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Analytical Evaluation Of Fortified *Godhuma Ladduka* Enriched With *Medhya Rasayana Dravyas.*

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ABSTRACT

Background: *Ayurveda* considers *Ahara* (diet) one of the three fundamental supporting pillars of life, collectively described as *Trayopastambha*, along with *Nidra* and *Brahmacharya*. Proper dietary intake is regarded as essential for maintaining strength, nourishment, and overall health. Traditional dietary preparations incorporating medicinal plants may therefore be explored as functional food preparations within an *Ayurvedic* framework.

Aim: To prepare and analytically evaluate a fortified *Godhuma Ladduka* enriched with the *Medhya Rasayana Dravya's Brahmi (Bacopa monnieri) and Mandukaparni (Centella asiatica).*

Materials and Methods: A fortified *Godhuma Ladduka* was prepared using wheat flour (*Godhuma*), sugar (*Sharkara*), ghee (*Ghrita*), *Brahmi churna* and *Mandukaparni churna* according to a standardized preparation procedure. The finished product was evaluated for organoleptic characteristics, including colour, taste, aroma, and texture. Selected nutritional and mineral parameters were assessed by laboratory analysis.

Results: The prepared *Ladduka* exhibited acceptable organoleptic characteristics, with a light-brown colour, sweet taste with a mild astringent aftertaste, pleasant aroma, and soft-granular texture. Analytical evaluation showed moisture of 16.94 g/100 g, total carbohydrate of 76.58 g/100 g, total sugar of 45.71 g/100 g, protein of 3.97 g/100 g, fat of 1.05 g/100 g, total mineral content of 1.46 g/100 g, sodium of 30.10 mg/100 g, potassium of 282.52 mg/100 g, and calcium of 76.86 mg/100 g. The reported energy value was 331.65 kcal/100 g.

Conclusion: The fortified *Godhuma Ladduka* demonstrated acceptable organoleptic characteristics and provided substantial carbohydrate content along with measurable protein, fat, and selected minerals. The inclusion of *Brahmi* and *Mandukaparni* has a classical *Ayurvedic* rationale based on their description among *Medhya Rasayana Dravya's*. [2] However, the present study does not establish clinical cognitive efficacy, antioxidant activity, therapeutic efficacy, or long-term stability of the finished formulation. Further microbiological, stability, pharmacological, and clinical studies are required.

Keywords: Fortified *Godhuma Ladduka; Medhya Rasayana; Ahara Kalpana; Brahmi; Bacopa monnieri; Mandukaparni; Centella asiatica*; nutritional analysis.

INTRODUCTION: *Ayurveda* places considerable emphasis on *Ahara* (diet) as an important determinant of health. *Ahara*, *Nidra*, and *Brahmacharya* are described as the three supporting pillars of life (*Trayopastambha*), which contribute to the maintenance of strength, nourishment, and healthy functioning of the body the quality, quantity, suitability, and method of preparation of food are therefore important considerations in *Ayurvedic* preventive health care. [1]

Godhuma (wheat) is an important cereal described in *Ayurvedic* literature. Classical descriptions attribute *Madhura Rasa, Guru* and *Snigdha Guna, Sheeta Virya,* and *Madhura Vipaka* to *Godhuma,* along with nourishing and strengthening properties. [3] *Godhuma*-based traditional preparations are also included in the *Ayurveda Aahara* Compendium published by the Food Safety and Standards Authority of India (FSSAI) in the present formulation, *Godhuma* serves as the principal cereal base, while *Ghrita* and *Sharkara* contribute to the sensory characteristics and energy density of the preparation. [4] The formulation is further enriched with two traditionally recognized *Medhya Rasayana Dravya's*, namely *Brahmi* and *Mandukaparni*. *Charaka Samhita* describes *Medhya Rasayana* preparations in *Rasayana Chikitsa* and specifically mentions *Mandukaparni* and *Brahmi* among substances associated with enhancement of *Medha* (mental faculties). [2] Modern research has also investigated these plants for cognitive and neuroprotective effects.

