



Research Article

Formulation of Nutri Bar: A Zero-Sugar, High-Protein, Plant-Based Nutraceutical Formulation

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The present focus was to formulate and assess a nutri bar that includes finger millets (ragi sprouts), moringa, and guava leaves. These nutrients are rich in proteins, vitamins, and fibers which enhance immune function, aid in weight management, and maintain a low glycemic index, making it an excellent choice for health-conscious individuals. Prepared through a series of steps including drying, grinding, dough formation, moulding, sand-bath drying, and a final cocoa coat and freeze, this cost-effective product is distinguished by its use of herbal ingredients. For evaluation of its nutritional profile, various methods were employed. The Kjeldahl method for protein analysis, the Soxhlet extraction for fat content, the oven drying for moisture, sodium content (FSSAI Manual), carbohydrate content by calculation, and ash content by (FSSAI Manual). These herbal ingredients also provide therapeutic advantages for antioxidant and anti-inflammatory effects. Organoleptic evaluation demonstrated satisfactory taste, appearance, and texture, indicating a functional and enjoyable health supplement. The product aims to function as a protein-rich dietary supplement for Pediatric, Children and Geriatric also those who are interested in functional food options. It has strong commercial potential within a functional and therapeutic food market, especially for those consumers seeking natural plant-based products.

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INTRODUCTION

Nutraceutical bars are solid preparations that deliver nutrients in a convenient and dose-controlled form. In this modern society, nutraceutical bars play major roles in providing both nutritional benefits and therapeutic effects. This combination contains plant-based ingredients, bioactive compounds, and dietary components that help to prevent and manage chronic diseases such as obesity, diabetes, and cardiovascular disorders.

Commercial nutrition bars commonly contain added sugar, which can be problematic for individuals with diabetes. These bars are zero-added sugar, diabetic-friendly. Ingredients used in these bars have a low glycemic index, high fiber strongly recommended for individuals with malnutrition and diabetes to reduce postprandial glucose spikes.

Nutri-bar key ingredients include Sprouted Ragi (Finger Millet), which is remarkably known for its rich nutrient content, including calcium, iron, and dietary fiber, providing impressive health benefits. And sprouting enhances the protein and nutrient content [1].

Moringa leaf powder contains all 9 essential amino acids with 30% of plant protein, and is traditionally used to support glucose metabolism [2].

Guava leaves (*Psidium guajava*) are rich in polyphenolic compounds, especially quercetin, which exhibits antidiabetic potential by inhibiting carbohydrate-digesting enzymes such as α -glucosidase and α -amylase. Studies have shown that guava leaf extract can reduce postprandial glucose levels, making it suitable for diabetic formulations [3].

Commercially available protein bars often contain refined sugars, whey-based proteins, and synthetic additives, which may not be suitable

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for individuals with diabetes or lactose intolerance. There is a growing consumer demand for clean-label, plant-based, and zero-added-sugar options. Formulating bars with these characteristics not only helps improve glycemic control but also aligns with sustainable and culturally relevant dietary practices [4].

Herbal and food-based functional ingredients are widely accepted over synthetic medications for long-term use due to fewer side effects, cultural acceptance, and affordability. Bars offer a better taste and ease of use, particularly among the general population. The goal is to formulate a plant-based, safe and effective food that can be consumed daily for health-conscious individuals and diabetic patients.

MATERIALS AND METHODOLOGY

The herbal pharmaceutical ingredients finger millet powder, Morning leaf powder and Guava leaf powder were prepared in Rani Chennamma College of Pharmacy, Belagavi. Other Chemicals - Polyvinylpyrrolidone (PVP), Methyl paraben were acquired from Burgoyne Burblidges & Co., India. All the chemicals and solvents used were of analytical grade. Authentication of moringa and guava leaf was done at ICMR with reference no: RMRC - 1941 and RMRC- 1942, respectively.

Materials

The following natural and food-grade materials were used for the formulation of Nutri Bar. All ingredients used were free from refined sugar, synthetic colors, and artificial flavours, as shown in Table 1.

Table 1: Formulation of Nutri bar

Sr. No.	Ingredient	Quantity	Role in Formulation
1	Sprouted Ragi powder	12g	Base ingredient, provides proteins, fibers, minerals
2	Morning leaf powder	3g	Protein enrichment antioxidant source
3	Guava leaf powder	2g	Functional ingredients for blood sugar support
4	Stevia powder	1g	Natural sweetener with zero glycemic impact
5	Polyvinylpyrrolidone (PVP)	1g	Binding agent
6	Methyl paraben	0.2g	Preservative
7	Dry fruits: almonds, cashews, raisins	1.5g	Additives
8	cardamom	1g	Flavoring agent
9	Cocoa Butter	1g	Texture enhancer
10	Distilled Water	3mL	Vehicle

Preparation of Sprouted Ragi Powder

Cleaning: Raw ragi seeds were meticulously cleaned to eliminate any stones, husk, and dirt. **Soaking:** the seeds were immersed in clean water for 8-10 hours.

