestion, and promote overall well-being, they are a beloved indulgence with a healthy twist.⁷¹⁻⁷³



S. No.	Type of Laddu	Introduction / Key Ingredients	Formulation (Key Ingredients & Ratios)	Evaluation Parameters	Highlights / Purpose	Health Benefits
1	Multigrain Flour & Herbal Powder Laddu ^{72,74}	Prepared using multigrain flour, Bengal gram flour, and herbal powder (curry & basil leaves). Multigrain	T2 formulation: 30 g multigrain flour, 40 g basil leaf powder, 40 g curry leaf powder, 70 g Bengal gram	Overall acceptability, taste, flavour, texture, colour.	Multigrain (cereals, millets, pulses) improves nutritional quality; 30% multigrain showed best acceptability.	Reduces CVD risk, cholesterol, and obesity; provides high fibre and protein.

		flour rich in minerals, fiber, and proteins.	flour.			
2	Jowar Laddu with Banana Peel & Ashwagandha Powder ^{75,76}	Made from jowar flour, banana peel powder, ashwagandha, jaggery, melon seeds. Jowar rich in fiber, vitamins, phenolics.	50 g jowar flour, 35 g jaggery, variable banana peel + ashwagandha, 1 tbsp each of nuts, ghee, melon seeds, cardamom.	Aroma, colour, taste, mouthfeel, overall acceptability.	Utilizes banana peel (rich in antioxidants & minerals) with adaptogenic herb Ashwagandha.	Improves brain & nerve function, immunity, antioxidant & adaptogenic activity.
3	Nutra Laddu with Flaxseed & Dry Fruits ^{73,77}	Incorporates flaxseed (<i>Linum usitatissimum</i>) rich in omega-3, PUFA, fibre, and protein.	Flaxseed at 5–50%; 20–30% found most acceptable. Fat 7.08%, protein 7.85%, carbs 58.4%.	Sensory: colour, taste, texture, flavour, appearance (9-point & 5-point hedonic scales).	Functional food rich in omega-3, protein, and fibre; 20–30% flaxseed ideal.	Reduces blood lipid levels; supports heart health; antioxidant and fibre-rich.
4	Herbal Laddu with Ashwagandha, Banana Flower & Cereal-Legume Mix ^{44,78}	Combines Ashwagandha root, banana flower, cereals, and legumes. Improves protein and micronutrient value.	Trials with 3%, 5%, 7% Ashwagandha. 5% <i>formulation most acceptable.</i>	Appearance, colour, taste, mouthfeel, aftertaste, overall acceptability.	Enhances shelf-life, nutrition, and palatability of traditional laddus.	Boosts immunity, reduces stress, balances tridosha; banana flower aids lactation, anemia, and diabetes.
5	Laddu with Lepidium sativum (Garden Cress) ^{79,80}	Uses <i>L. sativum</i> rich in alkaloids, glycosides, minerals, flavonoids, and fatty acids.	12 variations; 15% <i>L. sativum</i> + 44 g jaggery most accepted; rich in Fe, Ca, protein, β -carotene, ascorbic acid.	Sensory: colour, texture, taste, mouthfeel, acceptability (9-point scale); proximate analysis (protein, fibre, polyphenols).	Functional meal enriched with polyphenols and micronutrients.	Galactagogue, emmenagogue; antioxidant, hepatoprotective, antimicrobial, bronchodilator.
6	Satavari Root & Liquorice (Aonla) Laddu ^{81,82}	Contains Satavari (<i>Asparagus racemosus</i>), Liquorice (<i>Glycyrrhiza glabra</i>), and	Optimum: 4% Satavari + 2% Liquorice powder + Aonla; enhanced with cardamom,	Sensory (colour, flavour, texture), nutritional & microbiological analysis.	Combines rejuvenating herbs with vitamin C-rich Aonla for health-promoting	Treats respiratory, digestive, and reproductive disorders; antioxidant, anti-inflammatory,

		Aonla (<i>Emblica officinalis</i>).	sugar.		dessert.	hepatoprotective.
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Table 5. “Formulation, Introduction, and Evaluation Parameters of Functional Snacks Variants”

The Multigrain Flour & Herbal Powder Laddu combines multigrain flour, Bengal gram, and curry–basil leaf powders, offering high fibre and protein while reducing cholesterol and obesity risk. The Jowar Laddu with Banana Peel & Ashwagandha uses jowar, banana peel, and Ashwagandha for antioxidant and adaptogenic benefits that boost brain and immune health. The Nutra Laddu with Flaxseed & Dry Fruits (20–30% flaxseed) is rich in omega-3, protein, and fibre, promoting heart health and lowering lipids.

The Herbal Laddu with Ashwagandha, Banana Flower & Cereal-Legume Mix enhances nutrition and shelf-life, with 5% Ashwagandha giving best sensory results and supporting immunity and stress relief. The Garden Cress (*Lepidium sativum*) Laddu provides iron, calcium, and antioxidants, acting as a galactagogue and hepatoprotective food. Lastly, the Satavari & Liquorice (Aonla) Laddu blends rejuvenating herbs and vitamin C–rich Aonla, improving respiratory, digestive, and reproductive health.

Overall, these laddus integrate traditional herbs with modern nutrition to create health-promoting, functional sweets.⁸³

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