A systematic review of randomized controlled trials reported that standardized *Bacopa monnieri* preparations may improve certain aspects of memory, particularly delayed free recall, although evidence for other cognitive domains remains limited.[5] A meta-analysis of randomized controlled trials also reported potential cognitive benefits associated with *Bacopa monnieri.*[6] A systematic review and meta-analysis reported insufficient evidence for significant improvement across major cognitive domains compared with placebo, although some effects on mood-related outcomes were observed.[7] Therefore, the modern literature provides a scientific rationale for further investigation but does not establish the present *Ladduka* as a clinically proven cognitive-enhancing formulation. The present study was undertaken to prepare a fortified *Godhuma Ladduka* enriched with *Brahmi* and *Mandukaparni* and to evaluate its organoleptic and selected nutritional characteristics.

AIM AND OBJECTIVES

Aim: To prepare and analytically evaluate fortified *Godhuma Ladduka* enriched with *Medhya Rasayana Dravya's.*

Objectives

1. To prepare fortified *Godhuma Ladduka* incorporating *Brahmi (Bacopa monnieri)* and *Mandukaparni (Centella asiatica).*
2. To assess the organoleptic characteristics of the prepared formulation.
3. To evaluate selected nutritional and mineral parameters of the formulation using laboratory-based analytical methods.
4. To interpret the formulation from both Ayurvedic and contemporary nutritional perspectives.

MATERIALS AND METHODS

- **Study Design**: An analytical and organoleptic evaluation study.
- **Study Site**: Pathya Laboratory, Department of Swasthavritta and Yoga, Alva's Ayurveda Medical College & Hospital, Vidyagiri, Karnataka, India.

- **Raw Drug Procurement:** The raw materials required for preparation, including *Godhuma* (wheat flour), *Sharkara* (sugar), *Ghrita* (ghee), *Brahmi churna*, and *Mandukaparni churna*, were procured from Manas Ayurved, Nagpur, Maharashtra, India.
- **Raw Drug Authentication:** The herbal ingredients were authenticated by experts from the Department of *Dravya Guna,* Alva's Ayurveda Medical College & Hospital, Karnataka.

INGREDIENTS USED

SL	Ingredients	Botanical Name	Quantity
1	Wheat flour (*Godhuma)*	*Triticum aestivum*	250 g
2	Sugar (*Sharkara*)	—	200 g
3	Ghee (*Ghrita*)	—	Quantity sufficient
4	*Brahmi churna*	*Bacopa monnieri*	10 g
5	*Mandukaparni churna*	*Centella asiatica*	10 g

METHOD OF PREPARATION

A. Preparation of Raw Materials

- *Godhuma* flour was sieved and roasted over a mild flame until a light-brown colour and characteristic pleasant aroma developed.
- *Brahmi* and *Mandukaparni* were cleaned, dried, and powdered separately.
- Sugar syrup was prepared by dissolving the required quantity of sugar in a small quantity of water and heating until the desired binding consistency was achieved.

B. Preparation of *Godhuma Ladduka*

- The measured quantity of *Godhuma* flour was dry-roasted over a mild flame until a light-brown colour and characteristic aroma developed. *Ghrita* was added to the roasted flour and mixed thoroughly to obtain a uniform mixture. *Brahmi* and *Mandukaparni churna* were added and mixed uniformly.
- The prepared sugar syrup was gradually incorporated into the flour mixture with continuous stirring. The mixture was allowed to cool to a suitable handling temperature. *Ladduka* of approximately uniform size were prepared manually.
- The prepared *Ladduka* were transferred into clean, dry, airtight containers and stored under dry conditions until analytical evaluation.

STORAGE CONDITIONS: The prepared *Ladduka* were stored in airtight containers in a cool and dry environment until evaluation.