Germination: After soaking, the seeds were drained and placed in a moist cloth or closed container for 24–36 hours at room temperature to facilitate sprouting.

Drying: The sprouted grains underwent shade drying followed by oven drying at a temperature of 50–60°C for 24 hours until they were completely moisture-free.

Powdering: The dried sprouts were then ground into a fine powder using a domestic grinder and sifted to achieve a uniform particle size by using a 60 mesh sieve.

Preparation of Moringa and Guava Powder

The fresh leaves were collected from trees, thoroughly washed, shade-dried for 3–5 days, and then ground into a fine powder using a domestic grinder.

Formulation of Nutri Bar

Weighing and Mixing: As per the formulation Table 1 sprouted ragi powder, moringa leaves powder, and guava leaves powder were accurately weighed and mixed in a clean, dry bowl to ensure a uniform mixture.

Sweetener Addition: A small quantity of stevia powder (1gm) was incorporated into the mixture to enhance the sweetness, ensuring it didn't significantly impact the overall glycemic load.

Binding: Weighed quantity of PVP was dissolved in 3mL of distilled water and poured into the above mixture, mixed well to achieve good consistency.

Shaping: The prepared dough was shaped either by pressing it into molds or hand-shaping it into uniform bars to ensure consistent size and thickness.

Drying: The prepared bars were subjected to drying on a sand bath for 1–2 hours until complete moisture removal was achieved.

Coating: The Nutri bar was dipped into the warm cocoa butter until a uniform, consistent layer was formed.

Setting: The bars were allowed to cool and set at room temperature. They could also be refrigerated for 2–3 hours to achieve a firmer texture.

Packaging: After the bars had set to the desired firmness, they were sealed in food-grade cling film or placed in airtight containers. This helps retain freshness, prevents moisture uptake, and ensures the product remains a convenient, nutrient-rich snack that preserves the beneficial properties of its ingredients.

Evaluation Parameters

The formulated Nutri Bar was subjected to the following preliminary evaluations:

1) Organoleptic Evaluation

A preliminary sensory assessment was conducted to evaluate the color, taste, aroma, texture, and overall acceptability of the Nutri Bar. As shown in Table 2.

Table 2: Organoleptic Evaluation

Parameter	Observation	Remarks
Color	Brown with a greenish tint	Due to moringa and guava leaf powders
Texture	Firm, non-sticky, slightly oily surface	Suitable for hand-held consumption
Aroma	Earthy and natural	No off-odours detected
Overall Acceptance	Good	Acceptable

2) Weight Uniformity Test

Ten randomly selected Nutri Bars were individually weighed using a calibrated digital balance to assess weight consistency.

Mean Weight (n = 10): 25.2 ± 0.8 g

3) Texture Evaluation

The texture of the bar was assessed manually for firmness and chewability.

Observation: The bar maintained its shape without crumbling and was easy to bite.

4) Moisture Estimation by Oven Drying Method (FSSAI Manual)

Previously weighed Nutri bar was dried in a hot air oven at 105°C for 4 hours. Drying was continued till a constant weight of the nuti bar was achieved [5, 6].

Procedure:

- Dry the empty moisture dish in the oven at 105°C for 30 minutes.
- Cool in a desiccator and weigh the empty dish (W1). Add 2–5 g of the powdered Nutri Bar sample into the dish. Weigh the dish with the sample (W2).
- Place the dish with the sample in the hot air oven at 105°C for 4–6 hours or until a constant weight is achieved. Avoid charring the sample.
- After drying, cool the dish in a desiccator for 30 minutes. Weigh the dish with the dried sample (W3).

$$\text{Moisture (\%)} = \frac{(W2 - W3)}{(W2 - W1)} \times 100 \quad (1)$$

5) Protein Content - Kjeldahl Method (IS 7219:1973)

Protein analysis was conducted based on total nitrogen estimation using the Kjeldahl method. The nitrogen content was multiplied by the conversion factor 6.25 to calculate crude protein [7].

Procedure:

Digestion:

- Accurately 0.5 to 2 g of the Nutri Bar sample was weighed and transferred into a Kjeldahl digestion flask.
- Then 10–15 mL of concentrated H₂SO₄ was added, followed by a small amount of catalyst mixture (e.g., 5 g K₂SO₄ + 0.5 g CuSO₄) to accelerate digestion.
- The flask was heated gently in a fume hood until the mixture became clear (indicating complete destruction of organic matter and the appearance of a clear blue/green solution).

- The digested sample was then cooled completely.

Distillation:

- To the cooled digest, 40% NaOH was carefully added to make the solution alkaline. The flask was immediately connected to the distillation unit.
- The released ammonia was distilled into a conical flask containing 25 mL of 2% boric acid solution with 3–4 drops of mixed indicator.

Titration:

- The collected boric acid solution was titrated with 0.1 N HCl until the color changed from green to pink.
- The volume of acid used was noted.

$$\text{Protein (\%)} = \text{Nitrogen (\%)} \times 6.25 \quad (2)$$

$$\text{Nitrogen(\%)} = \frac{V \times N \times 1.4}{W} \quad (3)$$

Where,

V = Volume of acid used in titration (mL)

N = Normality of acid

W = Weight of sample (in grams)

1.4 = Conversion factor (based on molecular weight of nitrogen and constants in the Kjeldahl process)

6) Fat Content - Soxhlet Extraction (IS 7874:1975)

Crude fat was extracted using the Soxhlet method with petroleum ether (BP: 40°C - 60°C) as the solvent [8].

Procedure:

- The dried sample (2–5 g) was accurately weighed.
- The ground Nutri Bar sample was oven-dried at 105°C for 2–3 hours to remove moisture.
- It was then cooled in a desiccator and weighed.
- The dried sample was placed in a thimble or wrapped in fat-free filter paper.
- The thimble was inserted into the Soxhlet extractor.
- A round-bottom flask was filled with 150–200 mL of petroleum ether.

- The flask was connected to the Soxhlet and attached to a condenser. The assembly was heated gently so that the solvent boiled and condensed.
- Extraction was continued for 6–8 hours (a minimum of 12–15 siphon cycles). After extraction, the flask was removed, and the solvent was evaporated (using a water bath or rotary evaporator).
- The flask containing the extracted fat was dried in an oven at 105°C for 30 minutes.
- Finally, the flask was cooled in a desiccator and weighed with the fat residue.

$$\text{Fat (\%)} = \frac{W_{fat}}{W_{sample}} \times 100 \quad (4)$$

Where,

W_{fat} = Weight of fat residue

(Weight of flask after extraction – Weight of flask before extraction)

W_{sample} = Weight of the dried food sample used

7) Ash Content- Muffle furnace (FSSAI Manual)

Ash value was determined by incinerating a known quantity of the sample in a muffle furnace at 550°C to estimate total mineral content [5].

Procedure:

- The empty crucible was heated in a muffle furnace at 550 °C for 30 minutes.
- It was then cooled in a desiccator, and its weight (W_1) was recorded.
- About 2 g of finely powdered Nutri Bar sample was added to the crucible and the combined weight (W_2) was noted.
- The sample was gently charred on a hot plate or over a low flame to prevent loss from spattering.
- The crucible was then transferred to a muffle furnace set at 550 ± 25 °C.
- Heating was continued until the residue appeared white or light gray with no visible black particles, which typically required 4–6 hours.
- Afterward, the crucible was removed, cooled in a desiccator and the final weight (W_3) was recorded.

$$\text{Ash Content (\%)} = \frac{(W_3 - W_1)}{(W_2 - W_1)} \times 100 \quad (5)$$

8) Sodium Estimation - Flame Photometer or Titration (FSSAI Manual)

Sodium was estimated by measuring the intensity of light emitted by sodium atoms when introduced into a flame photometer. The intensity of the emitted light at a specific wavelength (589 nm) was directly proportional to the sodium concentration in the sample. Alternatively, sodium was precipitated as a sodium zinc uranyl acetate complex and titrated using a standard solution of uranyl acetate, which reacted with sodium ions. The endpoint was determined by a visual or indicator-based color change [6].

$$\text{Sodium(mg/100g)} = \frac{C \times V}{W} \times 100 \quad (6)$$

Where,

C -concentration of sodium in sample solution

V - volume of dilute sample (mL)

W - weight of original sample

9) Total Carbohydrates - by Difference Method (FSSAI Manual)

Carbohydrate percentage was estimated by subtracting the sum of moisture, protein, fat, and ash content from 100 [6].

$$\text{Total Carbohydrate (\%)} = 100 - (\% \text{ Moisture} + \% \text{ Protein} + \% \text{ Fat} + \% \text{ Ash}) \quad (7)$$

10) Energy Value - by Calculation (FSSAI Manual)

Energy is calculated based on the calorific value of the major macronutrients [6-8]:

$$\text{Energy (kcal/100g)} = [4 \times \text{Protein (g)}] + [9 \times \text{Fat (g)}] + [4 \times \text{Carbohydrate (g)}] \quad (8)$$

RESULTS AND DISCUSSION**(1)Moisture Estimation by Oven Drying Method (FSSAI Manual)**

Moisture (%) was found to be 8.4%. This is acceptable for maintaining shelf life; below the recommended 10% threshold [5, 6].