ORGANOLEPTIC EVALUATION:

Parameter	Observation
Color	Light brown
Taste	Sweet with mild *Kashaya* after taste
Aroma	Pleasant and characteristic
Texture	Soft and granular

The formulation demonstrated acceptable sensory characteristics. The incorporation of herbal powders at the selected quantities did not produce an objectionable taste or aroma.

ANALYTICAL EVALUATION

SL. No.	PARAMETER	UNIT	RESULTS	METHOD
1	Energy	kcal	331.65	ALSOPF008
2	Total Carbohydrates	g/100g	76.58	ALSOPF007
3	Total Sugar	g/100g	45.71	FSSAI- Manual of Methods of Analysis of Foods- Cereal and Cereal Products
4	Total Protein	g/100g	3.97	
5	Total Fat	g/100g	1.05	
6	Moisture	g/100g	16.94	
7	Total Mineral content	g/100g	1.46	
8	Sodium	mg/100g	30.10	FSSAI- Manual of Methods of Analysis of Foods- Metals
9	Potassium	mg/100g	282.52	
10	Calcium	mg/100g	76.86	

OBSERVATION AND RESULTS: The fortified *Godhuma Ladduka* was successfully prepared using *Godhuma* (wheat flour), *Sharkara* (sugar), *Ghrita* (ghee), *Brahmi Churna*, and *Mandukaparni Churna*. The incorporation of the herbal ingredients did not adversely affect the overall sensory characteristics of the finished formulation. The organoleptic evaluation demonstrated a light-brown colour, sweet taste with a mild astringent aftertaste, pleasant characteristic aroma, and soft-granular texture. The mild astringent aftertaste may be attributed to the incorporation of *Brahmi and Mandukaparni churna*. The formulation remained physically intact during the period of observation under the stated storage conditions. The analytical evaluation demonstrated a moisture content of 16.94 g/100 g, total carbohydrate content of 76.58 g/100 g, total sugar of 45.71 g/100 g, protein of 3.97 g/100 g, total fat of 1.05 g/100 g, and total mineral content of 1.46 g/100 g. The formulation contained 30.10 mg/100 g sodium, 282.52 mg/100 g potassium, and 76.86 mg/100 g calcium. The reported energy value was 331.65 kcal/100 g. The high carbohydrate

content is expected because *Godhuma* and *Sharkara* constitute the major ingredients of the formulation The preparation also contained measurable quantities of calcium, potassium, and sodium. However phytochemical markers were not analysed in the present study.

DISCUSSION: The present study was undertaken to develop and analytically evaluate a fortified *Godhuma Ladduka* containing the *Medhya Rasayana Dravya's Brahmi* and *Mandukaparni*. From the *Ayurvedic* perspective, *Ahara* is an important supporting pillar of life and is closely associated with nourishment and maintenance of the body. [1] *Godhuma* was selected as the principal ingredient because of its classical nourishing properties. Ayurvedic texts describe *Godhuma* with *Madhura Rasa* and *Guru-Snigdha* qualities and associate it with *Brimhana* and *Balya* effects.[3] *Godhuma*-based *Modaka* preparations are also recognized in the FSSAI Ayurveda *Aahara* Compendium, providing a contemporary regulatory reference for traditional cereal-based preparations.[4] The selection of *Godhuma* is also consistent with contemporary dietary practice because wheat is a major cereal food and provides carbohydrate along with smaller amounts of protein and minerals. The addition of *Brahmi* and *Mandukaparni* was based on their classical association with *Medhya Rasayana*. Charaka Samhita describes *Mandukaparni* among *Medhya Rasayana* preparations and discusses its use in relation to longevity, strength, digestive capacity, complexion, voice, and mental faculties. [2] *Brahmi* has also traditionally been associated with *Medhya* activity. [2]

Interpretation of the organoleptic characteristics: The prepared *Ladduka* demonstrated satisfactory sensory characteristics, including acceptable colour, taste, aroma, and texture. The light-brown colour can be attributed principally to the roasting of the wheat flour and the caramelization/browning associated with heating of the ingredients. The pleasant aroma is likely related to the roasting process and the incorporation of *Ghrita*. The sweet taste is consistent with the relatively high proportion of *Sharkara* used in the formulation. The mild astringent aftertaste may be associated with the herbal powders, particularly the inclusion of *Brahmi* and *Mandukaparni*. Despite this, the herbal ingredients did not appear to markedly compromise the sensory acceptability of the product.