(2) Protein Content - Kjeldahl Method (IS 7219:1973)

The Nitrogen (%) was calculated to obtain Protein (%). As the Nitrogen (%) was 2.975% the result of Protein (%) was 18.6g/100g protein. That indicates a good plant-based protein source suitable for diabetic and vegetarian consumers [7].

(3) Fat Content - Soxhlet Extraction (IS 7874:1975)

Fat content was determined to be 9.8g per 100g, which provides essential fats and improves satiety without excess calories [8].

(4) Ash Content- Muffle Furnace (FSSAI Manual)

Ash value was determined to estimate total mineral content. That was found to be 1.2g per 100g [5].

(5) Sodium Estimation - Flame Photometer or Titration (FSSAI Manual)

Estimated Sodium content of the Nutri Bar was 35mg per 100g. The low sodium content of the Nutri Bar makes it suitable for individuals with hypertension and diabetes. Reduced sodium intake helps in maintaining normal blood pressure levels and supports overall heart health, making the product beneficial for cardiovascular wellness [6].

Table 3: Results Obtained from standard lab methods

Sr.No.	Test parameter	Unit	Result	Test method
1	Moisture	g/100gm	8.4	FSSAI Manual
2	ash	g/100gm	1.2	FSSAI Manual
3	Total fat	g/100gm	9.8	IS 7874: 1975
4	Protein content	g/100gm	18.6	IS 7219: 1973
5	Sodium	mg/100gm	35.0	FSSAI Manual
6	Total carbohydrates	g/100gm	62.0	By Calculation
7	Energy value	K Cal/100gm	410.6	By Calculation

(6) Total Carbohydrates - by Difference Method (FSSAI Manual)

The results obtained for total carbohydrates were 62 g per 100g. The results indicated an adequate presence of energy-providing nutrients, making the Nutri Bar suitable for sustaining energy levels naturally without the need for added sugars [6].

(7) Energy Value - by Calculation (FSSAI Manual)

The formulated Nutri Bar was yielding an energy value of 410.6 kcal/100 g. Hence the Nutri Bar provided balanced energy suitable for diabetic individuals, offering a moderate caloric load with well-controlled levels of fat and sugar [6-8]. As shown in Table 3.

CONCLUSION

The formulated product was analysed, which contains 18.6 g/100 g protein, 62 g/100 g carbohydrates, and 9.8 g/100 g fat, yielding an energy value of 410.6 kcal/100 g. The moisture content (8.4%) was within the acceptable limit for extended shelf life, and the low sodium level (35 mg/100 g) made it suitable for hypertensive and diabetic consumers.

Organoleptic evaluation indicated good aroma, texture, and overall acceptance. The use of herbal ingredients such as moringa and guava leaf powder contributed additional antioxidant, anti-inflammatory, and antidiabetic benefits, while sprouted ragi enhanced the protein and micronutrient profile.

Overall, the Nutri Bar met the desired functional food criteria being plant-based, diabetic-friendly, nutrient-dense, and free from refined sugars or synthetic additives. It has strong potential for commercial production as a healthy, convenient, and culturally acceptable snack option for health-conscious individuals and patients with metabolic disorders.

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REFERENCES

[1] Devi Palanisamy Bruntha et al. "Health benefits of finger millet (*Eleusine coracana* L.) polyphenols and dietary fiber: a

review." *Journal of food science and technology*, 2014; 51(6): 1021-40. doi:10.1007/s13197-011-0584-9

- [2] Leone Alessandro et al. "Moringa oleifera Seeds and Oil: Characteristics and Uses for Human Health." *International journal of molecular sciences*, 2015; 17(12): 2141. 20 Dec. 2016, doi:10.3390/ijms17122141
- [3] Ojewole J A O. "Hypoglycemic and hypotensive effects of *Psidium guajava* Linn. (Myrtaceae) leaf aqueous extract." *Methods and findings in experimental and clinical pharmacology*, 2005; 27(10): 689-95. doi:10.1358/mf.2005.27.10.948917
- [4] Ganesan K., Xu B. A critical review on phytochemical profile and health promoting effects of mung bean (*Vigna radiata*). *Food Science and Human Wellness*. 2018 Mar 1;7(1):11-33.
- [5] FSSAI. Manual of Methods of Analysis of Foods – Cereals and Cereal Products. New Delhi: FSSAI; 2023. Moisture determination method (air-oven, AOAC 925.10/993.26).
- [6] Food Safety and Standards Authority of India. Manual of Methods of Analysis of Foods: Nutritional Parameters. New Delhi: FSSAI; 2016.
- [7] Bureau of Indian Standards. IS 7219:1973: Methods of Test for Determination of Protein in Foods and Animal Feeding Stuffs. New Delhi: BIS; 1973.
- [8] Bureau of Indian Standards. IS 7874:1975: Methods of Test for Determination of Fat in Foods and Animal Feeding Stuffs. New Delhi: BIS; 1975.