Interpretation of nutritional findings: The analytical results demonstrated that the formulation contained 76.58 g/100 g carbohydrate, indicating that carbohydrate was the predominant macronutrient. This finding is expected because *Godhuma* and *Sharkara* together constitute the major proportion of the formulation. The total sugar content was 45.71 g/100 g, which reflects the use of 200 g *Sharkara* in relation to 250 g *Godhuma*. Although the formulation is traditionally prepared as a sweet food, this relatively high sugar content should be considered when defining the intended population and serving size. Future formulation studies may investigate whether the quantity or type of sweetening agent can be optimized without compromising palatability and binding characteristics.

The protein content was 3.97 g/100 g, while the total fat content was 1.05 g/100 g. These values indicate that, based on the laboratory results, the formulation should primarily be considered a carbohydrate-rich food rather than a high-protein or high-fat nutritional supplement. The reported energy value of 331.65 kcal/100 g is consistent with the reported macronutrient values when conventional Atwater factors are applied. The formulation also demonstrated measurable mineral content, including calcium (76.86 mg/100 g), potassium (282.52 mg/100 g), and sodium (30.10 mg/100 g). These findings provide useful preliminary information regarding the mineral profile of the formulation. However, because only selected minerals were estimated, the formulation should not be described as a complete micronutrient supplement.

The present work therefore provides preliminary evidence regarding the feasibility and analytical characteristics of the formulation but does not establish its clinical efficacy.

CONCLUSION: The present study demonstrated the feasibility of preparing a fortified *Godhuma Ladduka* enriched with *Brahmi (Bacopa monnieri)* and *Mandukaparni (Centella asiatica*) with acceptable organoleptic characteristics. The formulation contained predominantly carbohydrates, along with measurable protein, fat, calcium, potassium, and sodium. The selection of *Godhuma* as the primary food base is supported by its classical Ayurvedic description as a nourishing and strengthening food, while the inclusion of *Brahmi* and *Mandukaparni* is supported by their classical association with *Medhya Rasayana*.[1],[3] Modern evidence suggests potential cognitive benefits from standardized *Bacopa monnieri* preparations, although the evidence is not sufficient to establish the cognitive efficacy of the present whole-powder food formulation.[5],[6] Therefore, the present study establishes the feasibility, sensory acceptability, and selected nutritional characteristics of the formulation but does not establish clinical efficacy or long-term safety. Further studies involving standardized formulation parameters, microbiological evaluation, stability testing and controlled clinical trials are necessary to establish the efficacy, safety, and appropriate target population of the formulation.

FUTURE SCOPE AND IMPLEMENTATION STRATEGIES

- Conduct comprehensive physicochemical evaluation of the finished formulation.
- Perform microbiological analysis.
- Conduct accelerated and real-time stability studies to determine an evidence-based shelf life.
- Conduct appropriately designed clinical studies evaluating nutritional status, anthropometric parameters, cognitive performance, quality of life, safety, and tolerability.
- If future clinical studies are conducted in children, appropriate ethical approval, parental consent/assent, and age-appropriate outcome measures should be incorporated.

LIMITATIONS OF THE STUDY

- The study was limited to organoleptic and selected analytical evaluation. Dietary fibre, iron, vitamins, fatty-acid composition, and antioxidant capacity were not evaluated.
- No clinical evaluation was conducted. The cognitive effects of the finished formulation were not assessed in human participants.

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CONFLICT OF INTEREST: The authors declare that they have no conflict of interest.

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ETHICAL CONSIDERATION: As the present study involved preparation and laboratory-based analytical evaluation of a food formulation and did not involve human participants or experimental animals, institutional ethical committee approval was not required for the reported work.

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